World Armaments and Disarmament

SIPRI yearbook 1984

Stockholm International Peace Research Institute

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Stockholm International Peace Research Institute

SIPRI is an independent institute for research into problems of peace and conflict, especially those of disarmament and arms regulation. It was established in 1966 to commemorate Sweden's 150 years of unbroken peace.

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PREFACE

The fifteenth Yearbook continues the SIPRI series of surveys of the world military sector, and of the success or failure of attempts to set constraints on military activity. The survey is that of an international staff working on neutral ground.

Part I concerns itself particularly with nuclear issues. It describes the very substantial nuclear rearmament programmes which are under way; it comments on the breakdown of the arms control talks; and it discusses possible forms in which they might be started up again.

The chapter on nuclear weapon tests comments in particular on the history and present status of French testing in the Pacific, a matter of concern to other governments in that region.

In part II of the Yearbook, on armaments, the military expenditure section looks in particular at what is happening to the share of military spending in the government expenditure of industrialized countries. There is a special collection of statistics on expenditure on military research and development. The arms trade chapter reviews the situation in the main supplying countries; it has a section on the way in which the resupply of weapons has made it possible for the Iraq–Iran war to continue. There is a special chapter on the consequences for the arms trade of co-production schemes in Western countries, and another on Spanish arms production and trade. The chapter on conflicts in the Latin American region this year deals with the confrontation between Honduras and Nicaragua.

The section on military technology and strategy provides a review of what has been happening in the chemical and biological warfare field; in particular, it examines the new studies of the 'Yellow Rain' allegations. There is a chapter on the developments, present and prospective, in military activity in outer space. The chapter also discusses whether a regional satellite monitoring agency could be set up in Europe. Part II of the Yearbook also has a study of the changes in NATO's military thinking which have gone under the heading of 'deep strike'.

There are three more technical chapters in part II. One is on the accuracy of missiles; it shows that many of the standard formulations take insufficient account of the various influences on the functioning of a missile. A second reviews the US and Soviet command and control systems for nuclear weapons. A third looks at the possible consequences for biological warfare arising from recent developments in genetic engineering.

The arms control issues connected with nuclear weapons are dealt with in the nuclear weapon part. In part III there is a full account of the negotiations concerned with chemical disarmament, a comprehensive test ban, and arms control in outer space. This draws on the proceedings both in the UN General Assembly and at the Conference on Disarmament in Geneva. A short section comments on recent accusations, both by the United States and the Soviet Union, that the other party is in breach of certain arms control treaties. There is a chapter which reviews the background to the Stockholm Conference, and examines what is known of the initial negotiating positions. Finally, there is a discussion of the concept of common security, on the basis of the papers and debate at a SIPRI conference in September 1983.

We are grateful to our outside contributors William Arkin, Frank Barnaby, Richard Fieldhouse, Erhard Geissler, Björn Hagelin, David Johnson, Julian Perry Robinson and Kosta Tsipis. Once more this year, Connie Wall and Billie Bielckus carried the burden of editorial responsibility, and have been responsible for piloting this Yearbook through all its production stages.

SIPRI
March 1984

Frank Blackaby
Director

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Part I. The nuclear arms race

Part II. World armaments

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GLOSSARY

Acronyms

ABM	Anti-ballistic missile
ALCM	Air-launched cruise missile
ASAT	Anti-satellite
ASBM	Air-to-surface ballistic missile
ASW	Anti-submarine warfare
AWACS	Airborne warning and control system
BMD	Ballistic missile defence
BW	Biological weapon
C^3I	Command, control, communications and intelligence
CBM	Confidence-building measure
CBW	Chemical and biological warfare
CD	Committee on Disarmament (from 1984: Conference on Disarmament)
CDE	Conference on Disarmament in Europe
CEP	Circular error probable
CSBM	Confidence- and security-building measure
CSCE	Conference on Security and Co-operation in Europe
CTB	Comprehensive test ban
CW	Chemical weapon
DC	Disarmament Commission
ENMOD	Environmental modification
ERW	Enhanced radiation (neutron) weapon
FBS	Forward-based systems
FOBS	Fractional orbital bombardment system
GLCM	Ground-launched cruise missile
IAEA	International Atomic Energy Agency
ICBM	Intercontinental ballistic missile
INF	Intermediate-range nuclear force
IRBM	Intermediate-range ballistic missile
ISMA	International Satellite Monitoring Agency
LRTNF	Long-range theatre nuclear force
MAD	Mutual assured destruction
MARV	Manoeuvrable re-entry vehicle
M(B)FR	Mutual (balanced) force reduction
MIRV	Multiple independently targetable re-entry vehicle
MRV	Multiple (but not independently targetable) re-entry vehicle
NPT	Non-Proliferation Treaty
OPANAL	Agency for the Prohibition of Nuclear Weapons in Latin America
PNE(T)	Peaceful Nuclear Explosions (Treaty)
PTB(T)	Partial Test Ban (Treaty)
R&D	Research and development
RV	Re-entry vehicle
RW	Radiological weapon
SALT	Strategic arms limitation talks
SAM	Surface-to-air missile
SCC	Standing Consultative Commission (US–Soviet)
SLBM	Submarine-launched ballistic missile
SLCM	Sea-launched cruise missile
SRBM	Short-range ballistic missile
SSBN	Ballistic missile-equipped, nuclear-powered submarine
START	Strategic arms reduction talks
TTBT	Threshold Test Ban Treaty

Anti-ballistic missile (ABM) system	Weapon system for intercepting and destroying ballistic missiles.
Anti-satellite (ASAT) system	Weapon system for destroying, damaging or disturbing the normal function of, or changing the flight trajectory of, artificial Earth satellites.
Atomic weapon	Explosive device in which the main part of the explosive energy released results from the fission of the nuclei of heavy atoms such as uranium-235 or plutonium-239.
Ballistic missile	Missile which follows a ballistic trajectory (part of which may be outside the Earth's atmosphere) when thrust is terminated.
Battlefield nuclear weapons	*See:* Theatre nuclear weapons.
Binary chemical weapon	A shell or other device filled with two chemicals of relatively low toxicity which mix and react while the device is being delivered to the target, the reaction product being a super-toxic chemical warfare agent, such as nerve gas.
Biological weapons (BW)	Living organisms or infective material derived from them, which are intended for use in warfare to cause disease or death in man, animals or plants, and the means of their delivery.
Chemical weapons (CW)	Chemical substances—whether gaseous, liquid or solid—which might be employed as weapons in combat because of their direct toxic effects on man, animals or plants, and the means of their delivery.
Circular error probable (CEP)	A measure of missile accuracy: the radius of a circle, centred on the target, within which 50 per cent of the weapons aimed at the target are expected to fall.
Committee on Disarmament (CD)	Multilateral arms control negotiating body, based in Geneva, which is composed of 40 states (including all the nuclear weapon powers) and called the Conference on Disarmament from 1984. The CD is the successor of the Eighteen-Nation Disarmament Committee, ENDC (1962–69), and the Conference of the Committee on Disarmament, CCD (1969–78).
Conference on Disarmament in Europe (CDE)	Conference on confidence- and security-building measures and disarmament in Europe, the first stage of which opened in Stockholm, Sweden, in January 1984.
Conference on Security and Co-operation in Europe (CSCE)	Conference of the European states and the USA and Canada, which on 1 August 1975 adopted a Final Act (also called the Helsinki Declaration), containing, among others, a Document on confidence-building measures and certain aspects of security and disarmament.
Conventional weapons	Weapons not having mass destruction effects. *See also:* Weapons of mass destruction.
Counterforce attack	Nuclear attack directed against military targets.
Countervalue attack	Nuclear attack directed against civilian targets.
Cruise missile	Unmanned, self-propelled, guided weapon-delivery vehicle which sustains flight through aerodynamic lift and can fly at very low altitudes following the contours of the terrain. It can be air-, ground- or sea-launched and deliver a conventional or nuclear warhead with high accuracy.
Disarmament Commission (DC)	A subsidiary, deliberative organ of the UN General Assembly for disarmament matters, composed of all UN members.
Enhanced radiation weapon (ERW)	*See:* Neutron weapon.
Enriched nuclear fuel	Nuclear fuel containing more than the natural content of fissile isotopes.
Enrichment	*See:* Uranium enrichment.
Eurostrategic weapons	*See:* Theatre nuclear weapons.

Fall-out	Particles contaminated with radioactive material as well as radioactive nuclides, descending to the Earth's surface following a nuclear explosion.
First-strike capability	Capability to destroy within a very short period of time all or a very substantial portion of an adversary's strategic nuclear forces.
Fission	Process whereby the nucleus of a heavy atom splits into lighter nuclei with the release of substantial amounts of energy. At present the most important fissionable materials are uranium-235 and plutonium-239.
Flexible response	Reaction to an attack with a full range of military options, including a limited use of nuclear weapons.
Fractional orbital bombardment system (FOBS)	System capable of launching nuclear weapons into orbit and bringing them back to Earth before a full orbit is completed.
Fuel cycle	*See:* Nuclear fuel cycle.
Fusion	Process whereby light atoms, especially those of the isotopes of hydrogen—deuterium and tritium—combine to form a heavy atom with the release of very substantial amounts of energy.
Genocide	Commission of acts intended to destroy, in whole or in part, a national, ethnical, racial or religious group.
Ground zero	The point on the Earth's surface at which a nuclear weapon is detonated or, for airburst, the point on the Earth's surface directly below the point of detonation.
Helsinki Declaration	*See:* Conference on Security and Co-operation in Europe (CSCE).
Intercontinental ballistic missile (ICBM)	Ballistic missile with a range in excess of 5 500 km.
Intermediate-range nuclear force (INF)	*See:* Theatre nuclear weapons. (US–Soviet negotiations on INF were adjourned *sine die* in November 1983.)
International Nuclear Fuel Cycle Evaluation (INFCE)	International study conducted in 1978–80 on ways in which supplies of nuclear material, equipment and technology and fuel cycle services can be assured in accordance with non-proliferation considerations.
Kiloton (kt)	Measure of the explosive yield of a nuclear weapon equivalent to 1 000 tons of trinitrotoluene (TNT) high explosive. (The bomb detonated at Hiroshima in World War II had a yield of some 12–15 kilotons.)
Launcher	Equipment which launches a missile. ICBM launchers are land-based launchers which can be either fixed or mobile. SLBM launchers are missile tubes on submarines.
Launch-weight	Weight of a fully loaded ballistic missile at the time of launch.
Long-range theatre nuclear force (LRTNF)	*See:* Theatre nuclear weapons.
Manoeuvrable re-entry vehicle (MARV)	Re-entry vehicle whose flight can be adjusted so that it may evade ballistic missile defences and/or acquire increased accuracy.
Medium-range nuclear weapons	*See:* Theatre nuclear weapons.
Megaton (Mt)	Measure of the explosive yield of a nuclear weapon equivalent to one million tons of trinitrotoluene (TNT) high explosive.
Multiple independently targetable re-entry vehicles (MIRV)	Re-entry vehicles, carried by one missile, which can be directed to separate targets (as distinct from—multiple but not independently targetable re-entry vehicles—MRVs).
Mutual assured destruction (MAD)	Concept of reciprocal deterrence which rests on the ability of the nuclear weapon powers to inflict intolerable damage on one another after surviving a nuclear first strike. *See also:* Second-strike capability.

Mutual reduction of forces and armaments and associated measures in Central Europe	Subject of negotiations between NATO and the Warsaw Treaty Organization, which began in Vienna in 1973. Often referred to as mutual (balanced) force reduction (M(B)FR).
Neutron weapon	Nuclear explosive device designed to maximize radiation effects and reduce blast and thermal effects.
Nuclear fuel cycle	Series of steps involved in preparation, use and disposal of fuel for nuclear power reactors. It includes uranium ore mining, ore refining (and possibly enrichment), fabrication of fuel elements and their use in a reactor, reprocessing of spent fuel, refabricating the recovered fissile material into new fuel elements and disposal of waste products.
Nuclear weapon	Device which is capable of releasing nuclear energy in an explosive manner and which has a group of characteristics that are appropriate for use for warlike purposes. The term denotes both the thermonuclear and atomic weapons.
Nuclear weapon-free zone (NWFZ)	Zone which a group of states may establish by a treaty whereby the status of total absence of nuclear weapons to which the zone shall be subject is defined, and a system of verification and control is set up to guarantee compliance.
Peaceful nuclear explosion (PNE)	Application of a nuclear explosion for such purposes as digging canals or harbours or creating underground cavities.
Plutonium separation	Reprocessing of spent reactor fuel to separate plutonium.
Radiological weapon (RW)	Device, including any weapon or equipment, other than a nuclear explosive device, specifically designed to employ radioactive material by disseminating it to cause destruction, damage or injury by means of the radiation produced by the decay of such material, as well as radioactive material, other than that produced by a nuclear explosive device, specifically designed for such use.
Re-entry vehicle (RV)	That part of a strategic ballistic missile designed to carry a nuclear warhead and to re-enter the Earth's atmosphere in the terminal phase of the trajectory.
Second-strike capability	Ability to survive a nuclear attack and launch a retaliatory blow large enough to inflict intolerable damage on the opponent. *See also:* Mutual assured destruction.
Standing Consultative Commission (SCC)	US–Soviet consultative body established in accordance with the SALT agreements.
Strategic arms limitation talks (SALT)	Negotiations between the Soviet Union and the United States, held from 1969 to 1979, which sought to limit the strategic nuclear forces, both offensive and defensive, of both sides.
Strategic arms reduction talks (START)	Negotiations between the Soviet Union and the United States, initiated in 1982, which seek to reduce the strategic nuclear forces of both sides. Adjourned *sine die* in December 1983.
Strategic nuclear forces	ICBMs, SLBMs and ASBMs (not yet deployed) as well as bomber aircraft of intercontinental range.
Tactical nuclear weapons	*See:* Theatre nuclear weapons.
Terminal guidance	Guidance provided in the final, near-target phase of the flight of a missile.
Theatre nuclear weapons	Nuclear weapons of a range less than 5 500 km. Often divided into long-range—over 1 000 km (for instance, so-called eurostrategic weapons), medium-range, and short-range—up to 200 km (also referred to as tactical or battlefield nuclear weapons). For the USSR, weapons of a range exceeding 1 000 km (but less than 5 500 km) are medium-range. The USA uses the term 'intermediate' to denote weapons of a range both above and below 1 000 km (but not short-range).

Thermonuclear weapon	Nuclear weapon (also referred to as hydrogen weapon) in which the main part of the explosive energy release results from thermonuclear fusion reactions. The high temperatures required for such reactions are obtained with a fission explosion.
Throw-weight	'Useful weight' of a ballistic missile placed on a trajectory toward the target.
Toxins	Poisonous substances which are products of organisms but are inanimate and incapable of reproducing themselves. Some toxins may also be produced by chemical synthesis.
Uranium enrichment	The process of increasing the content of uranium-235 above that found in natural uranium, for use in reactors or nuclear explosives.
Warhead	That part of a missile, torpedo, rocket or other munition which contains the explosive or other material intended to inflict damage.
Weapons of mass destruction	Nuclear weapons and any other weapons which may produce comparable effects, such as chemical and biological weapons.
Weapon-grade material	Material with a sufficiently high concentration either of uranium-233, uranium-235 or plutonium-239 to make it suitable for a nuclear weapon.
Yield	Released nuclear explosive energy expressed as the equivalent of the energy produced by a given number of tons of trinitrotoluene (TNT) high explosive. *See also:* Kiloton and Megaton.

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ABSTRACTS

DEN OUDSTEN, E., 'Public opinion and nuclear weapons', in *SIPRI Yearbook 1984*, pp. 15–20.

Opinion polls, based on seven sources, show that there was a majority against the deployment of nuclear weapons in FR Germany in 1983. In the UK there was also a majority in 6 of 7 sources. In September 1982 and October 1983 an extensive poll was taken in 9 countries, with some 10 000 respondents. Between those 2 dates there was an increased concern about the threat of war (a rise from 31% to 42% in the proportion who considered it 'among their greatest concerns'); there was also increased concern about nuclear weapons (a rise from 30% to 35%). In the October 1983 poll, 31% of the respondents wanted some kind of unilateral action in the nuclear field; 45% favoured a nuclear balance. Only 8% was in favour of the use of nuclear weapons against a non-nuclear attack.

FERM, R., 'Nuclear explosions', in *SIPRI Yearbook 1984*, pp. 51–60.

According to preliminary figures, 50 nuclear explosions—all underground—were conducted during 1983. The Soviet Union and the United States were responsible for the major part of the explosions. Since 1966, France has conducted its nuclear tests in French Polynesia, most of them at the Mururoa atoll. Protests from all over the world have been expressed, especially when the tests were made in the atmosphere. From 1975, all tests have been carried out underground. Suspicions have been raised that the conditions for underground testing are not satisfactory since several severe accidents have been reported. Two official investigations have been made, one by a team of French scientists in 1982 and another by experts from Australia, New Zealand and Papua New Guinea.

LODGAARD, S. & BLACKABY, F. 'Nuclear weapons', in *SIPRI Yearbook 1984*, pp. 23–50.

In 1983 discussions of US strategic weapon programmes centred on the Scowcroft Commission report and the basing of MX missiles. The USSR still does not publish its forward plans: information on Soviet proprogrammes must therefore be drawn from Western information about tests. The role of forward-based systems in superpower force postures is increasing, pushed by the termination of the INF and START talks. If nuclear arms talks resume, they should be merged and preferably cover all systems with a range above 200 km. If this were combined with nuclear disengagement, as a measure of constraint on short-range theatre nuclear forces, then the entire range spectrum would be covered. The proposal for a 1-year moratorium on new nuclear weapon deployment is examined. For Europe, it might provide another chance for restraint on euromissiles. However, the crucial question is whether the superpowers are willing to stop their struggle for margins of superiority and apparent political advantage.

SKÖNS, E. & TULLBERG, R., 'World military expenditure', in *SIPRI Yearbook 1984*, pp. 63–136.

In 1983, \$750–\$800 billion were spent for military purposes according to SIPRI estimates. The volume increase of military spending has risen from an annual 2.4% for the period 1975–79 to an annual 3.3% for the period 1979–83. This acceleration is due to the rapid increase in US military spending; without the US contribution to the world total, military spending would have grown 1.7% per year in the latter period. In industrial market economies with budget deficits, military spending is being maintained at the expense of other government programmes. In the Soviet Union, military spending already absorbs a high share of national product and aggravates the shortage of labour. In most Third World countries, which have to import their weapons, debt problems are becoming acute. Even oil exporters are no longer completely free from financial constraints in the current situation of a weakened demand for oil.

LOOSE-WEINTRAUB, E., 'Spain's new defence policy: arms production and exports', in *SIPRI Yearbook 1984*, pp. 137–149.

The 3 most important areas of defence affected by the country's new political direction are Spain's membership in the NATO Alliance, relations between the government and the armed forces, and programmes to modernize the 3 military services. Apparently to reassure the army, no alterations in the plan to acquire new weapons have been made, and the defence industry is making great efforts to produce weapons indigenously and to co-produce with foreign countries. This has led to the rapid growth in sales of arms and defence technology, especially to Third World countries. Whatever the political future of Spain, developments are unlikely to affect the defence industry's increasingly visible role as an arms exporter.

HAGELIN, B., 'Multinational weapon projects and the international arms trade', in *SIPRI Yearbook 1984*, pp. 151–163.

Co-operation in acquisition of weapons has become common, especially between west European nations. Members of the EEC have expressed hope that with a larger European or Atlantic market the pressure to export arms to other nations will decrease. Others have argued that longer production runs increase the international competitiveness of the arms industry and, in turn, arms exports. An examination of jointly produced west European helicopters, aircraft and missiles shows that exports generally did not decrease with co-production. There are cases, notably the Tornado aircraft, where the differences in participating governments' arms export policies seem to have contributed to restraint in export marketing. There is, however, no reason to believe that there will be an automatic reduction in west European arms exports as a result of increased co-operation. What is necessary is change in the political attitude toward the national benefits from international arms trade. Barriers to arms exports have to be political; they seem not to be part of the economics of co-production.

ACLAND-HOOD, M., 'Statistics on military research and development expenditure', *SIPRI Yearbook 1984*, pp. 165–174.

The qualitative arms race is fuelled by military R&D, which, even when static or declining, creates, by producing technological change, long-lasting preserves for increased military spending. World military R&D is about 10% of total world military expenditure but about 25% of R&D of all kinds. In 1983 it was probably about $60 billion: lack of information, especially about the USSR and China, makes precision impossible. The distribution of world military R&D expenditure is highly concentrated: around 80% is accounted for by the USA and the USSR and a further 10% by the UK, France, China and FR Germany. In the 19 countries for which there are time series, military R&D expenditure is concentrated even more than total military expenditure, and big spenders also use very big shares of their government and total R&D spending and significant shares of their national income on military R&D.

OHLSON, T. & BRZOSKA, M., 'The trade in major conventional weapons', in *SIPRI Yearbook 1984*, pp. 175–289.

Growth in the volume of arms transfers has come to a halt. This is not the result of international detente or political decisions; it is caused by the serious economic problems in the world, particularly in the Third World. Competition among the arms suppliers is increasing, as they intensify their marketing efforts in order to avoid declining arms export revenues. The USSR and the USA account for over 33% each of total arms exports: the Soviet share is declining, while the trend for US arms exports is rising. The Third World accounts for 67% of total arms imports, and the Middle East absorbs close to 50% of Third World imports. Syria, Libya, Iraq, Egypt and Saudi Arabia are the main Third World importers.

BERG, P. & HEROLF, G., ' "Deep strike": new technologies for conventional interdiction', in *SIPRI Yearbook 1984*, pp. 291–318.

Exploiting emerging technologies for conventional interdiction is under discussion in NATO, focusing on 'deep strikes' into the enemy rear with conventional weapons. The proponents maintain that this offers a solution to NATO's perceived inferiority in conventional weapons, thus raising the nuclear threshold. Sceptics have raised serious doubts concerning the technological feasibility, particularly taking battlefield conditions and enemy technical and operational countermeasures into account. Even if deep strike proved technologically and economically feasible—at least some weapons are likely to be developed—there are serious arms control implications. The technologies could prove destabilizing by enhancing pre-emptive incentives on both sides, especially when combined with such offensive operational doctrines as the US AirLand Battle and the Soviet operational manoeuvre groups (OMGs). If deep strike technologies are used to reinforce and monitor less provocative defence postures, such as disengagement zones, their contribution could prove both security- and confidence-building.

PERRY ROBINSON, J. P., 'Chemical and biological warfare: developments in 1983', in *SIPRI Yearbook 1984*, pp. 319–349.

The progress during 1983 of the US chemical rearmament programme is described. The Congress declined to fund full-scale production of the new binary nerve-gas munitions, but will again be asked to do so during 1984. The Pentagon published new details of its perception of the Soviet chemical weapon programme, stating that production was continuing. Opinion became more sharply polarized during the year on the truth of the Yellow Rain use allegations from Southeast Asia wherein Moscow, against strong denials, stands accused by Washington. Thus far, the body of published evidence excludes neither a natural nor a CBW causation for the refugee reports. Some progress towards global chemical disarmament was registered during the Geneva negotiations. The reports of chemical warfare from the Gulf War at the close of the year gave added emphasis to the importance of these negotiations during 1984.

JASANI, B., 'The military use of outer space', *SIPRI Yearbook 1984*, pp. 351–378.

Militarization of the outer space environment has continued with the deployment of spacecraft performing military functions to enhance the performance of Earth-based weapons. During 1983, with some of these spacecraft, the USA and USSR have monitored conflict areas of the world and several military manoeuvres in Europe. The most significant event was the speech made by the US President on 23 March in which he called on scientists and engineers to find space-based defensive weapons to make nuclear weapons impotent and obsolete. During the past 25 years, outer space has remained free from the deployment of weapons but now there is a danger of the extension of the arms race on Earth to outer space. Issues raised by developments in the field of anti-satellite and ballistic missile defence (BMD) systems are discussed. Checking the militarization of outer space by emphasizing the role of observation satellites in verifying compliance with arms control agreements and in observing military manoeuvres in Europe as a confidence-building measure is explored.

TSIPIS, K., 'The operational characteristics of ballistic missiles', in *SIPRI Yearbook 1984*, pp. 379–419.

Strategic planners in the USA and USSR are concerned about the vulnerability of their nuclear arsenals to a disarming first strike by the other side. When in 1977–78 the USSR began to achieve more accurate intercontinental ballistic missiles, US strategic thinking became dominated with the premise that the system could destroy nearly 90% of the US ICBMs in a first strike. An attack against missiles in silos is a new type of counterforce attack with different requirements on the predictable performance of ICBMs. However, the considerable technical uncertainties involved are not usually considered in the simplified calculations quoted by the Pentagon. Uncertain factors include the yield of the warhead, reliability of the missile, reponse of silos to nuclear effects, timing of the attack, and interference between warheads used. Many of these factors have never been and can never be tested. Although a successful counter-silo attack still leaves the attacked nation with land- and sea-based nuclear weapons with which it could retaliate, formulae of silo kill probability are used in the public debate in the West. To base defence policy or weapon procurement and planning on such predictions approaches the irresponsible.

GEISSLER, E., 'Implications of genetic engineering for chemical and biological warfare', in *SIPRI Yearbook 1984*, pp. 421–454.

Genetic engineering allows the development of more efficient biological and toxin weapons. By gaining deeper insights into their target structures and functions, genetic engineering also allows a specific tailoring of toxins and of other chemical weapons. The use of these new weapons is forbidden by the Geneva Protocol and by the Genocide Convention. The prohibition of *development* of biological and toxin weapons by the Biological Weapons Convention also includes weapons developed by genetic engineering. Lack of appropriate definitions, however, provides a loophole in this Convention which might be misused to synthesize toxic molecules differing in size and/or composition from natural toxins. Peaceful research on pathogenic agents and toxins permitted by the Convention might camouflage experiments aimed at developing weapons. Therefore all corresponding 'peaceful' research projects should be made public and definitions should be included in or added to the Convention.

ARKIN, W. M. & FIELDHOUSE, R., 'Nuclear weapon command, control and communications', in *SIPRI Yearbook 1984*, pp. 455–516.

The US military C^3 system has been identified by the Reagan Administration as the weakest link in US nuclear forces and the first priority of modernization. Interest has been focused on improving crisis communications and inadvertent confrontation. Any perception that the improvements to C^3 are to avert accidents or correct weaknesses in internal crisis mangement is false. Improvements go beyond correcting deficiencies in the peace-time system. The goal is to provide wartime 'survivability and endurance' to fight and control a nuclear conflict and to facilitate the 'successful' use of nuclear weapons. The chapter describes and analyses the C^3 systems of the United States and the Soviet Union which support nuclear weapons. Four key issues are the adequacy of crisis measures between the superpowers, trends in the control of nuclear weapons, attack assessment programmes and launch-on-warning/launch-under-attack options.

GOLDBLAT, J. & MILLÁN, V., 'The Honduras–Nicaragua conflict and prospects for arms control in Central America', in *SIPRI Yearbook 1984*, pp. 517–554.

The Honduras–Nicaragua conflict has heightened the level of militarization in both countries. Military expenditures, the number of military personnel and arms supplies have all increased. Losses, both human and material, are assessed. Efforts to bring about peaceful settlement of the dispute, especially those of the Contadora Group, are described. A question is posed as to whether the USA, which considers Central America to be of critical importance for its security, will accept the Sandinista regime and refrain from interference. A series of confidence-building measures in the military field are suggested to facilitate arms control which is envisaged in the 1984 document adopted by the Central American states. However, for arms limitation in Central America to be introduced and endure, far-reaching domestic reforms are needed.

BARTON, D., 'The Conference on Confidence- and Security-Building Measures and Disarmament in Europe', in *SIPRI Yearbook 1984*, pp. 557–581.

The conference was convened in Stockholm on 17 January 1984 by the 35 CSCE states with the overall aim of security and confidence- and security-building measures. The results achieved in Stockholm will be evaluated at the CSCE review meeting in Vienna in 1986, when the states will decide whether to move on to a second stage of disarmament measures. It may be several years before work can begin on disarmament measures for Europe where the concentration of military forces and expenditures is still the largest in the world. Opening positions of the NATO, WTO, and neutral/non-aligned states indicate some basis for agreement to expand the existing notifications of military manoeuvres to include, e.g., smaller manoeuvres, a longer notification period, military movements such as troop rotations, some air/naval/amphibious exercises, and new guidelines for observer missions. One important difference which must be bridged is the emphasis NATO places on transparency of military activities and exchange of certain military information while the WTO gives priority to declarations of no-first-use of nuclear weapons and non-aggression. Agreement in Stockholm on a new set of CSBMs, even though modest and fairly insignificant militarily, would be better than no agreement at all since there are few signs of progress in other arms control negotiations.

ROTHSCHILD, E., 'Common security', in *SIPRI Yearbook 1984*, pp. 583–591.

SIPRI held an International Conference on Common Security in September 1983. The concept of common security was described in the 1982 report of the Independent Commission on Disarmament and Security Issues as an alternative to deterrence, and has been discussed in the UN and by other international groups. The SIPRI conference examined the concept and the security policies it may imply. Some participants argued that nuclear deterrence had ensured peace and political security in Europe; others favoured minimal deterrence. Opponents argued that it worsened political relationships and stimulated the arms race. Policies for increasing confidence were described.

GOLDBLAT, J., 'Multilateral arms control efforts', in *SIPRI Yearbook 1984*, pp. 593–636.

Sweden submitted a draft treaty banning nuclear weapon test explosions in all environments. The essential provisions of this draft, and of the 3 protocols annexed to it, are summarized. The most controversial problem was that of peaceful nuclear explosions. The Western states opposed the establishment of a separate regime for PNEs, arguing that any nuclear explosive device ostensibly developed for peaceful purposes is inherently capable also of being used as a weapon. Some progress was made in working out a chemical disarmament convention. The points of disagreement have been reduced in the following areas: destruction/elimination of stockpiles and of the means of production of chemical weapons; non-production of chemical weapons in the chemical industry; verification institutions; and non-use of the prohibited weapons. A concise summary is given of the UN report on provisional procedures for the verification of compliance with the 1925 Geneva Protocol prohibiting the use of chemical and bacteriological warfare agents. The Soviet Union submitted a draft treaty prohibiting the use or threat of force in outer space. However, there was no substantive debate because of a dispute regarding the mandate of a working group to deal with arms control in outer space.

GOLDBLAT, J. & FERM, R., 'Arms control agreements', in *SIPRI Yearbook 1984*, pp. 637–676.

Summaries of arms control agreements are followed by a review of allegations of breaches, made public by the USA and USSR in January 1984. Most of the charges appear vague and conjectural. In some cases they may be the result of a lack of precise definitions in the treaties; in others suspicions may have arisen because the treaties were signed but have not entered into force. Regarding the serious charge of use of CB weapons by the USSR, no fresh evidence was provided to invalidate the 1982 UN experts' statement that the allegations had not been proven. The bulk of the remaining accusations relate to issues of relatively minor importance. It is concluded that mechanisms to clarify suspicions regarding compliance and to protect parties against ill-considered allegations are indispensable. The status of the implementation of the major arms control agreements are presented in a table.

Introduction

FRANK BLACKABY

The purpose of this introduction is to provide a general overview of what is going on in the world military sector, and to report on the progress—or lack of progress—in attempts at control. The general picture of 1983, and the prospects for 1984, are sombre. Substantial rearmament programmes—particularly in the nuclear weapon field—are going ahead. The arms control negotiations dealing with these weapons are still in suspense (March 1984). The problem for 1984 is one of limiting the damage caused by the events of 1983.

Indeed there was virtually no progress anywhere in arms control in 1983. There was stalemate at the Vienna talks on force reductions in Europe. At the Conference on Disarmament in Geneva, the only negotiations which showed any sign of movement were those on chemical weapons; however, final agreement is clearly a long way off.

This introduction concentrates on nuclear weapon issues: the negotiations about eurostrategic and intercontinental weapons; nuclear explosions and a comprehensive test ban; and peace movements and the various proposals for raising the nuclear threshold in Europe. A section follows on the militarization of space, and the absence of negotiations in this sphere.

Rearmament programmes also show up in the figures for world military expenditure; this introduction reports on trends in military spending and in the arms trade. It discusses developments in chemical weapons—in evidence on allegations of use, and in the Geneva negotiations and gives a short report on the Conference on Confidence and Security-Building Measures which began in Stockholm in January 1984.

I. Nuclear weapons

Nuclear weapons in Europe

At the beginning of 1983, there seemed to be a slim chance of some agreement at Geneva before new intermediate-range nuclear missiles were deployed in Europe. Hopes faded during the year. The negotiations broke down on 23 November 1983.

The US position was that there should be some measure of equality between Soviet land-based intermediate-range nuclear weapons targeted on western Europe and US weapons, stationed in Europe, which could reach the Soviet Union. This equality could be either at zero or some other number. Initially the United States had demanded parity, not just with Soviet warheads targeted on Europe, but with all Soviet intermediate land-based warheads, including those on missiles deployed in eastern Siberia. As a late concession, the United States agreed not to include the missiles located in the Far East, and also agreed to discuss aircraft.

The Soviet Union's final position was that it was willing, in exchange for no new deployment on the US side, to reduce the number of missile launchers targeted on western Europe to a figure of 140 (or possibly 120)—leading to a rough equivalence with the number of French and British warheads targeted on the Soviet Union. It also tentatively floated this offer in a form which did not mention French and British forces. This would bring the number of Soviet warheads targeted on western Europe below the figure which existed before the SS-20s were deployed. It offered to dismantle the missiles which would be removed, and to freeze the number in eastern Siberia. The assessment in *SIPRI Yearbook 1983*—that the Soviet Union would not be willing to go much beyond this offer—proved correct.

The matter of nuclear-capable aircraft with a combat radius of 1 000 km or more was left unresolved. Soviet figures show NATO having more such aircraft than the Soviet Union; US figures show the opposite. However, according to the US chief negotiator, the differences had been narrowed before the talks broke down.

The negotiations provided a good case history of the many fallacies which have bedevilled so many arms control negotiations since the end of World War II. There was the central fallacy that there is some military need for parity in nuclear weapon deployment. There is no such military need: each side already has far more nuclear weapons than it could conceivably use without producing a planetary disaster. The demand for parity is a political, not a military demand. There is the fallacy that, if new weapons are deployed, this will make the other side more malleable at the conference table. Certainly in these negotiations the opposite appears to be true. There is the 'myth of the last move': that, after some new deployments, the game will stop and some alleged disparity will be rectified. The game does not stop: new moves produce countermoves.

At the turn of 1983/84, nine Pershing II missiles were declared operational in the Federal Republic of Germany (Schwäbisch-Gmünd), and the first flight of cruise missiles (16) was operational in Britain (Greenham Common). In Italy, the first cruise missile flight was scheduled to be operational in March 1984. In FR Germany (Hasselbach), cruise missile deployment is not due until 1986. In Belgium and the Netherlands, the sites for eventual cruise missile deployment have been designated (Florennes and Woensdrecht, respectively). However, it is still uncertain whether the two governments will accept deployment. NATO's December 1979 decision envisages a total deployment of 572 missiles. If East–West relationships remain tense, the number could ultimately be greater.

On the Soviet side, an unspecified number of SS-22 missiles are being deployed in the German Democratic Republic and in Czechoslovakia, manned by Soviet troops. New SS-23 missiles are likely to follow, replacing old Scud systems. The declared moratorium on the deployment of SS-20 missiles within striking range of Europe has been lifted. The Soviet Union, in explicit response to the short flight time of the Pershing II missile, is reported to be deploying submarine-launched ballistic missiles nearer than before to the US coastline; this may be followed by the deployment of new sea-launched cruise missiles.

The new deployment of land-based missiles in Europe may indeed seem small, compared with the total stock of nuclear weapons or with other new deployments—the USA proposes to deploy some 8 000 cruise missiles on bombers, ships and submarines, most of them with nuclear warheads. However, the European deployments are more important than their numbers may suggest. The Soviet Union sees the Pershing II as a particularly dangerous weapon, because it is considered accurate enough, and with a long enough range, to destroy Soviet command centres. Its flight time is short: so the Soviet Union could be tempted to move towards pre-delegation of firing authority, and even to consider 'launch-on-warning', which—given the risk of false warnings—would be very dangerous. The same thing could happen on the side of the United States, if it also becomes threatened by Soviet warheads which are accurate and have short flight times. Forward-based systems are growing, creating very unstable situations.

The political consequences of the new deployments are also unsettling. There is now no consensus on defence policies between the government and the main opposition party in either FR Germany or Britain. In eastern Europe, there is little doubt that many inhabitants of the GDR and Czechoslovakia are unhappy about additional nuclear-capable missiles, manned by Soviet forces, deployed on their territory.

Those in the West who have regarded the new deployment of intermediate-range missiles as a 'victory' for the West and a 'defeat' for the Soviet Union have failed to understand the idea of common security. Security can only be obtained in the long run by policies and practices which increase the feeling of security of both parties. Any step which makes a potential enemy feel more insecure is a backward step, which simply stirs up more trouble for the future. In the long run, security for one side cannot be obtained by deployments which reduce the feeling of security on the other side.

Intercontinental nuclear weapons

The competition in intercontinental nuclear weapons is intensifying: there are formidable weapon developments in train. As usual, much more is known about US plans than about Soviet plans. However, so far as advanced military technology is concerned, the United States has tended to lead the Soviet Union.

The United States is upgrading its strategic nuclear weapon deployment right across the board. To justify its programme, it has used in particular the 'window of vulnerability' argument—that Soviet land-based missiles are now powerful and accurate enough to eliminate in a first strike virtually all US land-based missiles. The implication is that the Soviet Union has acquired some kind of strategic superiority, and the US government finds this unacceptable.

There are many reasons for doubting whether this window of vulnerability exists. To attempt a first strike of this kind would be an act of incredible folly. First of all, it assumes a degree of accuracy and reliability for the Soviet intercontinental ballistic missile (ICBM) force which is entirely implausible. Second, there is no way in which the Soviet Union could effectively attack both US bomber bases and land-based missiles; either there would be sufficient warning time for the bombers to take off, or the attack on airfields would enable US missiles to be launched before they were hit. Third, there would be the likelihood that the United States would use its largely invulnerable submarine-launched ballistic missile force in retaliation.

The US programme includes the building of a new ballistic missile submarine fleet, and the development of a new missile for that fleet (the Trident II (D5)) which is expected to be accurate enough to attack Soviet missiles in their silos. The proposed land-based missile—the MX—would also have that capacity. Cruise missiles are accurate enough to destroy hardened targets as well. It appears that the USA wishes to be in a position to threaten Soviet land-based missiles in the same way that, it suggests, the Soviet Union threatens US land-based missiles.

In the longer term, there is a possibility that the USA might move away from the large land-based missiles with multiple warheads to smaller land-based missiles, probably mobile, with single warheads. There appears to be some belated recognition that missiles with multiple warheads are destabilizing, since a single missile on one side can threaten a number of missiles on the other. However, this would not be a return to the simple 'mutually assured destruction' doctrine of the 1960s: for it is proposed that the new land-based missile with a single warhead (the Midgetman) should also have the power and accuracy to attack Soviet missiles in their silos.

The forward plans of the Soviet Union are not published: they can only be inferred. There are certainly attempts to match new US deployments. The Soviet Union is probably developing cruise missiles with capabilities similar to those of the US missiles, some of them to be deployed on platforms at sea, close to the extensive US coastlines. The USSR has an ambitious construction programme for ballistic and cruise missile-carrying submarines. It is also seeking to develop new solid-fuelled missiles. It has been testing one new ICBM (US code-name Plesetsk-4), an ICBM which the Soviet Union claims is a modification of the SS-13 (US code-name Plesetsk-5), and a new submarine-launched ballistic missile, the SS-NX-20. There will quite probably be an increase in the total number of Soviet intercontinental nuclear warheads which is at least equivalent to the expected US increase.

Both the USA and the USSR declare that the sole purpose of their nuclear weapons is deterrent: that a nuclear war cannot be won, and therefore must never be fought. However, both sides are proceeding to develop and deploy weapons far beyond the requirements of mutually assured destruction. Each, it seems, believes in the political value of nuclear weapons—that an apparent inferiority (even if it has no military meaning) is damaging, and that consequently an apparent military superiority is politically beneficial. If it becomes generally accepted that the nuclear weapon states are right in believing that nuclear weapons provide political power in international affairs, then it is hard to see how, in the long run, the number of nuclear weapon states can remain as limited as it is now.

Negotiations

The negotiations about intercontinental nuclear weapons—at present in suspense—confront a number of problems. Like the negotiations about eurostrategic weapons, they are bedevilled by the demand for parity. Given the different mix of weapons, with their varying capacities, it is very hard to negotiate agreements if that demand is pressed beyond the requirement for some very rough measure of overall equivalence. With nuclear weapons at their present levels, there is no military need for parity: certainly no need for it in any sub-category of nuclear weapons. There is no military use that could be made of margins of superiority, as measured by one or other of the measuring rods of nuclear weapon stocks.

There is a further complication now, arising from US allegations that the Soviet Union has been failing to comply with a number of treaties, or with undertakings it gave to respect the provisions of treaties signed but not ratified. These allegations have been met by Soviet counter-allegations. Almost all were based on suppositions or other, rather loose, grounds. These matters could have been clarified through existing consultation procedures. The fact that this route has not been sufficiently used testifies to the propagandistic nature of the mutual recriminations.

Further, once a party has made a public allegation of this kind, it has put itself in the position of a prosecuting counsel: that is, it is interested in evidence which supports the allegation, and not interested in evidence which rebuts it. This has been seen in the case of the allegations of Soviet involvement in the use of toxins in Laos, Afghanistan and Kampuchea. The US State Department tends to pour scorn on any evidence that might suggest a natural origin for the phenomena it reports, since it is now committed to the accusation.

It is probably true that the US and west European governments feel themselves under some public pressure not to appear too belligerent. Now that the deployments of new missiles in western Europe are under way, the tone of Western speeches and public statements has changed. The speeches now emphasize the need for dialogue; references to limited nuclear war are replaced by statements that nuclear war cannot be won. It is, of course, not difficult to change the tone of speeches. It is much harder for the electorate to establish whether or not there has been any change in the negotiating stance, or in strategic or military doctrine.

Before the negotiations about intercontinental nuclear weapons were suspended, the gap between the positions taken by the USA and the USSR still seemed wide. The USA was still primarily concerned with the threat from heavy Soviet missiles—the SS-18s and SS-19s: its negotiating strategy was to find ways of reducing in particular the number of these missiles, by a limit on total throw-weight, or by a ceiling on the number of land-based launchers. The Soviet Union was more interested in overall limits, with freedom to mix. It conceded that warheads and not just launchers should be counted; it wished to bring in discussion of bombers and cruise missiles from the start of the negotiations. This point the USA conceded.

In the USA, a number of influential members of the Congress were not satisfied with the Administration's negotiating stance; they indicated that they would only continue to support the MX programme if there were a change. One of their requirements was that the Administration should in some form adopt the 'build-down' proposal: the basic idea is that two old nuclear warheads should be eliminated for each new warhead deployed (though the ratio of old to new could be varied). In this way modernization would be accompanied by a reduction rather than an increase in the total number of warheads. The Administration agreed to put forward the proposal of a working party on this idea at Geneva. When the negotiations were broken off, the Soviet Union had not accepted the idea.

Negotiations are now suspended, while new deployments of nuclear weapons, both in Europe and elsewhere, are not. It is doubtful whether there is now much point in keeping the negotiations on eurostrategic weapons separate from those on intercontinental nuclear weapons. There are a great many overlaps between the weapons discussed in the two separate forums. The land-based cruise missiles are basically the same missiles as those which the United States intends to deploy at sea. It seems logical for the Soviet Union to wish to negotiate about all US nuclear warheads which could land on its territory, wherever they are fired from. Further, if the negotiations encompass all weapons with ranges of 1 000 km or more, this should make it more possible to accommodate in some way Soviet concern about French and British nuclear warheads.

The danger is that such negotiations would take a great many years, and in the mean time there would be no check to new nuclear weapon developments. Some interim check is badly needed: it would have to be relatively simple. One such suggestion is that of the Independent Commission on Disarmament and Security Issues (the Palme Commission): "We urge the Soviet Union and the United States to declare reciprocally a one-year pause on deployment of nuclear weapons to open the way for the resumption of talks."

The Western peace movements: the nuclear threshold

Insofar as their objective was to prevent the deployment in western Europe of Pershing II and cruise missiles, the west European peace movements failed. However, insofar as their objective was to persuade people to their point of view, the movements have had considerable success. In a number of countries a majority of the population seems—judging from opinion polls—to sympathize with some of the movements' main aims. Further, in both Britain and FR Germany the main opposition parties declared their opposition to the deployment of missiles at the end of 1983.

In the USA, the pressure from the various peace movements—in particular the nuclear freeze movement—has also had some political effect. On many armament and arms control issues, the majority of members of Congress have been more sympathetic to arms control issues than the Administration. For example, in spite of the Administration's requests in successive years, appropriations for the production of new binary chemical weapons have been turned down.

A number of research programmes were under way in 1983 to examine in greater detail the possible effects of nuclear war. One main suggested conclusion was that previous studies had not taken sufficient account of the effects of smoke and other residues from burning cities and forests. The use of only a small proportion of the world's stockpiles of nuclear weapons, it was suggested, could produce a 'nuclear winter'. The question follows: if the use of a small proportion of the stockpile could produce this effect, what justification could there be for its total size?

A broad consensus has emerged on the need to raise the nuclear threshold in Europe—and the peace movements can claim a good deal of credit for this change. NATO has announced the withdrawal of 1 400 nuclear weapons from Europe over the coming 5–6 years, including atomic demolition mines and warheads on Nike–Hercules missiles. These weapons would have to be used at the beginning of a conflict, before NATO's ability to stop a conventional attack by conventional means had been tested. With the introduction of new long-range theatre nuclear forces, further nuclear weapons are to be removed on a one-for-one replacement basis. These measures suggest that NATO's nuclear posture may slowly be moving towards 'no-early-use'.

However, there are at the same time developments which point in the other direction. The production of neutron warheads, meant for deployment in Europe, is continuing. (Altogether US nuclear weapon production is now of the order of 2 000 warheads a year.) Nuclear munitions still have considerable support among the armed services. The current modest trend towards denuclearization may still be reversed. In eastern Europe there are indications that in addition to missile modernization the Soviet Union is also storing nuclear weapons 'on the spot'. These weapons may include nuclear artillery shells.

No-first-use

There is a strong case for the peace movements to concern themselves with the issue of no-first-use of nuclear weapons. NATO's doctrine of flexible response, implying possible first use of nuclear weapons, has come under attack from a number of sources—from the churches, from international lawyers, from high ranking military officers and from leading politicians, including former members of the US and British administrations. There is a powerful argument for the West to prepare itself for a no-first-use commitment through changes in military force posture, and for a Soviet demonstration of the seriousness of its declared intent never to be the first to use nuclear weapons, through redeployment of its forces.

To be meaningful, a no-first-use declaration would have to be accompanied—or preferably preceded—by a withdrawal of battlefield nuclear weapons from areas adjacent to the East–West border in Europe. It could be followed by the removal of nuclear weapons from the territories of all European countries which do not themselves possess them. In the conventional field, perceived discrepancies in military strength might be eliminated through negotiation of a mutually acceptable balance of forces at a level lower than the present one.

In trying to redress the perceived conventional weapon imbalance, NATO has predominantly chosen the rearmament route. Recently, one main emphasis has been on exploiting emerging technologies for striking deep into enemy territory as a method of defence. The proponents of 'deep strike' claim that new conventional technologies offer a rather cheap way of raising the nuclear threshold. Sceptics emphasize the vulnerability of some of the new technologies, and the west European allies have voiced concern about the costs involved.

The arms control implications of many deep-strike technologies are potentially serious. They could prove destabilizing by enhancing the incentives for pre-emption on both sides, especially if combined with such offensive operational doctrines as the US AirLand Battle on the Western side and the operational manoeuvre groups on the Eastern side. If, instead, some of the deep-strike technologies were used in combination with less offensive defence postures, such as disengagement zones, they could perhaps enhance confidence and security in Europe.

Nuclear explosions

According to preliminary figures, there were 50 nuclear explosions carried out in 1983: 27 by the Soviet Union, 14 by the USA, 7 by France, and 1 each by Britain and China. However, this may not be a complete list. The United States does not announce all its tests. The Soviet Union does not announce any, and the information comes from the seismic detection systems in other countries. Thirteen of the Soviet explosions—those which took place outside the known weapon test sites—were possibly for civil engineering purposes. However, all nuclear explosions can provide some information of military value.

The French tests have come under increasing criticism from states in the South Pacific, as well as from non-governmental organizations active in the protection of the environment, since the tests are conducted on the other side of the world from France itself. These tests are on the Mururoa atoll in the Pacific Ocean.

Comprehensive test ban

It is now 20 years since the USA, the USSR and the UK signed a treaty whose preamble stated that they were seeking to achieve the discontinuance of all test explosions of nuclear weapons for all time, and were determined to continue negotiations to this end. However, it appears that an agreement on a comprehensive test ban is now much further away than it was in 1980, when the trilateral negotiations were discontinued. The major obstacle is the attitude of the US government, which has decided to regard such a measure as a long-term goal of its policy rather than a high-priority objective of arms control efforts, as most countries do. The USA has also failed to ratify two other treaties concerning nuclear explosions, both of which it signed some years ago: the Threshold Test Ban Treaty (signed in 1974) and The Peaceful Nuclear Explosions Treaty (signed in 1976).

During the 1983 session of the Committee on Disarmament at Geneva, Sweden tabled a full draft treaty for a comprehensive test ban. However, the working group established in this area was given a mandate which did not include the elaboration of an actual treaty; its task was only to discuss and define issues relating to verification and compliance.

II. Military space programmes

Outer space has, of course, been militarized for a long time, in that the bulk of the activity in space is for military purposes. Two recent developments threaten a great deal more military activity in the future than in the past.

The first development concerns anti-satellite (ASAT) weapons. The Soviet Union has, over a number of years, conducted tests with an anti-satellite device—essentially intercepting one satellite with another. It has, however, not admitted that these were anti-satellite tests—indeed, it has not admitted that it has any military space programmes at all. The USA has been developing a rather more sophisticated anti-satellite weapon—a missile launched from an F-15 aircraft. The first test of this air-launched system was conducted in January 1984. (Until 1975 the USA had deployed a land-based ASAT system at Kwajalein atoll in the Pacific Ocean.) If there is no treaty banning these weapons, then we can expect the development of weapons which can attack satellites in high orbits—the present systems can only attack low-orbit satellites; we can also expect the exploration of defensive measures—hardened satellites, and the deployment of spare satellites to replace any which might be attacked.

There is a link between this first development and the second—President Reagan's proposal, in a notable speech on 23 March 1983, in which he appealed to the US scientific community to work towards solving the problems of defence against ballistic missiles. The development of defence against ballistic missiles is not the problem of developing one particular weapon: it involves developing and perfecting a whole set of systems.

The expansion of the US research and development programme—which was already considerable—is now beginning. (As usual, there are only Western reports of the Soviet research and development efforts, some suggesting that they have been of comparable size to those of the USA up to now.) The US proposed programme has come under substantial criticism, particularly from scientists in the arms control community. The criticism is on three main grounds. First, they doubt whether effective systems can be developed, even with enormous expense. Even then, there could be a number of ways for new offensive developments in nuclear delivery systems to negate these defensive systems. Second, before such systems were deployed, there would have to be an abrogation (or re-negotiation) of the Anti-Ballistic Missile Treaty, and also the Partial Test Ban Treaty. Third, if either side were to develop what it believed to be a successful system, then fears of an attempted first strike might be better based than they are now.

Arms control in outer space

It has been found impossible, in the Committee on Disarmament at Geneva, to set up a working group to negotiate a treaty on arms control in outer space. The non-aligned countries, China and the Soviet Union wanted a working group with a mandate for undertaking negotiations for "the conclusion of an agreement or agreements". The United States and other Western countries agreed only to a mandate restricted to identifying issues relevant to the prevention of an arms race in outer space. Somewhat reluctantly, the non-aligned countries, *faute de mieux*, went along with this limited suggestion. However, at the time of writing (March 1984) the Soviet Union has not done so.

The Soviet Union, in 1983, submitted a new draft treaty in this field. It also declared a unilateral moratorium on the launching of any anti-satellite weapons, for as long as other states refrained from deploying such weapons.

Any agreement seems very distant. The USA argues that it needs to catch up with Soviet deployment; and an inter-agency study has concluded that it would be impossible to verify such an accord. The USA also probably considers that any prohibition of anti-satellite weapons would prevent the eventual deployment of an anti-ballistic missile system. If weapons which could attack satellites were banned, this would prevent the deployment of weapons which could attack ballistic missiles—for any weapon which could attack a ballistic missile could also attack a satellite.

However, there is pressure in the US Congress for negotiations on anti-satellite weapons. This has been expressed in a resolution which calls for the President to "endeavour in good faith to negotiate a mutual and verifiable ban on anti-satellite weapons" before the Administration can proceed with testing an anti-satellite weapon against a target in space.

III. Chemical weapons

While there was no progress in negotiations about a comprehensive test ban, or a ban on anti-satellite weapons, there was some progress in 1983 in negotiations about chemical weapons.

The negotiations were helped by the fact that the US Congress eventually turned down the Administration's request for appropriations for the production of new binary chemical weapons. (The Soviet Union continues its policy of saying nothing whatever about its production or stocks of chemical weapons.)

At the negotiations, the Committee on Disarmament has accepted that the objective is complete disarmament. That would be a most impressive achievement, which would augur well for success elsewhere. For success in the chemical weapon negotiations, verification and other confidence-building measures of an exceptionally innovative kind will be needed, because of the peculiarities of chemical weapon technology and of the industrial base which supports it. If these complex problems can be solved, it should be possible to solve other simpler ones.

The gap between the US and Soviet positions is still wide: a document from the Committee sets out the state of agreement and disagreement on more than 100 issues on which consensus must be reached. However, this and other documents do serve to set out the outer bounds within which a potentially valuable compromise might be negotiated.

In the interim before a chemical weapons convention is agreed upon (which may indeed be a very long interim) the UN General Assembly has been concerning itself with establishing a mechanism for investigating allegations of the use of chemical or biological weapons. In October 1983 an expert group submitted a report, with detailed recommendations on the way in which such an investigation should be conducted: the work of the group was extended by a General Assembly resolution. A complaint was received by the Secretary-General, from Iran, that Iraq had used chemical weapons. The expert group which he appointed has reported that mustard gas and nerve gas have been used in Iran. The Security Council has condemned their use, without naming the culprit. The USA has banned the export of certain chemicals to both countries. Both countries are parties to the Geneva Protocol.

The other allegations of the use of chemical weapons have been the US allegations concerning Yellow Rain in Afghanistan and South-East Asia. A number of academics concerned themselves with this question during 1983. What has become clearer is that most (and maybe all) publicly disclosed evidence pointing to the use of toxic weapons in these countries does not in fact exclude the possibility of natural causation for the reported death and disease.

It is most important that the UN should be enabled to set up an efficient fact-finding mechanism. This would help to deter possible violations, and should also discourage ill-considered charges.

IV. Military expenditure and the arms trade

In the past two years (using provisional figures for 1983) the rise in the volume of world military spending is estimated at about 5 per cent per year—well above the post-war trend.

A good deal of this acceleration is explained by the US rearmament programme: the volume rise in the rest of the world, excluding the USA, was 3 per cent during the past two years. After the end of the war in Viet Nam, military spending in the USA came down, and then levelled off between 1975 and 1979. Since 1979, with the rearmament programme initiated by President Carter, and intensified by President Reagan, the volume increase in US military spending has averaged 7.5 per cent per year. In the post-war period, accelerations of this kind have previously only happened when the United States was engaged in an actual war—at the time of the Korean or Viet Nam wars.

The trend in the Soviet Union is always a matter for conjecture; the official rouble figure for 1983 was slightly lower than that for 1979, which seems highly implausible. During 1983 the CIA reduced its estimate of the trend of Soviet military spending, and now puts the volume trend from 1976 to 1981 at 2 per cent per year. Their preliminary estimates for 1982 indicate a continuation of that trend.

Other NATO countries—apart from Britain—have not followed the US example. British military spending has been influenced not only by a determination to fulfil NATO goals but also by the Falklands/Malvinas war. Identifiable extra costs for the war and subsequent garrison have recently been estimated at $4.7 billion to the end of fiscal year 1986/87, but this may not be the full picture. Economic constraints are beginning to tell. Over a long period up to 1980, in most Western countries, military spending was a falling share of central government expenditure. In many countries the fall has now slowed down or stopped, and in some—the United States and Britain, for example—it has begun to rise.

In a period of fluctuating exchange-rates, it is not easy to produce a sensible figure for the total of world military expenditure. The SIPRI estimate for world military spending in 1983, *at 1980 prices and exchange-rates*, is $600–650 billion. If one applies to that figure the US rate of inflation between 1980 and 1983, it produces a figure of $750–800 billion.

Whereas world military spending has been rising fast, the arms trade in major weapons has not. Since 1980 the trend has flattened out and, on provisional figures, shows some decline. The main reason is undoubtedly economic. Third World countries are extensively in debt, and are in no position to continue massive purchases of major weapons. A recent study has concluded that about a quarter of the accumulated Third World debt can be explained by weapon imports. A number of OPEC countries which accounted for a good part of the increase in arms sales since the early 1970s have faced reduced export earnings.

On the supplier side, the Soviet Union and the United States account for a third each of total exports of major weapons; the Soviet share has been declining, while the trend for US arms exports is rising. Facing domestic arms procurement cut-backs, many supplier countries have intensified their marketing efforts in order to increase their arms export revenues. Some governments which might, possibly, have wished to constrain their arms sales on political grounds have found the economic pressures too strong. The arms market is becoming more of a buyer's market; thus, for example, Iraq and Iran have had little difficulty in obtaining a continued re-supply of weapons. Had it been possible to organize an effective arms embargo on those two countries, the war could have been brought to a halt.

V. The Stockholm Conference

The conference at Stockholm—the first phase of the Conference on Confidence- and Security-Building Measures and Disarmament in Europe—is in its early stages. It began, perhaps, with some excessive expectations of what it might accomplish, to some extent because a number of foreign ministers attended the meeting and met for discussions.

The proposals from the NATO group of countries were presented early. They consist essentially of proposals for an intensified process of information exchange and notifications—*inter alia* a yearly exchange of information on the location and command organization of military formations; an annual forecast of military activities; notification of movements of troops as well as manoeuvres; and a certain number of permitted inspections to determine the non-threatening nature of notified activities. The NATO countries argue that this proposal is fully in line with the restricted mandate for the first phase of the conference, as set out in the final document of the conference in Madrid.

At the time of writing, the Soviet Union had not tabled proposals. However, judging from the opening speech of the Soviet Foreign Minister, the Soviet Union gives priority to such items as a pledge of no-first-use of nuclear weapons, a pledge of mutual non-use of conventional and nuclear military force, and nuclear and chemical weapon-free zones. It remains to be seen how these matters could be dealt with in this first phase of the conference.

Appendix A

Public opinion and nuclear weapons

EYMERT DEN OUDSTEN

The assistance of Connie de Boer of the POLLS Archives at the University of Amsterdam is gratefully acknowledged.

Superscript numbers refer to the list of notes and references at the end of the appendix.

This appendix briefly summarizes some of the developments in public opinion about nuclear weapons during 1983.[1] The material is based on opinion polls. It is, of course, well known that answers to opinion polls can vary with the wording of the question: on a number of the subjects discussed below, the question was put, by various organizations, in a variety of different ways. On some subjects, therefore, the conclusions are reasonably robust and give a good indication of the way in which, for instance, a vote in a referendum might have gone.

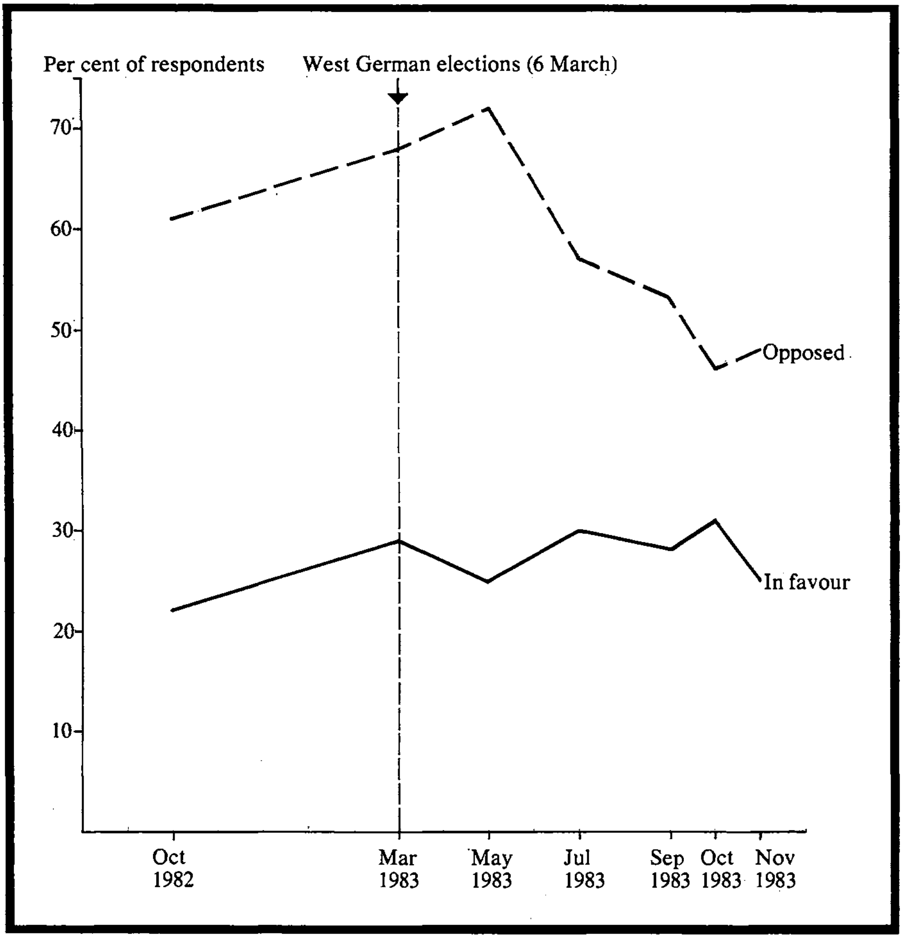
Missile deployment in FR Germany and Britain

In the Federal Republic of Germany, the question was generally put in some variation of the following form: "If there is no agreement at Geneva, should the Pershing II and cruise missiles be deployed?" However the question was asked, there was a significant margin of opinion against deployment. The margin increases somewhat when the words "new" and "American" are included in the description of the missiles. It decreases somewhat when the SS-20 is mentioned, and also when there is a reference to the NATO dual-track decision. However, there was no case in which the answers to the question showed a majority in favour of deployment.

In Great Britain, the question was usually put in the form: "Do you think that Britain should or should not allow cruise missiles to be based here?" Sometimes the words "new" and "American-controlled" were added. With one exception, there was a majority against deployment. The exception was a poll taken in June 1983, about the time of the general election. On this occasion the proposition was: "Great Britain should ban cruise missiles from being stationed in Great Britain", without any reference to the missiles being US missiles or under US control. By October, there was once again a majority against deployment.

In Britain, an overwhelming majority of the respondents want joint control of the missiles. When the question was put: "If American missiles are based in this country, should they be under the joint control of the

Figure A1. Federal Republic of Germany: replies concerning the deployment of cruise and Pershing II missiles



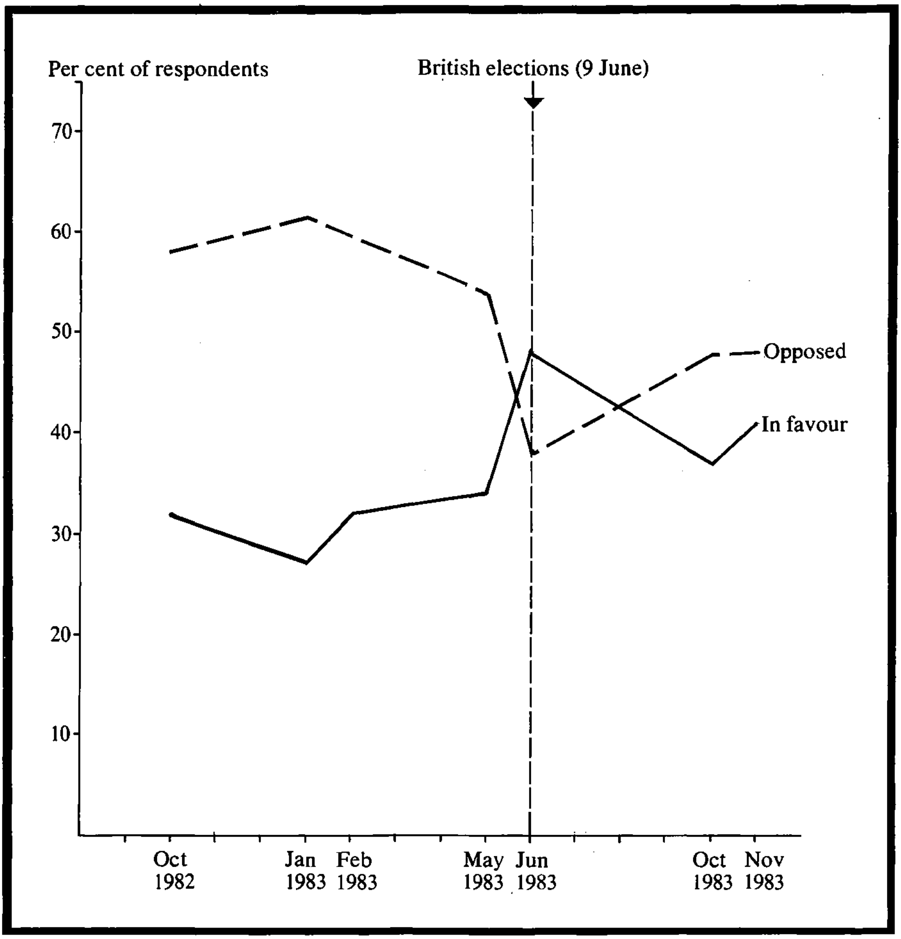
Sources: October 1982, SINUS; March 1983, INFAS; May 1983, Forschungsgruppe Wahlen; July 1983, INFAS; September 1983, INFAS (the third possibility, "negotiate further", has been divided into two-thirds against and one-third for, according to a similar question in March 1983); October 1983, Allensbach; and November 1983, Gallup.

British and American governments or under the sole control of the American government?", 93–95 per cent of the respondents opted for joint control.[2]

Threat perceptions and the fear of war

In October 1983 the Atlantic Institute for International Affairs (AIIA) and a number of national newspapers sponsored a poll, executed by Louis Harris with over 10 000 respondents in nine countries. A similar poll had

Figure A2. Great Britain: replies concerning the deployment of cruise missiles



Sources: October 1982, Gallup; January 1983, MORI; February 1983, Gallup; May 1983, Marplan; June 1983, NOP; October 1983, Marplan; November 1983, Gallup.

been taken in September 1982. During 1983, in almost all countries where the poll was taken there was an increasing fear of war and an increasing concern with nuclear weapons. The evidence is in the replies to the question: "Which of the following are your greatest concerns for yourself and your country today?", with a list of some 10 items, including unemployment, inflation, and so on. Between September 1982 and October 1983, in all the countries surveyed except Norway and Spain, there was an increase in the percentage of respondents who listed "the threat of war" and "nuclear weapons" among their greatest concerns. The most startling

Table A1. "The threat of war" and "nuclear weapons" among "your greatest concerns for yourself and your country"

Figures are the percentage of respondents naming them.

	The threat of war		Nuclear weapons	
	Sep 82	Oct 83	Sep 82	Oct 83
FR Germany	25	28	32	38
France	42	44	18	26
Italy	37	36	40	38
Japan	36[a]	42	28[a]	34
The Netherlands	32	37	49	49
Norway	36	37	38	40
Spain	42	39	27	30
United Kingdom	28	31	28	29
United States	23	45	18	37
Weighted average[b]	31	42	30	35

[a] March 1983.
[b] Weighted by population.

Source: AIIA/Harris/*International Herald Tribune* polls, September 1982 and October 1983.

change was in the United States, where the percentage doubled for both categories (see table A1).

The use and possession of nuclear weapons

There have been a number of enquiries which attempt to elicit the views of respondents about the use of nuclear weapons. The tables below present some of the results, in which the respondents were asked to indicate which statement most closely approximated to their views.

Except in the United States, there is support for the view that the use of nuclear weapons is not acceptable, not even in response to a nuclear weapon attack. In Britain and France, countries with an independent nuclear deterrent, some 25 per cent of the population take this view. FR Germany, which does not have nuclear weapons of its own, follows with 30 per cent. The remaining five countries have a near or full majority taking this position.

The use of nuclear weapons against a non-nuclear attack has lost almost all support, except in the United States. In the four countries where the questions were asked both in 1981 and 1983, support for this policy fell by more than half between these two years; it is now well below 10 per cent (and only 14 per cent in the United States). The implication is clearly that a policy of no-first-use commands wide support.

A separate set of questions approaches the same subject in a rather different way, asking questions not about the use of nuclear weapons, but

Table A2. Replies to the question: "In the current debate over East–West nuclear weapons, which of the following best expresses your personal view about what the West should do?" (October 1983)

(1) Give up all nuclear weapons regardless of whether the Soviet Union does.
(2) Introduce no more nuclear weapons, even if the Soviet Union does.
(3) Introduce just enough nuclear weapons to create a balance between East and West until an acceptable agreement can be found.
(4) Introduce more nuclear weapons than the Soviet Union has introduced, in order to establish and maintain nuclear superiority.
(5) No answer/no opinion.

Figures are the percentage of respondents.

	(1)	(2)	(1)+(2)	(3)	(4)	(5)
FR Germany	23	18	41	39	1	19
France	16	13	29	47	6	18
Italy	35	10	45	30	2	23
Japan	22	20	42	21	4	33
The Netherlands	25	20	45	38	2	15
Norway	15	21	36	55	3	6
Spain	55	12	67	16	2	15
United Kingdom	17	12	29	62	4	5
United States	4	8	12	63	20	5
Weighted average[a]	18	13	31	45	9	15

[a] Weighted by population.

Source: AIIA/Harris Poll, October 1983.

Table A3. Replies to the question: "Which of the following statements most closely approximates to your own attitude towards nuclear weapons?"

(1) The use of nuclear weapons is not acceptable under any circumstances, not even when attacked by nuclear weapons.
(2) Nuclear weapons should be used if we are attacked with nuclear weapons.
(3) If we are attacked with non-nuclear weapons, we should be justified in using nuclear weapons to end the war quickly.
(4) No answer/no opinion.

Figures are the percentage of respondents.

	(1)		(2)		(3)		(4)	
	Jul 81	Oct 83	Jul 81	Oct 83	Jul 81	Oct 83	Jul 81	Oct 83
FR Germany	29	31	37	42	17	4	17	23
France	44	27	32	52	17	8	8	13
Italy	42	47	39	28	12	5	8	20
Japan	–	58	–	18	–	3	–	21
The Netherlands	–	42	–	36	–	4	–	18
Norway	–	48	–	45	–	4	–	3
Spain	–	61	–	24	–	2	–	13
United Kingdom	24	24	47	61	19	8	10	7
United States	–	14	–	66	–	14	–	6
Weighted average[a]		33		46		8		13

[a] Weighted by population.

Source: AIIA/Harris Poll, October 1983 (for the data from October 1983); Crespi, L., 'West European Perceptions of the US', paper presented at the Convention of the International Society of Political Psychology, June 1982, table 4 (for the data from July 1981).

about their possession. Outside the United States, these questions show a fairly wide measure of support (though only in one case a majority) for unilateral nuclear disarmament or a unilateral nuclear weapon freeze. The one country where there is some support for the idea of nuclear superiority is the United States, with about one-fifth of the respondents in favour of nuclear superiority; and there is very little support in the USA for any unilateral action.

Notes and references

[1] These and other developments are more fully discussed in the following articles: Capitanchik, D. and Eichenberg, R., 'Defense and public opinion', *Chatham House Papers* (Royal Institute of International Affairs), 1983; Eichenberg, R., 'The myth of hollanditis', *International Security*, Vol. 8, No. 2, Fall 1983, pp. 143–59; Everts, P., 'Public opinion, the churches and foreign policy: studies of domestic factors in the making of Dutch foreign policy', Ph.D. thesis at Leiden University, Netherlands, 1983; *IISS Conference on Defense and Consensus: The Domestic Aspects of Western Security*, Adelphi papers 182, 183 and 184 (IISS, London, 1983); Crespi, L., 'US standing in west European public opinion, some long term trends', *USICA Report no. R-13-82* (US International Communication Agency), July 1982; Fiske, S., Fischhoff, B. and Milburn, M. (eds), Special on 'Images of Nuclear War', *Journal of Social Issues*, Vol. 39, No. 1, 1983; Lumsden, M., 'Nuclear weapons and the new peace movement', in SIPRI, *World Armaments and Disarmament, SIPRI Yearbook 1983* (Taylor & Francis, London, 1983), chapter 6, pp. 101–28; Russett, B. and Deluca, D., 'TNF: public opinion in western Europe', *Political Science Quarterly*, summer 1983, pp. 179–214.

[2] National Opinion Polls, May/June 1983 (95 per cent); MORI, January 1983 (93 per cent).

Part I. The nuclear arms race

1. Nuclear weapons

SVERRE LODGAARD and FRANK BLACKABY

The tables on Soviet and US strategic nuclear weapon capability are based on material prepared by FRANK BARNABY; the section on US and Soviet forward plans draws heavily on material prepared by the Center for Defense Information, Washington.

Superscript numbers refer to the list of notes and references at the end of the chapter.

I. Introduction

This chapter begins by reviewing Soviet and US nuclear weapon system programmes. As with any statistics of military capabilities, there is much more material on US than on Soviet forward plans. It then reports on some of the debates on these issues in the United States, and in particular on the discussion of the conclusions of the Scowcroft Commission. Finally, it turns to the question of arms control negotiations. At the time of writing there are no negotiations, and it is wholly uncertain when they might be resumed. In the long run, the choice is between a resumption and an unending arms race in nuclear weapon systems. It is useful, therefore, to set out some of the considerations relevant to their resumption.

II. Soviet nuclear weapon programmes

Material on possible future Soviet developments in nuclear weapon technology continues to come mainly from the United States: the Soviet Union still does not publish its forward plans.

Intercontinental nuclear weapon systems

The Soviet Union's current intercontinental ballistic missile (ICBM) arsenal is made up of 550 SS-11s, 60 SS-13s, 150 SS-17s, 308 SS-18s and 330 SS-19s (see table 1.1). Future developments are unlikely to lead to any increase in the total number of missile launchers—the number has fallen since the mid-1970s. In the absence of an arms control agreement, the trend will probably be towards an increased number of warheads, solid-fuelled rather than liquid-fuelled missiles, and improvements in accuracy and survivability.

Table 1.1. Soviet strategic nuclear weapon capability at the end of 1983

Delivery vehicle	First deployed	Range (km)	Number deployed[a]	Warheads per vehicle	Yield per warhead (Mt)	Total warheads	Total delivery capability (Mt)
Land-based ICBMs							
SS-11 Mod 1	1966	10 500	250	1	1	250	250
Mod 3	1973	8 800	300	3	0.3	900	270
SS-13	1968	10 000	60	1	0.6	60	36
SS-17 Mod 1[b]	1975	10 000	130	4	0.75	520	390
Mod 2	1977	11 000	20	1	6	20	120
SS-18 Mod 2[c]	1977	11 000	115	8	0.9	920	828
Mod 3[d]	1979	16 000	23	1	20	23	460
Mod 4	1982	11 000	170	10	0.5	1 700	850
SS-19 Mod 2	1979	10 000	20	1	10	20	200
Mod 3	1982	10 000	310	6	0.55	1 860	1 023
Sub-total			*1 398*			*6 273*	*4 427*
Sea-based SLBMs							
SS-N-5[e]	1964	1 400	9	1	1	9	9
SS-N-6 Mod 2	1973	3 000	128	1	1	128	128
Mod 3	1974	3 000	256	2	0.2	512	102
SS-N-8 Mod 2	1972[f]	9 100	292	1	0.8	292	234
SS-N-17	1977	3 900	12	1	1	12	12
SS-N-18 Mod 2[g]	1978	8 000	64	1	0.45	64	29
Mod 3[h]	1980	6 500	160	7	0.2	1 120	224
SS-N-20	1982	8 300	20	9[i]	0.5[j]	180	90
Sub-total			*941*			*2 317*	*828*
Strategic bombers							
Tu-95 Bear	1956	10 000+[k]	100	2[m]	2[m]	200	400
Mya-4 Bison	1956	10 000+[k]	45	2[m]	2[m]	90	180
Sub-total			*145*			*290*	*580*
Total			**2 484**			**8 880**	**5 835**

[a] As of September 1983. All numbers are approximations, especially divisions between different models.
[b] Being replaced by Mod 3 from 1982, possibly with 4×2 Mt MIRV.
[c] Being replaced by Mod 4.
[d] Replacing Mod 1.
[e] SALT-accountable.
[f] First deployment of shorter-range Mod 1.
[g] Being replaced by Mod 3.
[h] Replacing Mod 1 (with 3 RVs) and Mod 2.
[i] Maximum number, loading varying from 6 to 8.
[j] SIPRI estimate.
[k] Depending on mission profile and weapon load.
[m] Average.

Most of the SS-17s, -18s and -19s have multiple independently targetable warheads; that phase of modernization is probably virtually complete. However, all these missiles, except the SS-13 (which seems to have been a relatively unsuccessful missile), are fuelled by liquids that are highly toxic and volatile. Preparing them for launching is time consuming, and the rockets require an intricate set of pumps and circuits in order to regulate the fuel flow.

The United States concluded more than 30 years ago that liquid fuels were too dangerous and unreliable and developed solid propellants. There is little doubt that the Soviet Union would like to make the shift to solid fuels. To quote Dr John Kincaid, who helped design most of the basic rocket motors now used by the US ballistic missile-equipped strategic nuclear submarines (SSBNs): "Whoever thinks the Soviets have stuck with liquids because they chose to do things that way does not know what they are talking about. No one would mess around with liquids if they did not have to."[1]

The Soviet Union is now testing a solid-fuelled ICBM, denoted the SS-X-24, which could become a mobile ICBM carrying up to 10 warheads. However, up to September 1983 there were reported to have been seven failures out of ten tests of this missile; normally at least a dozen successful tests are needed before deployment.[2] It is also suggested that fifth-generation SS-18s and SS-19s are being developed, but have not yet been tested.

The Soviet Union will probably continue to replace older submarines and launchers in its submarine-launched ballistic missile force. (The SALT I agreement, as extended, allows the Soviet Union 62 modern hulls with 950 launchers.) The first Typhoon Class submarine has completed its sea trials and has moved to port facilities on the north coast of the Kola peninsula: a second Typhoon has been launched at the Severodvinsk shipyard. These new submarines are each equipped with 20 launchers for the SS-NX-20 solid-fuelled ballistic missile. The Soviet Union conducted some initial unsuccessful tests with this missile, which is said to have 6–9 warheads and a range of 8 300 km.

The Soviet Union's long-range bomber force consists of 145 aircraft that are 25 years old. There are Western reports of the development of a new strategic bomber, designated Blackjack A by NATO. There are also Western reports of new air-launched cruise missiles: one designated in the West AS-X-15, with a range of 2 700 km, which could be deployed on Backfire or Blackjack bombers; and another, designated BL-10, a high-altitude supersonic cruise missile, with a range of some 3 500 km, which could be carried by old Tu-95 Bear bombers operating from stand-off carriers.[3]

Long-range theatre nuclear weapon systems

LRTN missiles

After the breakdown of the Geneva long-range theatre nuclear forces (LRTNF) talks, the Soviet Union lifted the moratorium on deployment of SS-20 missiles directed at Europe. More SS-20s are therefore likely to be deployed in the European part of the USSR, to avoid the impression that the moratorium was an empty gesture. Nevertheless, the SS-20 programme

Table 1.2. Long-range theatre nuclear missiles

Country	Missile designation	Year first deployed	Range (km)	CEP (m)	Warheads	Inventory[a] A	Inventory[a] B	Programme status
USSR	SS-4 Sandal	1959	1 800	2 400	1 × Mt	240	455	SS-4/SS-5 phasing out; the USSR has stated that there are no SS-5s left
	SS-5 Skean	1961	3 500	1 200	1 × Mt			
	SS-20	1976/77	5 000	400	3 × 150-kt MIRV 1 × ?[b]	378	..	According to NATO, by the end of 1983 there were 243 within range of Europe
	SS-N-5 Serb	1963	1 200	n.a.	1 × Mt	39	18	3 on each Golf II submarine, 6 of which have been deployed in the Baltic since 1976
USA	Pershing II	1983	1 800	40	10–50 kt[c]	9		108 launchers to be deployed by 1985
	GLCM	1983	2 500	50	200 kt[d]	32[e]		464 missiles to be deployed by 1988
UK	Polaris A-3	1967	4 600	800	3 × 200-kt MRV	64		On 4 SSBNs, being replaced by the Chevaline system[f]
	Trident II (D5)[g]	(1990s)	10 000	250	8 × 355-kt MIRV	0		Replacing the Polaris/Chevaline system from the 1990s, with 64 launchers on 4 submarines
France	SSBS S-3	1980	3 000	n.a.	1 × 1-Mt	18		
	MSBS M-20	1977	3 000	n.a.	1 × 1-Mt	80		On 5 SSBNs
	MSBS M-4	(1985)	4 000	n.a.	6 × 150-kt MRV	0		On the 6th SSBN; total programme, including retrofits: 96 (by 1992)

[a] A: US figures as of January 1984. B: Soviet figures as of 1 June 1983. Approximately two-thirds of the missiles are assumed to be within striking range of Europe.

[b] Some SS-20 missiles are equipped with a single warhead and may therefore have intercontinental range.

[c] Selectable yield.

[d] The W 84 warhead with a selectable yield, of which 200 kt is likely to be the highest.

[e] Includes 16 missiles at Greenham Common, and 16 missiles at Comiso scheduled to be operational by March 1984.

[f] Probably with three warheads. Six warheads (MRV), each of 50 kt, have also been indicated.

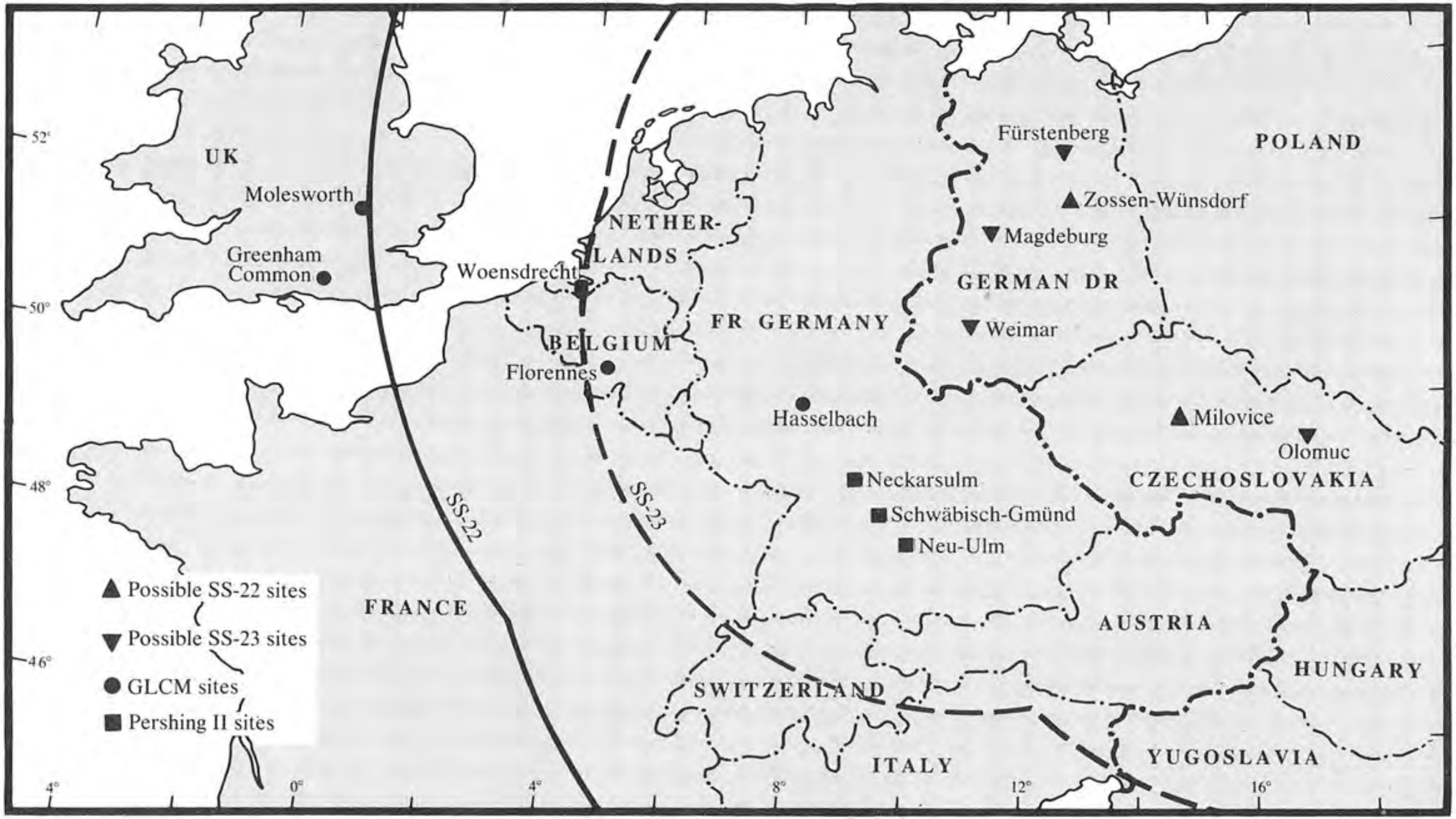
[g] Range and yield are based on the likely US choice of warheads. Since the UK will supply its own charges, it may choose force specifications which differ from those of the USA.

Table 1.3. US strategic nuclear weapon capability at the end of 1983

Delivery vehicle	First deployed	Range (km)	Number deployed[a]	Warheads per vehicle	Yield per warhead (Mt)	Total warheads	Total delivery capability (Mt)
Land-based ICBMs							
Minuteman II	1966	12 500	450	1	1.2	450	540
Minuteman III	1970	14 000	250	3	0.17	750	128
Minuteman III (Mk 12A)	1979	14 000	300	3	0.335	900	302
Titan II	1963	12 000	45[b]	1	9	45	405
Sub-total			*1 045*			*2 145*	*1 375*
Sea-based SLBMs							
Poseidon (C3)	1971	4 000[c]	304	10[d]	0.04	3 040	122
Trident I (C5)	1979	7 400[c]	264	8[e]	0.1	2 112	211
Sub-total			*568*			*5 152*	*333*
Strategic bombers[f]							
B-52	1956	10 000+[g]	241[h]	24[i]			
Bombs				4	2[j]	964	1 928
SRAM[k]		160[m]		20[n]	0.170	1 020	173
ALCM[o]		2 500		12[p]	0.2	384[q]	77
Sub-total			*241*			*2 368*	*2 178*
Total			**1 854**			**9 665**	**3 886**

[a] As of September 1983.
[b] Titan ICBMs are being withdrawn at a rate of about one every 30–45 days; retirement is planned to be completed in September 1987.
[c] With maximum number of MIRVs.
[d] Average number, maximum is 14.
[e] Average number, maximum is 10.
[f] In addition, there are 60 FB-111A medium bombers in service.
[g] Depending on model, mission profile and weapon load.
[h] 151 B-52Gs and 90 B-52Hs are operational. In addition, there are 31 B-52Ds being phased out, some 40 B-52G/Hs for training and in active reserve, plus more than 180 B-52s in inactive storage at Davis-Monthan AFB, Arizona.
[i] Maximum weapon load: 4 bombs and 20 SRAMs.
[j] Average yield.
[k] Short-Range Attack Missile.
[m] At high altitude.
[n] Maximum number (8 internally, 12 externally loaded).
[o] Air-Launched Cruise Missile (AGM-86B).
[p] Present configuration, all externally loaded. Later modifications will allow 8 internally loaded, for a total of 20.
[q] 2 squadrons each with 16 B-52Gs are operational.

Figure 1.1. Maximum range of SS-22 and SS-23 missiles from positions in Czechoslovakia and the German Democratic Republic



seems nearly completed. According to NATO, a total of 378 systems are now deployed, along with reload missiles. At the time the talks broke down and the moratorium was lifted, 243 launchers were deployed within striking range of western Europe (see table 1.2).[4]

Recent SS-20 deployments have been in eastern Siberia. There seem to be three base complexes in that area: at Novosibirsk (east of 80°), and at Drowjanaja and Olowjanaja on the Mongolian border east of Baikal. Altogether, 135 launchers have been deployed, and preparations for another 9 launchers are being made (according to the USA). The number of warheads on LRTN missiles in the area has increased greatly, possibly by a factor of three since the deployment of SS-20s started.

This Asian deployment of SS-20s, together with the build-up of other Soviet forces in the Far East, has led to increased concern in China, Japan and some other east Asian countries. Thus, in the statement issued after the ninth 'summit' meeting at Williamsburg, USA in May 1983 there was a specific reference to the need to consider both Asian and European deployments of SS-20s together: "Our nations are united in efforts for arms reductions .... The security of our countries is indivisible and must be approached on a global basis".[5] The Foreign Ministry of South Korea is reported as suggesting, on the question of deployment of SS-20s in north-east Asia, that the United States should afford Asia as much interest as it affords Europe in arms limitation talks with the USSR.[6] The Foreign Ministers of China and Japan, at a meeting in New York on 29 September 1983, agreed to "exchange information" on the Soviet SS-20s, while recognizing that their presence in Asia "constitutes a great threat" to the region.[7] China reportedly intended to add the reduction of SS-20s in the Far East to the other three conditions for improvement of Chinese–Soviet relations.[8]

In Europe, new theatre nuclear missiles are being deployed in the German Democratic Republic and Czechoslovakia. Marshal Ogarkov is reported as saying that "their range is sufficient for reaching most of the areas of the position of the American missiles being deployed in the countries of Western Europe".[9] Marshal Ogarkov further said that these were not deployments that would have occurred in any case: "They were not planned in advance and were necessitated only by the introduction of new American missiles into Europe".[9] These seem to be references to the SS-22, the successor to the SS-12 Scaleboard, which was not previously deployed outside the USSR. With a maximum range of about 900 km it is on the verge of reaching the cruise missile sites in Britain and would cover much of France (see figure 1.1), but it cannot reach Comiso in Italy.

If the objective was to put political and military pressure on FR Germany, then the SS-23 missile in particular—due to succeed the Scud—might have been appropriate. With a range of about 500 km, it would cover virtually all of FR Germany from positions in the GDR and Czechoslovakia. By the beginning of 1984, some SS-23s might have been fielded in the USSR. However, it was not known to be operational with Soviet forces in any of the east European countries.

Soviet leaders have also referred to additional naval deployments of nuclear weapons. Mr Andropov said, on 24 November 1983, "Since by deploying its missiles in Europe the United States increases the nuclear threat to the Soviet Union, the corresponding Soviet systems will be deployed with due account for this circumstance in ocean areas and in seas."[10] This may refer to sea-launched cruise missiles. The new SS-NX-21 cruise missile with a maximum range of about 3 000 km is likely to be deployed on Victor 3 Class submarines, and possibly also on converted Yankee Class submarines (nine have been converted from SSBNs to general-purpose submarines). The missile may be fitted into existing torpedo tubes on the Victor 3, which has 18 such tubes. Andropov's statement may refer to forward basing of existing cruise missile submarines as well, such as the Echo II type, whose missiles have a range of about 500 km. Also, in the beginning of 1984, some Delta II Class SSBNs moved south of the GIUK (Greenland–Iceland–United Kingdom) gap, sending another political message of Soviet counteraction to US missile deployments in Europe.[11]

In addition to the sea-based SS-NX-21, the Soviet Union has flight-tested another three types of cruise missile. Those which are air-launched have already been described. The ground-launched cruise missile (SSC-X-4) is similar in design and operational characteristics to the US GLCMs being deployed in western Europe.

LRTN aircraft

The deployment of Soviet LRTN aircraft has been undramatic over the past two years (compare *SIPRI Yearbook 1982*, tables 1.3–1.7). The Soviet Air Force still maintains a force of around 400 obsolescent Tu-16 Badger and Tu-22 Blinder aircraft in the bomber role, with a similar number for other missions (such as anti-shipping, electronic warfare, intelligence and aerial refuelling). The fleet of modern Tu-22M Backfires is increasing at a steady rate of 30 per year; at present there are some 210 available, of which 100 are assigned to naval aviation. A little less than one-third are deployed in the Far East.

As a result of the major reorganization of Soviet air forces, the modern Su-24 Fencer fighter-bombers have been transferred from frontal aviation to the new "aviation armies of the Soviet Union", which have replaced strategic aviation (the bomber force).[12] There are more than 600 Su-24s in service, with production continuing at a rate of some 60 per year.

III. US nuclear weapon programmes

The present inventory of United States intercontinental nuclear weapon systems is set out in table 1.3. There are very substantial programmes now in progress for upgrading these systems, with new weapon developments for all three legs of the strategic triad—on land, on sea and in the air.

Some 15 major programmes are under way (see table 1.4). All have so far received Congressional approval. The one programme which has had some appreciable difficulties in Congress, and which could still be aborted, is the MX programme (discussed below).

This section briefly reports on the status of the main programmes.

Submarine-launched ballistic missiles

The first two Ohio Class submarines with Trident missiles are now on patrol; a third was commissioned in June 1983, and a fourth in February 1984. This class has 24 missile tubes (as compared with 16 for the Lafayette Class equipped with Poseidon missiles), capable of carrying a larger missile than its predecessor. The eventual Trident programme will probably be for 20–25 submarines.

The first eight Ohio Class submarines will be fitted with the Trident I (C4) missile; this missile has now been retrofitted into 12 Lafayette Class submarines. The new Trident II (D5) missile, now under development, should be installed in the ninth Ohio Class submarine, scheduled for delivery in December 1988. Throughout the period 1989–96 the first eight Ohio Class submarines will be retrofitted with the D5 missile. The D5 missile will have much greater throw-weight than the C4; it will be able to carry 10 warheads, and is expected in addition to have the accuracy which would make it effective in attacking Soviet silos.

Long-range bombers

The bomber programme is linked with the development of cruise missiles. The later versions of the B-52 bomber are being equipped with air-launched cruise missiles. Sixty-four B-52G bombers—four squadrons—have each been fitted with 12 cruise missiles: eventually 105 B-52G bombers will be converted in this way. The air-launched cruise missile has a range of some 2 500 km, so that the bomber does not need to penetrate enemy defences. The missile carries a 200-kiloton warhead, and is highly accurate. In addition, 90 B-52Hs will carry 20 missiles, 12 externally and 8 internally. Further, there is a programme for 100 B-1B bombers: the first 16 are due

Table 1.4. Major US nuclear weapon system programmes

Weapon system	Number	First year operational	Money spent FY 1984 ($ bn)	Money requested for FY 1985 ($ bn)	Number requested for FY 1985	Money proposed for FY 1986 ($ bn)	Unit cost ($ mn)	Estimated total cost ($ bn)[a]	Remarks
MX missile	223	1986	10.9	5.0	40	3.8	123	27.4	100 deployed by 1989, balance test and spares
Trident submarine	20–25	1982	15.2	2.0	1	1.9	1 600	31–39	Cost for first 15 submarines: $23.6 bn
Trident I missile	595	1979	8.0	0.164	0	0.109	19	11.2	For 12 backfitted submarines and first 8 Trident submarines with 211 test and spares
Trident II missile	740	1989	2.2	2.3	0 (R&D)	3	50	37.6	For 15 submarines; for 20–25 submarines cost would be $45–53 bn
B-1B bomber	100	1986	18.4	8.2	34	6	400	40	90 operational aircraft will be deployed at four bases
Stealth bomber	132	Early 1990s	?	1	0 (R&D)	?	?	40–50 ?	Classified programme; one estimate $6.3 bn for FYs 1984–88
B-52 bomber modifications	263	Ongoing	2.8	0.596	–	0.461	20 per aircraft	5.8	Radar, engines, avionics and other improvements
Air-launched cruise missile	1 739	1982	4	0.155	0	?	2.7	4.7	Production cancelled at 1 739 of original 4 348
Ground-launched cruise missile	565	1983	2.2	0.707	120	0.733	6.3	3.6	464 for Europe, 1983–88
Sea-launched cruise missile	4 068	1984	2.6	0.670	180	0.593	2.8	11.5	Total is for all versions; includes 74 for R&D, 758 for nuclear attack

Advanced cruise missile	2 600	1987/88	?	?	0 (R&D)	?	5–7	7	Classified programme; figures are estimates
Pershing II missile	380	1983	1.8	0.472	93	0.521	7.0	2.7	108 for FR Germany, 1983–85
C^3I	Many programmes	Ongoing	?	9	–	?	–	40–50	Hundreds of programmes
Air defence	Many programmes	Ongoing	0.400+	0.396	various	0.489	–	7.8	Radar, F-15 aircraft, AWACS aircraft
Midgetman missile	1 000	1992	0.345	0.465	0 (R&D)	0.482	38–70	38–70	20-year costs could be $107 bn

[a] Does not include DoE costs for nuclear warheads and bombs which normally are an additional 10–20 per cent of the weapon system cost.

Source: Based on a table in *The Defense Monitor*, Vol. 12, No. 7, p. 9; table updated as of February 1984 on the basis of FY 1985 budget figures.

to go into operation late in 1986. Eventually they will also become cruise missile carriers after their penetration role has been taken over by the advanced technology (Stealth) bomber, which is still in the research and development stage: the operational date is given as 1991. Meanwhile the Air Force is incorporating some of the 'stealth' technology into the B-1B programmes.

Cruise missiles

The US cruise missile programme is a massive one, covering air, land and sea versions. The present programme is for some 8 000 of the three different varieties. Rapid advances are being made in cruise missile technology.

For the *air-launched cruise missile* (ALCM), the original plan was to build 4 348 of the first version. However, the decision has now been taken to limit the purchase of this first version to 1 739, and thereafter to go directly to the second version—the advanced cruise missile. If the total still remains the same, the implication is that some 2 600 of the advanced version will be procured, but it is possible that fewer may be bought. Information about this advanced version is classified; it could have up to three times the range of the first version, greater accuracy, increased speed and some stealth characteristics.

The *ground-launched cruise missile* (GLCM) is the weapon which is now being installed in western Europe. The first flight of 16 missiles is already operational at Greenham Common, UK. Another flight will be operational at Comiso, Italy in March 1984. In the next five years, 464 of these missiles are due to be deployed: the total procurement envisaged is 565. In Belgium and the Netherlands, the designated cruise missile sites are at Florennes (in Namur) and Woensdrecht (in Nord Brabant) respectively. The deployments are scheduled to begin in 1985 at Florennes and at the end of 1986 at Woensdrecht. So far, neither Belgium nor the Netherlands has made a political decision to accept deployment. In FR Germany, cruise missiles will be deployed at Hasselbach, in Rheinland-Pfalz.

The *sea-launched cruise missile* (SLCM) programme is a mixed programme of short-range (450 km) anti-ship missiles, medium-range (2 500 km) nuclear land-attack missiles, and medium-range conventional land-attack missiles—in all some 4 000 missiles for use on some 76 surface ships and 80 submarines by the early 1990s. The 450-km range anti-ship missile, with a conventional warhead, has already been installed on one attack submarine, and was due to be installed on a destroyer in March 1984. The 2 500-km range nuclear land-attack missile is scheduled to be deployed on attack submarines and surface ships in June 1984. The conventional land-attack version appears to be at an earlier stage of development.

This programme appears to have gone ahead without much consideration for the arms control problems which it poses. The conventional and nuclear models are indistinguishable and the missile is compact. Once large numbers of these sea-launched missiles are deployed—and the Soviet Union, which has had cruise missiles of shorter range at sea for a long time, may soon deploy the SS-N-21—then nearly every type of ship could become a potential nuclear attack platform.

Long-range theatre nuclear weapon systems

While the first GLCMs were being installed at Greenham Common, the first Pershing II missiles were installed in FR Germany. Both were declared operational by the turn of 1983/84. Over the next three to four years, 108 Pershing II launchers are due to be deployed in the Schwäbisch-Gmünd–Neu Ulm–Neckarsulm area. At the end of 1982, the West German government turned down a US suggestion to deploy one reload missile per launcher. Tentative plans now call for having only enough disassembled spare parts on hand to ensure that 108 missiles are operational at any time. However, it is not clear whether the US government actually dropped the reload option: the momentum of euromissile deployments and the tense relationship between East and West may still lead to the fielding of reload missiles. The original production programme was for 380 missiles.

The range of the Pershing II remains a matter of dispute, with the United States claiming that it could not reach Moscow, and the Soviet Union claiming that it could. To extend its range from 1 800 km (the official Western figure) to 2 500 km (the official Soviet estimate) poses no big technical problem. For instance, the range of a ballistic missile can be significantly increased by using fuel with a higher energy content per unit. It will probably be hard to allay Soviet suspicions that the Pershing II could be used against the command, control, communications and intelligence (C^3I) installations around the Soviet capital.

Whereas the Pershing II replaces the Pershing IA with the US forces in FR Germany on a one-for-one basis, no decision has been made so far to replace the 72 Pershing IAs operated by West German forces on a double-key basis with Pershing IBs. The Pershing IB has about the same range as the Pershing IA, but is terminally guided (like the Pershing II).

As with the WTO deployments, NATO deployments in the aircraft sector have been undramatic over the past two years. The F-111s remain the backbone of the US Air Force long-range interdiction force: of the 250 still in service, some 150 are deployed in Britain. In addition, the US Strategic Air Command has 60 FB-111 medium bombers in service. With necessary modifications and upgrading, the F/FB-111 force could remain in the US inventory throughout the 1990s. To complement the F-111s in the long-range strike mission, the USAF plans to modify 400 aircraft from its F-15 or F-16 programmes into a longer-range 'E' version.

Any statement of long-range theatre nuclear systems in Europe must include those deployed by France and Britain. There has been no significant change in present or proposed intermediate-range missile deployment (table 1.2). In the aircraft sector, the British Vulcan bombers have been retired from a nuclear role. The French plan to convert the Mirage IV to air-to-surface (ASMP) missile carriers. Eighteen such carriers are planned under the 1984–88 programme, together with 70 Mirage 2000N and 50 Super Etendard ASMP carriers. The Tornado programme is well under way; this aircraft is nuclear-capable and has a range well in excess of 1 000 km. More than 300 of the interdiction strike (IDS) version have been delivered to the British, West German and Italian air forces (out of a total of 532 planned).

The MX missile

Over a long period US government defence spokesmen have pointed to a 'window of vulnerability'—a situation in which Soviet land-based missiles could achieve an effective first strike against US land-based missiles. The Soviet Union was in a position to do this, it was argued, because the bulk of its missiles were land-based, with warheads powerful enough and accurate enough to destroy US silos. There are many reasons for thinking that an attempt at a first strike of this kind would be a totally irrational act, inviting the destruction of the Soviet Union. The window of vulnerability was, however, one of the main arguments used for the massive upgrading of US nuclear weaponry.

The Administration, however, faced a problem in explaining how the MX missiles would help to close this window of vulnerability. It is a much larger missile than the Minuteman, with more throw-weight and greater accuracy. It could, therefore, threaten Soviet silos in the same way that Soviet SS-18s can threaten US silos. The difficulty was that the MX is as vulnerable as the Minuteman missile. How could a missile which was itself vulnerable help to close the window of vulnerability?

In the long history of the MX missile, a number of different basing modes have been suggested. Under the Carter Administration, the proposal was for a 'race track' type of deployment, with the missiles being shuttled from one hole to another. A later proposal—under the Reagan Administration—went to the other extreme: the missiles would be deployed together, in a 'dense pack' mode, and would not be vulnerable because of the 'fratricide' effect of incoming missiles attacking them. The Administration failed to win Congressional approval for this latter idea. It therefore agreed to set up a commission not only to consider the problem of the basing of land-based missiles, but also to review the strategic modernization programme as a whole. This commission, chaired by a retired general, General Brent Scowcroft, was set up in January 1983, and reported in April.

IV. The Scowcroft Commission

The Scowcroft Commission had as senior counsellors representatives of previous administrations—for instance, Harold Brown, Henry Kissinger and James Schlesinger. It had a wide remit—"the strategic modernization program of the United States"—and it certainly had in mind to produce a report which might have bipartisan support. It is noticeable that the Commission could not bring itself to refer to the MX missile as the 'Peacekeeper' missile, the label which the Administration had invented.

The Commission usefully disposed of the window of vulnerability, by pointing out that the Soviet Union could not eliminate both US ICBMs and bomber and submarine bases simultaneously. This is because the Soviet Union would have to use different weapon systems to attack the bombers and the ICBMs. To attack the bombers, they would have to use the system which arrives promptly—submarine-launched missiles from submarines close offshore. However, these missiles are not accurate enough to destroy US ICBM silos, which would have to be attacked by Soviet ICBMs with a 30-minute flight time. If the Soviet Union tried a simultaneous *launch* of submarine-launched ballistic missiles (SLBMs) and ICBMs, the detonation of the SLBM warheads would precede the arrival of the Soviet ICBMs by 15 minutes—and US ICBMs could be launched before they were destroyed. (The Commission notes that this would be 'launch-under-attack', not 'launch-on-warning'.) If on the other hand the Soviet Union fired its missiles in such a way that the SLBMs and ICBMs would *arrive* together, the early warning of the firing of the Soviet ICBMs would give time for the bombers to take off before they were destroyed.

The Commission, although it briefly discussed—and endorsed—most other parts of the programme, concentrated on the land-based missile question. It recommended that in the longer run the United States should move away from heavy multi-warhead land-based missiles towards small single-warhead ICBMs: "looking towards deployment probably in the early 1990s. We suggest a single-warhead missile in order to reduce the value of the target, making it unremunerative to attack and, thus, enhancing the stability of the force—and small in order to open up . . . the opportunities for survivable basing almost certainly to include mobile basing."[13] The Commission thus recognized that the whole move towards multiple warheads was a mistake—and vindicated the position of those senators who in 1970 had argued for a mutual pause in the flight testing of MIRVed ICBMs with an eye towards banning them. For much the same reasons, the Commission recommended that research begin on smaller ballistic missile-carrying submarines, carrying fewer missiles than the Trident.

However, although the Commission declared its interest in arms control, its prime concern seemed to be with reducing the vulnerability of US missiles; at the same time it endorsed programmes which would increase the vulnerability of Soviet missiles. Thus it prescribed a hard-target kill capacity for the Midgetman missile: "It should have sufficient accuracy and yield to put Soviet hardened military targets at risk";[14] and it endorsed the cruise missile and the Trident II (D5) submarine-launched missile programmes—all these missiles could attack Soviet missiles in their silos. This broad endorsement of missile programmes with a hard-target kill capacity raises some questions about the chairman's claim that: "We are proposing new directions, both in ICBM forces and arms control. That new departure, fundamentally, is to integrate strategic force programs with arms control and to move both in the direction of stability".[13]

Further, the Commission—in a recommendation which brought a great deal of critical scrutiny in Congress—argued for the immediate deployment of about 100 MX missiles in existing Minuteman silos. It justified this somewhat contrary-looking recommendation on three grounds: first, to demonstrate US will and cohesion—in effect a fear that a decision now not to deploy would be taken as a sign of weakness; next, "in order to reduce the substantial imbalance in the capability of US ICBM forces compared to those of the Soviet Union. The Soviets can, with their ICBM forces, put our forces and other critical targets at risk in a way that the United States cannot begin to match"; and finally, "the MX is essential to induce the Soviets towards negotiations".[13]

Congressional advocates of arms control were more impressed by the arguments for eventual single-warhead missiles than by the arguments for the MX. The argument about the need to demonstrate US will could be used as justification for very foolish decisions. The second argument seems to imply a belief that Soviet ICBMs can put US strategic forces 'at risk' in a meaningful way, whereas elsewhere in the report the Commission argues powerfully that this is not the case. The final 'bargaining chip' argument has been used so often for deployments that were never subsequently reversed that it has fallen into disrepute.

The Administration has indicated that, in exchange for not deploying the MX, they would expect the Soviet Union to "forego their heavy and medium ICBMs".[15] This is hardly a serious negotiating position.

Congress, Scowcroft and arms control negotiations

Members of the Senate used the debate over the MX missile to attempt to force changes in the Administration's arms control stance. In May 1983, 19 senators wrote to the President: one paragraph of their letter reads as follows:

> We wish to emphasize that our support for releasing fiscal year 1983 funds does not represent a consensus on the need to deploy 100 MX missiles in Minuteman silo launchers. Rather, yesterday we effected our part of an agreement with your Administration to proceed with [a] military controversial program in exchange for a strong commitment to proceed seriously and immediately with a reformulation of the U.S. START proposal, a meaningful guaranteed builddown proposal, development of a more survivable, small single-warhead ICBM and creation of a bi-partisan, durable arms control panel.[16]

The build-down proposal is one of a number of arms control suggestions put forward in the US Congress. Many senators and representatives had clearly concluded that the Administration's negotiating position at Geneva was inadequate. Further, they saw the prospect, in the absence of any strategic arms control agreement, of an increase in the number of US strategic warheads from 9 500 to around 15 000, presumably matched by an equivalent increase on the Soviet side.

The build-down proposal was particularly promoted in Congress by Senators Cohen, Nunn and Perry and, in the House of Representatives, by Messrs Aspin, Gore and Dicks. The aim of the proposal is to permit modernization of the strategic forces, but at the same time to bring about a reduction in the number of warheads. The basic proposal—subsequently elaborated—is that the Soviet Union and the United States should each agree to eliminate two nuclear warheads from its strategic forces for each new warhead deployed.

The threat of opposition to the MX missile was sufficient to make the Administration agree to incorporate the build-down proposal into the Geneva strategic arms reduction talks (START) in some way. On 4 October 1983 the President announced that he was instructing the START delegation to propose to the Soviet side the setting up of a working group to discuss build-down. The proposal specifically includes:

1. A provision which links reductions to modernization using variable ratios which identify how many existing nuclear warheads must be withdrawn as new warheads of various types are deployed. According to press reports the ratios call for a 2:1 build-down of MIRVed ICBMs, a 3:2 build-down of SLBM warheads, and a 1:1 replacement of single-warhead ICBMs.

2. A provision calling for a guaranteed annual 5 per cent reduction if there is no new deployment.

(Whichever of these provisions produced the greater reduction would govern.)

3. A provision which addresses the build-down and trade-off of bombers and ALCMs, in which the USA has an advantage, for Soviet advantages in ICBMs.

4. The appointment of R. James Woolsey as member-at-large to join the US delegation.

The Administration also agreed to keep the Scowcroft Commission in being for possible future recommendations.

Critics of the build-down proposal argue that it permits the very process which arms control negotiations should be primarily concerned to stop—the technological modernization of weapons. Further, it could lead to an unstable situation if the introduction of new MIRVed missiles led to the withdrawal of single-warhead missiles. The proponents argue that it would produce a big improvement on the situation which would otherwise occur: that it would in fact encourage the deployment of single-warhead missiles, since these would not require reductions in the total missile stock: and that the proposal offers the prospect of a bipartisan approach to arms control.

There is no evidence as yet of any Soviet interest in the proposal.

V. Negotiations

The positions at the moment of breakdown

On 15 November 1983 the British government announced the arrival of cruise missiles at Greenham Common. On 22 November the *Bundestag* reaffirmed its support for deployment of cruise and Pershing missiles in FR Germany. On 23 November the Soviet Union discontinued the talks on long-range theatre nuclear forces, and on 8 December the Soviet government also suspended the strategic arms reduction talks without agreeing on a date for resumption.

At START, the main distinction between the negotiating positions of the United States and the Soviet Union was this: the United States was particularly concerned with the threat from Soviet heavy land-based missiles and wanted an agreement which would lead to a sizeable reduction in their number. In addition to the reduction of warheads and launchers, this could be through special provisions limiting total throw-weight. However, in the course of the negotiations the United States adjusted its position, seeking not to regain equality in throw-weight but a reduction in the disparity. Initially, the United States proposed that the first stage of an agreement should not include bombers or cruise missiles: later it agreed to their inclusion. The Soviet Union wanted an agreement on the lines of the SALT I or SALT II agreements, primarily setting overall numerical limits significantly lower than the limits set by SALT II, allowing each side freedom to mix as it thought best. It agreed, in the course of the negotiations, to use warheads as well as launchers as primary counting units. It also indicated a willingness to consider verification measures which apparently went beyond those it was willing to consider in SALT II.[17]

At the LRTNF talks, the United States demanded numerical equality between warheads on Soviet land-based missiles within range of western Europe, and warheads on US missiles stationed in Europe which could reach the USSR. Various figures—from the initial 0 up to 420—were suggested. It is unclear what portion of the total number of SS-20s the USA wanted to include in a European deal: the USSR had indicated that all missiles west of 80° East could be taken into account. As in START, the Soviet Union eventually agreed to take both warheads and launchers into consideration, and offered to reduce the number of SS-20 launchers to 140 (420 warheads, reload capabilities not included) and eliminate all remaining SS-4s and SS-5s in exchange for no new deployment in western Europe. That would have brought the number of warheads on Soviet LRTN missiles targeted on Europe below the number which existed before the SS-20 deployments began. The parties agreed that decommissioned SS-20s should not be redeployed further east, and that the number of Soviet LRTN missiles in eastern Siberia should be frozen. The parties also agreed to bring LRTN aircraft into the deal, and—according to the US negotiator—the final positions on aircraft were not very far apart.[18]

An interesting exchange took place over the possibility of equal reductions, in existing and prospective deployments, of 572 warheads on both sides. Such a reduction would bring the number of Soviet SS-20 launchers down to about 120 (or a little more than that) in exchange for no new deployments in western Europe—still an approximate equivalent of the British and French forces, but without using that as the rationale for the accord. In the immediate aftermath of the breakdown, the two chief negotiators gave very different accounts of the origin of this proposal.[19]

These are brief summaries of the positions when the talks broke down. Obviously, it is important that negotiations should begin again; but there will be another failure unless the major powers define their national security objectives in ways which make arms control possible.

Security policy and arms control

Nuclear superiority

For arms control to succeed, its provisions must be compatible with national security policies. The prime objective of arms control is to reduce the risk of nuclear war. If the superpowers, as an integral part of their security policies, make preparations for fighting and winning a nuclear war, and if they are bent on trying to achieve some kind of nuclear superiority, then arms control negotiations are a waste of time. Negotiations can only have some reasonable chance of success if the nuclear powers accept that nuclear weapons have one use and one use only—to deter their use by others.

The leaders of both superpowers have stated that nuclear wars cannot be won and therefore must never be fought. However, the defence guidance documents in the United States, setting guidelines for the armed forces for the next five years, tell a rather different story. If deterrence fails, they indicate that the goal is to "prevail" in a nuclear war, and to be able to terminate the war on conditions favourable to the United States.[20] On both sides, the procurement policies in the nuclear weapon field do not seem to match the statements of the leaders.

Political advantage

Both superpowers also appear to believe that an appearance of inferiority in nuclear weapons brings great political damage. It follows that they believe—though they do not say this—that an appearance of superiority brings great political advantage. Thus, the former head of the Arms Control and Disarmament Agency, Eugene Rostow, has said, "The present state of the nuclear balance is a pervasive and insidious political force deeply affecting political attitudes throughout the West",[21] and again on another occasion, "The nuclear weapon is primarily a political, not a military force—a potent political force, generating currents of opinion which are transforming our world . . . I believe the risk of nuclear war is far less today than the risk that the unity of the West will be destroyed and the West reduced to neutrality by psychological and political pressures emanating from the nuclear balance."[22]

If, as Rostow suggests, there was indeed a political wound from the alleged Soviet superiority in land-based missiles, it was a self-inflicted wound. Instead of constantly referring to a non-existent window of vulnerability, US spokesmen could simply have pointed out that a land-based missile superiority, if it existed, had no military value. Then there would be no cause for political consequences of any kind. The political effect, such as it is, was created by the same people who then proceeded to stress its importance.

All that it is necessary to do with a superiority which is militarily meaningless is, first, to point out that this is so and, second, to invoke the concept of sufficiency, not parity. Then there would be no reason for political consequences to arise from a militarily meaningless number.

The view that apparent nuclear superiority or inferiority is of great political importance is a very dangerous one. The consequence is an unending arms race in nuclear weapons. Further, the lesson will not be lost on the non-nuclear nations—that nuclear weapons, in the judgement of the United States and the Soviet Union, yield political dividends. The political importance that the major powers ascribe to nuclear weapons is a prescription for proliferation. All efforts to obtain unilateral advantage are at odds with arms control.

Reshaping the political relationship

When both sides are engaged in qualitative and quantitative developments of their nuclear weapons, they inevitably begin to think in terms other than those of basic deterrence: they look for some additional return from their investments in their weapons. In the Soviet Union, military considerations have always been important in foreign policy: so there is a natural tendency to seek a preponderance wherever possible. In the United States, there is a fixed belief that the Soviet Union will be forced to make concessions if it is confronted by an ambitious rearmament programme in the United States. There is no evidence that this tactic had any success in the past, and it is even less likely to be successful now. However, it is a view which still seems to be held as tenaciously as ever.

Arms build-ups often give rise to the doctrines which justify them. Military, industrial and technological forces have been combining to push doctrines away from basic deterrence and towards a belief that political and military gains can be obtained from some advantage in nuclear weapons. The prospects for arms control are poor so long as these beliefs hold sway.

The issue of compliance with arms control obligations has been turned into political polemics; this is another practice that has to be abandoned. The objective should be to clarify questionable behaviour, making full use of existing consultation mechanisms to that end—"not to exploit these concerns in order to further poison relations, repudiate existing agreements or, worse still, terminate arms control altogether".[23]

Security policy and arms control: the European dilemma

In Europe, the nuclear weapon policies which are now being pursued suffer from one fundamental flaw and one serious myth. The flaw concerns the role of nuclear weapons in national defence. Once the nuclear threshold is crossed, it is extremely hard to imagine that the use of nuclear weapons would be limited to selective employment in the battle area, or that fire-breaks would be observed which would limit collateral damage. Nuclear warfighting is not a meaningful form of defence. It is not surprising that NATO has never agreed on what to do next if an initial use of nuclear weapons, to show resolve, fails to stop hostilities.[24] Security policies should no longer be based on a nuclear response to a conventional attack. For the European states, the policy of extended deterrence is profoundly untenable.

The myth is that cruise and Pershing missiles will provide a link to US strategic intercontinental nuclear forces, and that the United States will be prepared to launch nuclear strikes against the Soviet Union in defence of western Europe. The coupling is rather the other way around: the new missiles make it virtually certain that western Europe will be drawn into any strategic war between the two superpowers (for a comprehensive discussion, see *SIPRI Yearbook 1982*, pages 25–32).

Instead of seeking technological fixes to sustain the myth, the west European members of NATO would do better to recognize the compelling logic of strategic parity between the two superpowers: the nuclear umbrella, originally meant to defend Europe, is gone. It makes no sense to ask the United States for a reassurance that it cannot possibly give. In a nuclear war, acts of irrationality may no doubt occur, and forward deployment of cruise and Pershing missiles may make Soviet decision makers more uncertain of the Western response to a WTO thrust westwards. But for the west European states it is hardly prudent defence planning to stake their national security on the assumption that, in time of war, the US authorities will abandon prudence and reason and risk committing suicide on their behalf.

The structure of resumed negotiations

Combining START and LRTNF

The basic requirement of successful negotiations is that the objectives of arms control policy and security policy should be compatible. However, the structure of the two sets of talks will also have to be reviewed: the present structure could hardly survive. Arms control negotiations should reflect military realities: the military reality is that many different types of nuclear weapons, located in different places, could be used for destroying any particular target. It is not very sensible, therefore, for arms control to constrain some of these options but not others. For instance, from the Soviet point of view, a land-based cruise missile launched from Britain or Italy towards Soviet territory is essentially in the same category as an air-launched or a sea-launched cruise missile fired from a US bomber or submarine, and it is not easy to see why they should be dealt with in separate negotiations. The division between START and the LRTNF talks was always somewhat arbitrary.

The growing deployment of forward-based systems also makes this separation less sensible. Just as weapons with an intercontinental range can be used over shorter distances, so systems with ranges less than 5 500 km (the traditional criterion for a strategic system) can be used for strategic missions if they are forward based. The correlation between range and mission is weak.

Negotiations about sub-categories of nuclear weapons are always prone to circumvention. The sea-based cruise missile is a case in point: it was included neither in START nor in the LRTNF talks. Also, in an amalgamated set of negotiations it would be easier to deal with the vexed question of French and British forces, and trade-offs because of geographical asymmetries, technological differences and differences in force structure would be easier to negotiate. The balance of the argument is for treating intercontinental and theatre nuclear systems in one negotiation.

The lower end of the range spectrum

The LRTNF talks were mainly concerned with systems having a maximum range somewhere between 1 000 and 5 500 km. However, non-circumvention rules for weapons of shorter range were considered. When forward based, such systems can cover many targets otherwise covered by LRTNFs. For instance, SS-22s in the GDR and Czechoslovakia can cover about 80 per cent of the nuclear weapon targets in western Europe, and SS-23s almost 50 per cent. A merged negotiation would also encounter this problem. One possibility would be to keep the 1 000-km limit and negotiate non-circumvention rules, through geographical limitations on deployment. Another solution, even better from the point of view of arms control, would be to lower the limit of the negotiations to 200 km—that is, to include everything except the short-range theatre nuclear forces.

The missile systems currently considered by NATO for deep-strike missions have ranges clearly in excess of 200 km (see chapter 8). Nuclear as well as conventional options are being considered for these weapons. It would therefore be an advantage to include them in the negotiations. A limit on nuclear warheads which included them would give both sides an incentive to deploy conventional munitions for these missions.

For shorter-range nuclear weapons, the disengagement option, as a technique of constraint, is perhaps more promising. If this were to be combined with negotiations covering all other nuclear weapons, then in principle the entire range would be covered.

Overall step-by-step reductions

If overall limits were negotiated, this would make it easier for trade-offs between asymmetric force positions, leaving both sides to mix force components as they wished. It should only be necessary to fix limits for a few dimensions of nuclear weapon capability: deliverable warheads would be the main unit of account.

The nuclear balance is not delicate. For basic deterrence, all that is required is sufficiency—enough nuclear weapons to survive a first strike and inflict severe damage on the other side. There is no military need for parity. There is no rational military use which could be made of some margin of superiority, measured by one or other of the yardsticks used. The search for parity is part of the problem, not a route to a solution.

It follows that there is a wide range of possible agreements which would enhance the security of both superpowers. One such agreement would be a deep, say 50 per cent, cut in the limits set by the SALT II agreement. However, a slower step-by-step approach may be easier to negotiate. "Experience teaches that negotiations with the Russians can proceed only if limitations accepted at one stage serve as a basis for stricter constraints at the next."[25]

Destabilizing technologies

More important than overall reductions are curbs on destabilizing technologies, for example, technologies that may be taken to serve nuclear first-strike purposes. Improved accuracies and anti-submarine warfare capabilities have such destabilizing effects. Effective ballistic missile defences deployed in outer space would also be destabilizing if they could ever be made to work. Even if only proposed, they could set in motion the development of countermeasures on the other side.

The increase in accuracy, which gives ballistic as well as cruise missiles and other stand-off weapons high counterforce potential (i.e., a potential to destroy the nuclear forces of the adversary), is particularly disturbing. It is true that the vulnerability to these weapons of ICBMs in hardened silos has been exaggerated: but this vulnerability is widely believed. The short flight time of forward-based missiles is also destabilizing: it encourages pre-delegation of authority to fire under attack. It could lead either of the superpowers to consider seriously a policy of launch-on-warning (although, in view of the uncertainties of such a system, it is hard to believe that either of them would in fact adopt it).

These developments lead to a greater risk of war by technical error and pressure for pre-emption in time of crisis. Some forward-based systems will, moreover, be targeted on enemy C^3I centres. If they were used for this function in war, the result could be a totally uncontrolled nuclear attack from the other side.

The Pershing II missile combines many of these destabilizing characteristics. It is the first ballistic missile with a terminal guidance system, the CEP[26] being a few tens of metres, and the flight time is only 12 minutes over a distance of 1 800 km. For strategic uses against Soviet territory, it will probably be targeted on C^3I installations and other targets deemed time-urgent (such as quick-reaction alert aircraft, missiles and submarines in port). It is mobile and therefore difficult to destroy unless pre-empted at base. However, Soviet deployments in the GDR and Czechoslovakia could provide area coverage of the Schwäbisch-Gmünd–Neu Ulm–Neckarsulm region, and so make it vulnerable. The temptation to pre-empt would increase on both sides.

Mainly because of their long flight time, the cruise missiles are less destabilizing. Still, they constitute another serious challenge to arms control, not least because of the verification problems that they raise. For some years, US plans for deployment of cruise missiles have indicated a leap forward in the number of deliverable strategic warheads. Air- and ground-launched cruise missiles are being deployed, while the first nuclear sea-based missiles are due to become operational on general-purpose submarines in the second half of 1984. Recently, the Soviet Union has also flight-tested long-range cruise missiles with terrain guidance technologies. Limits are therefore urgently needed. A complete ban on sea-launched cruise missiles is essential for effective verification of future agreements.

The role of forward-based systems in superpower force postures is increasing: witness the forward deployment of ballistic missiles in eastern and western Europe, huge cruise missile acquisitions for deployment world-wide, and submarines patrolling closer to foreign shores.

As one superpower increases its forward-based deployment, the other follows suit. Thus the Soviet Union deploys new missiles in eastern Europe, and threatens to deploy near the US coastline missiles which "will be comparable with the new American missiles in flight time to targets, nuclear yield and accuracy".[27] Long open coastlines with naval bases and many important airfields near the sea make the United States vulnerable to this counter-strategy.

This move towards forward-based systems is a very dangerous one, and it should be a high priority in resumed negotiations to find a way of restraining and reversing it.

The role of European countries

Nuclear weapons are also used as important means of political control. New US missiles in western Europe and new Soviet missiles in eastern Europe strengthen the grip of the major powers in their respective parts of the continent; and in the nature of things the major powers themselves may well be reluctant to give up the political leverage which they believe these deployments provide.

The initiative, therefore, for some halt and reversal to the competition in nuclear weapons may well have to come from Europe itself. Europeans have powerful reasons for concern: some 10 000 nuclear weapons are deployed on European soil for use in time of war. It is in this part of the world that public opinion against nuclear arms is most strongly voiced.

During the LRTNF talks, the European members of NATO formed a Special Consultation Group advisory to the United States. In a resumed negotiation, the claim for a European say would be particularly strong if the negotiations were to cover all nuclear weapons down to the 200-km threshold. Countries in other parts of the world where nuclear weapons above this range are deployed, or certain countries which consider themselves targets for such weapons, should also be involved. At the LRTNF talks, NATO proposed an overall ceiling with regional sub-ceilings. That might be a reasonable approach for new negotiations, with mechanisms for more direct third party participation.

The need for some interim measure

It does not seem likely that negotiations on nuclear arms control will be resumed soon—and when they do resume, they will probably take a long time. In the meantime, deployments of new nuclear weapons on new platforms will be going ahead. That is why it is very important that there should be some interim measure, setting some cap on nuclear arsenals.

In January 1984, at a combined meeting of the Palme and Brandt Commissions in Rome, the Palme Commission proposed a one-year moratorium on nuclear weapon deployments. The Commission urged "the Soviet Union and the United States to declare reciprocally a one-year pause on deployment of nuclear weapons to open the way for the resumption of talks". The statement went on to say, "This moratorium would create more favourable conditions and facilitate agreement on new principles to guide negotiations for significant qualitative limitations and quantitative reductions of nuclear weapons."[28] For Europe, such a moratorium would be sensible because it would provide another chance for agreed restraints on euromissiles. However, acceptance of the final Soviet offer in Geneva, to cut Soviet forces targeted on Europe by half, would have been better.

The statement did not specify how far down the range the moratorium should apply. However, it would seem that battlefield nuclear weapons could be exempted. On the NATO side, the number of these weapons is being reduced in any case, making a moratorium less relevant for this category of weapon: and the best way to deal with them is by a disengagement agreement rather than a moratorium.[29]

The argument may be presented that a moratorium would in some sense be of more benefit to the Soviet Union than to the United States. The United States is proposing to deploy a number of nuclear-tipped cruise missiles this year; the Soviet cruise missile programme is not that far advanced. On the other hand, any new Soviet ICBM deployments would be halted; the United States is not due to deploy new ICBMs in 1984. Both sides would have to stop bomber programmes and modernization at sea. The Soviet moratorium on deployment of SS-20s would be reinstated. Soviet deployment of SS-22s in the GDR and Czechoslovakia would be halted at a very early stage, and in western Europe, no further cruise or Pershing II missile would be added to the 41 now deployed.

A moratorium would not damage security on either side. The question is whether the superpowers are willing to stop their struggle for margins of superiority and apparent associated political advantage. The moratorium proposal is a test of their willingness to do so.

Notes and references

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[2] Getler, M., *Washington Post*, 16 September 1983.
[3] Robinson, C. A., 'Soviets test new cruise missile', *Aviation Week & Space Technology*, 2 January 1984.
[4] Official US figure. There may be one reload missile fielded per launcher.
[5] Statement at Williamsburg summit meeting, 29 May 1983.
[6] *Korea News Review*, 8 October 1983.
[7] Jiji Press, 29 October 1983.
[8] The three conditions are: reduction of forces along the Chinese–Soviet border (including Mongolia); an end to military support to Viet Nam in its war against Kampuchea; and withdrawal of Soviet troops from Afghanistan.
[9] Marshal Ogarkov, statement at a press conference, Moscow, 5 December 1983, quoted by TASS.
[10] TASS press release, 25 November 1983.
[11] See *Washington Post*, *Washington Times* and *Wall Street Journal*, all of 27 January 1984.
[12] Urban, M. L., 'Major re-organization of Soviet air forces', *International Defence Review*, Vol. 16, No. 6, 1983, p. 756.
[13] Statement by Lt. Gen. Brent Scowcroft, in *Committee on Armed Service*, House of Representatives, 98th Congress, 1st session, Part 2, Strategic Programs (US Government Printing Office, Washington, D.C., 1983), p. 63.
[14] Report of the President's Commission on Strategic Forces, April 1983, p. 15.
[15] Note 1, p. 15.
[16] Note 1, pp. 44 and 45.
[17] Speech by Edward Rowny before the Commonwealth Club of California, 27 January 1984.
[18] Nitze, P. H., 'The American negotiator's view of the Geneva talks', *New York Times*, 20 January 1984.
[19] Nitze (note 18); and Kvitsinsky, Y., 'The Soviet negotiator blames America', *New York Times*, 13 January 1984.
[20] *New York Times*, 30 May 1982.
[21] Note 1, p. 191.
[22] Note 1, p. 210.
[23] Harriman, A. W., 'Three years of Reagan: "nuclear irresponsibility" ', *New York Times*, 3 January 1984.
[24] For an overview and assessment of the debate on no-first-use, see Blackaby, F., Goldblat, J. and Lodgaard, S., *No-First-Use*, SIPRI (Taylor & Francis, London, 1984).
[25] Smith, G. C., Warnke, P. C. and Rhinelander, J. B., 'The road back to the negotiating table', *New York Times*, 29 December 1983.
[26] Circular error probable, a measure of missile accuracy: the radius of a circle, centred on the target, within which 50 per cent of the weapons aimed at the target are expected to fall.
[27] Kvitsinsky (note 19).

[28] Statement by the International Commission on Disarmament and Security Issues (ICDSI, the Palme Commission) following a joint meeting of ICDSI and the International Commission on International Development Issues (ICIDI, the Brandt Commission) in Rome, 20–22 January 1984.
[29] NATO has announced the withdrawal of 1 400 nuclear warheads from western Europe over the coming 5–6 years, comprising atomic demolition mines and warheads for Nike-Hercules air defence missiles. For a presentation and discussion of nuclear disengagement options in Europe, see Lodgaard, S. and Thee, M. (eds), *Nuclear Disengagement in Europe*, SIPRI (Taylor & Francis, London, 1983).

2. Nuclear explosions

RAGNHILD FERM

Superscript numbers refer to the list of notes and references at the end of the chapter.

I. Explosions in 1983

According to preliminary data, 50 nuclear explosions were carried out in 1983, all underground. Of these the United States conducted 14, the Soviet Union 27 and France 7. The United Kingdom and China conducted only one explosion each (see appendix 2A).

Fourteen of the 27 Soviet explosions took place at the known weapon test sites—12 at Semipalatinsk in the eastern part of Kazakhstan, and 2 on Novaya Zemlya. The remaining 13 were conducted outside these sites and are therefore presumed to have served non-weapon purposes. Six of these explosions, conducted on 24 September 1983, took place at five-minute intervals, which may be an indication that they were used in an engineering project. Indeed, in the area north of the Caspian Sea where they took place, large underground chambers may be needed for storage of natural gas. According to the data compiled by SIPRI, the Soviet Union has carried out 62 'peaceful' nuclear explosions during the past 10 years, while the United States has not conducted any explosion of that kind since 1973.

In all, as many as 1 440 nuclear explosions have been carried out since 1945, and it is noteworthy that the average number of explosions per year has increased considerably since the signing of the 1963 Partial Test Ban Treaty (PTBT), which prohibited atmospheric tests but allowed testing underground (see appendix 2B).

The figures given in this chapter may not be entirely accurate. Official information is either lacking or incomplete, because of the usual secretiveness of the military establishments. Certain states are reluctant even to reveal their capabilities to detect nuclear explosions, or to help others improve such capabilities. Some may also fear unfavourable public reaction to announced tests. Moreover, there is a trend in nuclear testing to reduce the size of explosions; in the case of very weak events, it is impossible to distinguish, through seismological methods alone, between chemical and nuclear explosions.

While China, the USA and the USSR conduct tests within or close to their mainland territories, French tests are conducted at sites far from the shores of France (and British tests are now conducted in Nevada, USA).

This has given rise to a number of problems in relations between France and other countries. The next section describes some of these problems.

II. The French testing programme

The decision to embark on an atomic weapon programme was taken by the French authorities as early as the beginning of the 1950s, but it was not until 1958 that an official order was issued to manufacture and test the bomb. The first explosion of a French nuclear device took place on 13 February 1960 in the Sahara Desert, in Algeria (then a French possession).

Seventeen nuclear tests were carried out at the Saharan site between 1960 and 1966, most of them (13) underground. Many African states strongly objected to the testing; Nigeria even broke off diplomatic relations with France. The UN General Assembly adopted a resolution in 1961 calling upon UN member states to refrain from carrying out nuclear tests in any form in Africa and to respect the continent of Africa as a denuclearized zone.[1]

When Algeria became independent in 1962, France was allowed to keep its nuclear testing facilities there for only five more years. French Polynesia, a French territory since 1843, was then chosen as the new test site, and the Centre d'Experimentation du Pacifique (CEP) was set up.

The main site was built on the Mururoa atoll, then uninhabited. It is located in the Tuamoto archipelago, a group of islands in the eastern part of French Polynesia, about 1 000 km south-east of Tahiti and 6 000 km east of Australia. (A subsidiary site was located at Fangataufa, an atoll about 40 km south of Mururoa.)

The first nuclear test in French Polynesia was carried out on 2 July 1966. All tests (41) in the period 1966–74 were conducted in the atmosphere. Some devices were exploded from a tower, but most were dropped from aircraft or balloons and detonated.

Although many states, including the USA, the Soviet Union and the United Kingdom, joined the Partial Test Ban Treaty, France refused to join, claiming that it had just reached a stage in its nuclear weapon development where its tests had to be conducted in the atmosphere. It declared that the PTBT was a discriminatory agreement, aimed at preventing the armament of unarmed countries.[2]

Continued French (and Chinese) testing in the atmosphere, after the other three nuclear weapon powers had stopped, provoked a very negative reaction from several governments and public opinion in general. The effects of nuclear explosions on man and the environment, that were not universally understood even by scientists when the Soviet Union, the USA and the United Kingdom carried out atmospheric testing, were well known when France started its testing programme in Polynesia. Strong protests were raised by the people of the Polynesian islands and neighbouring countries. Trades unions, environmental and other organizations, and international conferences became involved in the campaign against the French explosions. Especially active at the beginning of the 1970s was Greenpeace, an international environment protection organization which has devoted special interest to nuclear testing. Greenpeace did not succeed in stopping the French explosions but it did delay some of the tests by the presence of its vessel in the forbidden testing area. Its first goal—the cessation of atmospheric tests—was reached a few years later.

Resolutions adopted by the UN General Assembly have repeatedly condemned nuclear testing in the atmosphere, and in November 1972 testing in the Pacific was expressly mentioned.[3] A year later, another UN resolution deplored "environmental pollution by ionizing radiation from the testing of nuclear weapons".[4] In 1973 Australia and New Zealand brought the matter before the International Court of Justice, claiming that nuclear testing in the atmosphere over the Pacific Ocean was not consistent with the rules of international law. France denied that it was violating international law and argued that the Court was not competent to pass judgement since nuclear testing is an activity connected with national defence and therefore excluded from the authority of the Court. The Court indicated that the French government should avoid nuclear tests causing the deposit of radioactive fall-out on the territory of the states in the region,[5] but France did not consider itself bound by this order and started a new series of atmospheric tests. It was only in 1974 that France stated that it had reached a stage in its nuclear technology where it could continue its programme by relying exclusively on underground testing. It took steps to do so the very next year.[6] After this announcement the International Court of Justice stated that it found that the objective of Australia and New Zealand had been accomplished.[7]

The underground tests were to take place on the Mururoa atoll (and some also on the Fangataufa atoll). Mururoa is a long and narrow reef, 30 km by 10 km, easily washed over by the sea in stormy weather and made of porous coral resting on hard, brittle, permeable rock. French authorities stated that geological and seismological tests had proved that the volcanic rock under the atoll would make underground testing possible, but doubts were raised by the people in the region about whether Mururoa was an appropriate place. Protests in the region continued. It was argued that the tests created risks for the environment and that radioactivity was seeping into the sea. The Territorial Assembly (the local parliament) of French Polynesia asked on several occasions for the creation of an international commission of inquiry, composed of impartial civilian doctors and radiobiologists, with the task of undertaking a comprehensive health survey. The demand was repeatedly rejected by the French government.

It may be noted that the social and economic impact of the testing on French Polynesia has been significant. The islands now derive about 40 per cent of their income from the testing activities, and it would probably create economic difficulties for the population if testing were ceased. Local people are therefore somewhat divided on the nuclear testing issue. Since some 20 000 Frenchmen have moved to Polynesia the indigenous lifestyle of the population has changed dramatically.

France's explosion of a large nuclear device in May 1983 caused the Australian government to react particularly strongly. The Minister for Foreign Affairs claimed that, according to reports, the explosion had a yield of about 70 kt, the biggest since 1979, although he had been assured by the French government that testing at Mururoa would be confined to smaller explosions.[8] He later also expressed concern about the reports that neutron weapons had been tested, and urged the French government to take Australia's objection into account before any decision was taken to start manufacturing these weapons.[9]

On an official visit to Paris in June 1983, the Australian Prime Minister declared that the Australian Cabinet had decided to suspend shipments of uranium to France until the end of 1984. (Australia is potentially the third largest producer of uranium in the world.)

There have been reports that the explosions have severely damaged the Mururoa atoll so that the sea has become contaminated by radiation. One explosion has even broken the rock and caused a tidal wave that submerged certain installations. Several other accidents have also been reported and it is now generally acknowledged that serious leaks of radioactivity have occurred. The French Defence Minister admitted that a "*situation radiologique nouvelle*" had arisen.

A document based on reports by workers at the Mururoa test site was prepared by the French trade union Confédération Française Démocratique du Travail (CFDT) in 1981.[10] It complained about poor security arrangements and revealed that several severe accidents had occurred. The CFDT estimated that the atoll had sunk 1.5 m as a result of the tests —about 2 cm at each explosion—and that an underwater crack had formed, about 50 cm wide and 800 m long, that may be leaking radioactive blast products into the sea.

Storms are a major threat to man and the environment in the region. Between December 1982 and May 1983 seven cyclones struck French Polynesia, causing extensive damage. Although no reports were issued by the French authorities about possible damages on Mururoa, the Defence Ministry ordered a postponement of the 1983 test series for a month.

It was claimed that the CEP staff needed time to check that the storms had not affected the atoll and that the security arrangements were in order.

To pacify critics and to reply to the reports about accidents, the French government started an investigation under the well-known vulcanologist Haroun Tazieff. In June 1982 the eight-man team took air and water samples during a test to verify the safety arrangements. The report published a year later played down most of the risks connected with the tests.[11] It did not give any figures but, in referring to radioactivity, it used the terms "feeble" and "innocuous". The main conclusion was that there was little risk of radioactive contamination from the underground tests and that the fall-out from past atmospheric tests was harmless throughout the area. Thus the conclusions were not alarming, but the report contained criticism.

Concerning the reported changes to the atoll, the Tazieff team argued that the atoll could have sunk as part of its natural evolution and that this did not necessarily have anything to do with the tests, but it admitted that the explosions had caused certain subsidences. The team urged that more research on and around Mururoa should be carried out. Although releases of radioactivity were unlikely in the short term, there was a risk of long-term releases into the ocean if the test chambers were connected with the sea through cracks in the basement of the atoll. Tazieff advised the French authorities to publicize the scientific information about the tests so as to improve the "psychological climate". The scientists in the team had to rely on data provided by local monitoring groups and complained that some information was not satisfactory. One member drew attention to the fact that no studies had been made to investigate the impact on the marine environment of the waste products accidentally brought into the lagoon in 1981. It was regretted that the time the team spent in Polynesia was too short—three days on Mururoa and three days on Tahiti—and it was stressed that the report should be considered preliminary.

After the publication of the report the French Defence Minister declared that measures of protection against storm damage to the atoll would be improved and that a group was studying how to improve the detection of radioactive leaks around Mururoa during the test periods.

In June 1983 a special envoy of the French President went on a tour to the Pacific countries, among other reasons to explain his government's policies on nuclear testing. He confirmed an invitation extended earlier to each country in the region to inspect the Mururoa test site.

Australia accepted the invitation, as did New Zealand and Papua New Guinea. The remaining states, not having nuclear expertise, were content with a symbolic representation. The Australian Prime Minister said before the group left for Mururoa: "It is important to stress that environmental inspection of Mururoa Atoll, although an important consideration, does not meet Australia's concerns about nuclear testing."[12]

The team, consisting of experts in marine geology, environmental science, radiation and biology, left for Mururoa in October 1983. They took samples from the sea around the atoll and from a smaller part of the atoll itself but not in the zones where nuclear tests had taken place because of "defence security reasons".[13] On their return from Mururoa the scientists declared that it was too early to say whether they had discovered any evidence of radiation pollution, because it would take time to analyse the samples and to study the data collected.

France, the world's third largest nuclear power, possesses an arsenal of about 50 launchers for short-range tactical missiles, 18 silo-based intermediate-range ballistic missiles, a little more than 100 nuclear-designated aircraft and 5 nuclear-powered submarines with, altogether, 80 ballistic missiles. In April 1983, the French Cabinet approved a five-year military spending programme which gives priority to the nuclear forces and includes modernization of France's arsenal, both strategic and tactical. France has developed its own multiple warhead missile (the M4), to be deployed on the sixth submarine, and has confirmed that the nuclear testing programme at Mururoa also included experiments in neutron weapon technology. (The Defence Minister declared, however, that the neutron bomb would not enter production unless the French President so decided.)[14] Testing nuclear devices is claimed to be absolutely essential to develop and maintain these nuclear forces and to check the safety of the weapons. The French administration stressed that France had the same right to test as the other nuclear weapon states. In response to complaints that it was testing far away from its own territory, France responded that its overseas territories constituted part of the national territory.

Although it declared that it would not carry out any more atmospheric tests, France has refused to accede to the PTBT. Moreover, in the Geneva Disarmament Committee, the French delegation has stated that it was not able to participate in negotiations for a comprehensive test ban treaty. In this connection France reiterated its position that the cessation of tests must take place within the framework of an effective nuclear disarmament process.[15]

Notes and references

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[2] Goldschmidt, B., *Le complexe atomique. Histoire politique de l'énergie nucleaire* (Fayard, Paris, 1980), pp. 186–87.

[3] UN document A/RES/2934A (XXVII), 29 November 1972.

[4] UN document A/RES/3154A (XXVIII), 14 December 1973.

[5] *Yearbook of the United Nations 1973, Vol. 27* (Office of Public Information, United Nations, New York, 1976).

[6] UN document A/PV.2238, 23 September 1974.
[7] International Court of Justice, Communiqué No. 74/12.
[8] *Australian Foreign Affairs Record*, Vol. 54, No. 5, May 1983, pp. 186–87.
[9] *Australian Foreign Affairs Record*, Vol. 54, No. 6, June 1983, p. 296.
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[11] *Rapport d'Haroun Tazieff sur l'ensemble de la mission scientifique en Polynesie Française* (Paris 1983) (mimeograph).
[12] Press statement, Australian Information Service, 9/83-32.
[13] Press statement, New Zealand government, 20 October 1983.
[14] *Der Spiegel*, 27 June 1983, p. 110.
[15] Committee on Disarmament document CD/PV.176, 5 August 1983.

Appendix 2A

Nuclear explosions, 1983 (preliminary data)

Note

1. The following sources were used in compiling the list of nuclear explosions:

(*a*) US Department of Energy,

(*b*) Hagfors Observatory of the Research Institute of the Swedish National Defence, and

(*c*) press reports.

2. Events marked with an asterisk * may be part of a programme for peaceful uses of nuclear energy in view of their location outside the known weapon testing sites.

3. m_b (body wave magnitude) indicates the size of the event; the data have been provided by the Hagfors Observatory of the Research Institute of the Swedish National Defence.

Date (GMT)	Latitude (deg)	Longitude (deg)	Region	m_b
USA				
11 Feb	37.051 N	116.045 W	Nevada	
17 Feb	37.163 N	116.063 W	Nevada	
26 Mar	37.301 N	116.460 W	Nevada	5.3
14 Apr	37.073 N	116.046 W	Nevada	6.1
5 May	37.012 N	116.089 W	Nevada	4.7
26 May	37.103 N	116.006 W	Nevada	
9 Jun	37.158 N	116.089 W	Nevada	4.9
3 Aug	37.119 N	116.089 W	Nevada	
11 Aug	37 N	116 W	Nevada	
27 Aug	37 N	116 W	Nevada	
1 Sep	37.273 N	116.355 W	Nevada	5.5
21 Sep	37.210 N	116.210 W	Nevada	
22 Sep	37.106 N	116.049 W	Nevada	
16 Dec	37 N	116 W	Nevada	5.3
USSR				
1 Feb	47 N	48 E	W Kazakhstan*	4.3
24 Feb	47 N	48 E	W Kazakhstan*	4.3
25 Feb	47 N	48 E	W Kazakhstan*	4.2
2 Mar	47 N	48 E	W Kazakhstan*	4.1
30 Mar	50 N	78 E	E Kazakhstan	5.0
12 Apr	49.815 N	78.222 E	E Kazakhstan	5.0
30 May	49.740 N	78.210 E	E Kazakhstan	
12 Jun	49.894 N	78.964 E	E Kazakhstan	
24 Jun	50 N	78 E	E Kazakhstan	5.0
10 Jul	51.327 N	53.286 E	S Ural Mountains*	
10 Jul	51.336 N	53.290 E	S Ural Mountains*	
10 Jul	51.357 N	53.301 E	S Ural Mountains*	
28 Jul	50 N	78 E	E Kazakhstan	5.0

18 Aug	73.373 N	54.839 E	Novaya Zemlya	
11 Sep	49.801 N	78.244 E	E Kazakhstan	
24 Sep	46.773 N	48.300 E	N of Caspian Sea*	5.4
24 Sep	46.763 N	48.281 E	N of Caspian Sea*	5.2
24 Sep	46.872 N	48.214 E	N of Caspian Sea*	5.2
24 Sep	46.748 N	48.299 E	N of Caspian Sea*	5.4
24 Sep	46.772 N	48.267 E	N of Caspian Sea*	5.5
24 Sep	46.758 N	48.257 E	N of Caspian Sea*	5.5
25 Sep	73.341 N	54.501 E	Novaya Zemlya	6.4
6 Oct	49.933 N	78.833 E	E Kazakhstan	
26 Oct	49.883 N	78.856 E	E Kazakhstan	
20 Nov	50 N	78 E	E Kazakhstan	6.4
29 Nov	50 N	78 E	E Kazakhstan	5.5
26 Dec	50 N	78 E	E Kazakhstan	5.7
UK				
22 Apr	37.112 N	116.022 W	Nevada	
France				
19 Apr	21.864 S	138.941 W	Mururoa	
25 May	21.912 S	138.936 W	Mururoa	
28 Jun	21.815 S	138.950 W	Mururoa	
20 Jul	22 S	139 W	Mururoa	
4 Aug	22 S	139 W	Mururoa	
3 Dec	22 S	139 W	Mururoa	
7 Dec	22 S	139 W	Mururoa	
China				
6 Oct	41.552 N	88.741 E	Lop Nor	5.9

Appendix 2B

Nuclear explosions, 1945–83 (known and presumed)

I. 16 July 1945–5 August 1963 (the signing of the Partial Test Ban Treaty)

USA[a]	USSR	UK	France	Total
331	164	23	8	**526**

II. 6 August 1963–31 December 1983

a atmospheric
u underground

	USA[a]		USSR		UK		France		China		India		
Year	a	u	a	u	a	u	a	u	a	u	a	u	Total
6 Aug–31 Dec 1963	0	14	0	0	0	0	0	1					**15**
1964	0	29	0	6	0	1	0	3	1	0			**40**
1965	0	28	0	9	0	1	0	4	1	0			**43**
1966	0	40	0	15	0	0	5	1	3	0			**64**
1967	0	28	0	15	0	0	3	0	2	0			**48**
1968	0	33[b]	0	13	0	0	5	0	1	0			**52**
1969	0	29	0	15	0	0	0	0	1	1			**16**
1970	0	30	0	12	0	0	8	0	1	0			**51**
1971	0	12	0	19	0	0	5	0	1	0			**37**
1972	0	8	0	22	0	0	3	0	2	0			**35**
1973	0	9	0	14	0	0	5	0	1	0			**29**
1974	0	7	0	19	0	1	7	0	1	0	0	1	**36**
1975	0	16	0	15	0	0	0	2	0	1	0	0	**34**
1976	0	15	0	17	0	1	0	4	3	1	0	0	**41**
1977	0	12	0	16	0	0	0	6	1	0	0	0	**35**
1978	0	12	0	27	0	2	0	7	2	1	0	0	**51**
1979	0	14	0	29	0	1	0	9	0	0	0	0	**53**
1980	0	14	0	21	0	3	0	11	1	0	0	0	**50**
1981	0	16	0	21	0	1	0	11	0	0	0	0	**49**
1982	0	18[c]	0	31	0	1	0	5	0	0	0	0	**55**
1983	0	14	0	27	0	1	0	7	0	1	0	0	**50**[d]
Total	**0**	**398**	**0**	**363**	**0**	**13**	**41**	**71**	**22**	**5**	**0**	**1**	**914**

[a] Data for the USA take into account information in *Announced United States Nuclear Tests* (January 1983), prepared by the US Department of Energy in co-operation with Los Alamos, Lawrence Livermore and Sandia National Laboratories.
[b] Five devices used simultaneously in the same test are counted here as one explosion.
[c] Two devices used simultaneously in the same test are counted here as one explosion.
[d] The data for 1983 are preliminary.

III. 16 July 1945–31 December 1983

USA	USSR	UK	France	China	India	Total
729	527	36	120	27	1	**1 440**

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Introduction / Background / Militarization of the region / Armed attacks / Peaceful endeavours / Conclusions and recommendations / UN Security Council resolution 530, 19 May 1983 / UN General Assembly resolution 38/10, 11 November 1983 / OAS General Assembly resolution, 17 November 1983 / Communiqué of the meeting between the Ministers of the Contadora Group and the Ministers of the Central American countries

3. World military expenditure

ELISABETH SKÖNS and RITA TULLBERG

The section on US military expenditure is based on material provided by DAVID JOHNSON, Center for Defense Information, Washington, D.C.

Superscript numbers refer to the list of notes and references at the end of the chapter.

I. Introduction

In 1982 the rate of growth in world military spending, at 6.1 per cent, was extraordinarily rapid. The estimated rise in 1983 was smaller, but it is still well above the long-term trend of 2.9 per cent for the past 10 years. When comparing the period 1979–83 with 1975–79, the volume increase has accelerated from 2.4 per cent per year on average to 3.3 per cent.

The acceleration is due to the extremely rapid rate at which the United States is investing resources for military ends. This can be seen if US military spending is excluded from the world total. The trend then becomes reversed. The rate of growth in military expenditure for all other countries combined has almost halved from 3.3 per cent per year for the period 1975–79 to 1.7 per cent over the period 1979–83.

Military expenditure rates in other regions of the world have, however, also been both high and accelerating. In the Middle East, Oceania and South America there has been a marked acceleration. In South Asia military expenditure has grown at continuously high rates; in the Far East (excluding China) growth rates are also very high, although they have been substantially lower in recent years.

There are, however, examples of average growth rates for 1979–83 which are below 3 per cent per year. These are Europe—NATO, the WTO as well as the neutral and non-aligned countries—the African continent and China, the latter having reduced its military expenditure by an average of more than 9 per cent per year during this period.

There exist no indisputable data on Soviet military expenditure trends. Since the Soviet Union persistently refuses to publish any credible figures, its military spending has long been the subject of more or less ingenious estimation techniques and guesses. The US Central Intelligence Agency estimates, which are the most widely quoted, have recently been revised for the period since 1976. Soviet arms procurement costs are now estimated to have been roughly constant since 1976, compared to the previous estimates showing a 4 per cent real increase per year. The estimates for total Soviet military spending have thereby been reduced to a 2 per cent trend from the previous estimates of 3–5 per cent. Although the higher estimates, especially for procurement, have been a major argument for the initiation of the current US military build-up and for the conclusion that the policy of detente towards the Soviet Union had failed, the revision seems to have been largely ignored.

World military expenditure in 1983 has, according to SIPRI estimates, reached US $750–800 billion, at current prices.[1] This massive diversion of resources for military consumption is a growing problem for most countries. In industrial market economies, military spending is being maintained, in the face of high budget deficits, at the expense of other government programmes. In the Soviet Union, military spending already absorbs a high share of national product and aggravates the shortage of labour. In most Third World countries, which have to import their weapons, debt problems are becoming acute. Even oil exporters are no longer completely free from financial constraints in the current situation of a weakened demand for oil.

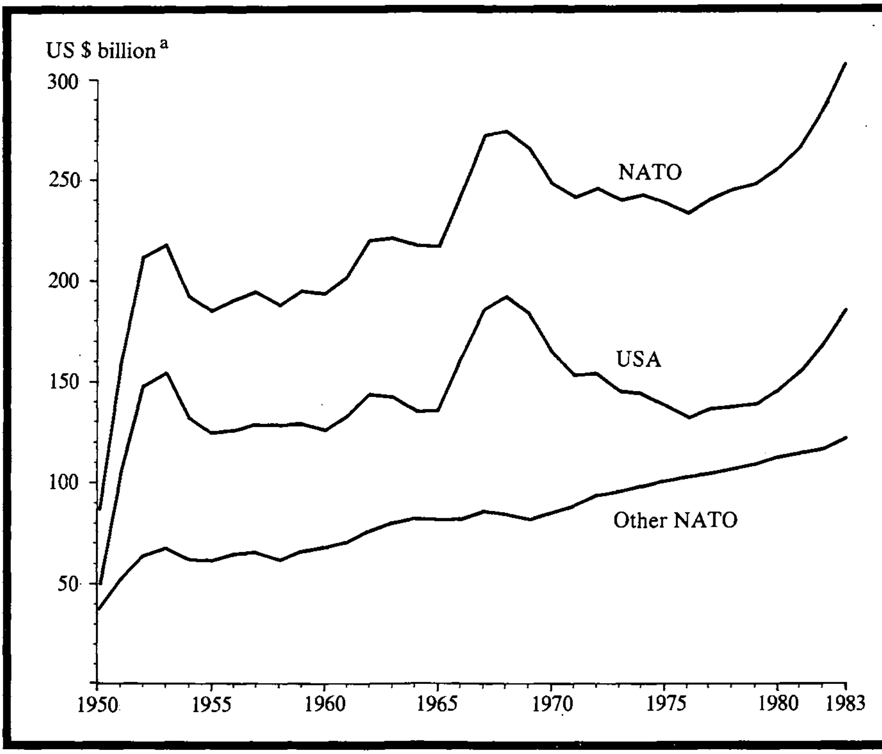
II. NATO

There has been a dramatic rise in NATO military expenditures in recent years. The acceleration from a real growth rate of 4 per cent in 1981 to 6 per cent in 1982 and 8 per cent in 1983 is of course mainly a reflection of the extraordinary rate of rearmament in the United States. In 1983 the real increase in US military expenditure according to the NATO definition was 11.3 per cent, the steepest rise since 1967.

The disparity between military spending in the USA and other NATO countries has, as expected, increased considerably over the past year (figure 3.1). What was less expected, however, is that the combined military expenditures of the latter show a substantial rise for 1983. With 1983 growth rates of 3.9 per cent for NATO Europe and 3.3 per cent for Canada, the average increase in non-US NATO military spending exceeds for the first time the 3 per cent volume target to which all NATO members committed themselves in 1978. However—so far as NATO Europe is concerned—the picture changes radically when the figure for the UK is excluded. For the rest of NATO Europe, the 1983 volume increase was only 1.6 per cent.

The growth rates in table 3.1 are based on NATO standardized military expenditure data which have been deflated using consumer price indices, in order to obtain a trend for the opportunity cost of military expenditures. Prices for military purchases do not necessarily move in line with average consumer prices. Since the value of the dollar has risen considerably during recent years, prices for arms imports have increased rapidly. Thus, the

Figure 3.1. NATO military expenditure, 1950–83



[a] At 1980 prices and exchange-rates.

purchasing power of non-US military spending has not increased as much as the figures in table 3.1 suggest.[2]

The recommendation that all NATO member countries should aim at defence budget increases in the region of 3 per cent per year was first laid out in the Ministerial Guidance approved by NATO defence ministers in 1977. This guidance saw the need for a more comprehensive framework for NATO defence planning, incorporating a longer-term approach than before. The resulting Long Term Defence Programme (LTDP) for the 1980s was adopted by NATO heads of state and government at the 1978 Washington Summit Meeting, at which the 3 per cent target was also endorsed. Robert Komer, adviser for NATO affairs to the US Secretary of Defense during the Carter Administration, traces the origin of the LTDP to a group of Rand and US DoD (Department of Defense) analysts, including himself, in the early 1970s. They felt that NATO's ability to carry out its strategy was increasingly in question. "Moreover, we believed that as the United States disengaged from its long entanglement in South-East Asia, it must remedy its neglect of . . . the defense of Western Europe."[3]

Table 3.1. NATO countries: estimated volume increases in military expenditure

Country	Annual, or average annual percentage increases						Relative size of military spending (USA = 100)[a] (1983)
	'Pre-target': From 1972–74 average to 1976–78 average	'Post-target': From 1976–78 average to 1983	1979–80	1980–81	1981–82	1982–83	
USA	−2.0	5.5	3.7	6.9	9.0	11.3	*100*
Canada	3.9	2.8	3.4	1.7	9.8	3.3	*3*
All NATO Europe	2.2	2.5	2.7	0.8	2.3	3.9	*62*
UK	0.3	3.8	8.1	−5.7	5.0	11.2	*16*
NATO Europe (excl. UK) of which	2.8	2.1	1.0	2.9	1.4	1.6	
FR Germany	1.0	1.3	1.3	1.6	−1.3	2.2	*15*
France	3.8	2.6	1.8	2.4	2.1	1.5	*15*
Italy	−0.3	4.9	4.6	2.1	7.0	4.1	*6*
Netherlands	3.4	0.9	−2.7	1.1	−0.4	0.5	*3*
Belgium	5.1	0.5	2.0	0.9	−3.3	−3.6	*2*
Turkey	17.6	0.5	−5.3	23.5	9.3	−2.5	*2*
Greece	14.3	0.8	−13.5	18.3	2.0	0.1	*1*
Denmark	3.2	1.8[b]	1.6	1.1	2.9	. .	*1*
Norway	4.1	2.5	1.1	1.1	3.9	1.6	*1*
Portugal	−13.5	1.4	8.5	−0.5	0.1	0.9	*0.5*
Luxembourg	5.8	5.0	16.4	3.4	0.9	2.0	*Negligible*
Total NATO	−0.3	4.2	3.3	4.2	6.3	8.2	

[a] Based on 1983 military spending figures, at 1980 prices and exchange-rates.
[b] From 1976–78 average to 1982.

Source: Appendix 3A, table 3A.2.

With the advent of the Carter Administration, efforts were made to strengthen the US contribution to NATO forces. They recognized, however, that an exclusive US force improvement scheme would not be politically feasible: "... our Congress and electorate would insist that any US effort be matched by those of our allies."[4] The purpose of the 3 per cent target was to "produce a certain amount of peer pressure"[5] in anticipation of economic and political constraints to the provision of the additional resources required by the LTDP.

Allied burden sharing has continued to be a very sensitive issue in the United States. The DoD has therefore to submit to Congress each year a *Report on Allied Contributions to the Common Defense*, which surveys a variety of statistical indicators of burden sharing. The most recent report is somewhat more critical of the allies than previously. The conclusion is that the trends up to 1982, "if they continue, threaten to undermine the progress achieved in prior years towards a more equitable distribution of the allied defense burden".[6]

The US allies have responded to these reproaches by pointing to their physical contributions to NATO forces. NATO Europe provides 90 per cent of the ground forces, 80 per cent of the combat aircraft, 80 per cent of the tanks and 90 per cent of the armoured divisions stationed in Europe in peace-time.

General Bernard Rogers, NATO Supreme Allied Commander, Europe, has for some years pressed for an acceleration in NATO military spending to an average annual volume growth of 4 per cent over six years in order for NATO to be able to exploit more advanced military technologies. Advances in targeting and guidance technologies and in conventional munitions offer the capability of striking WTO targets at an early stage and deep into its territory. The reliance on tactical nuclear weapons would thereby be reduced, and thus the nuclear threshold raised. European NATO members have so far hesitated to incorporate these emerging technologies into NATO strategy, mainly for four reasons: the more offensive character of the strategy involved, the fact that most of the required military equipment is produced by US defence industries, doubts about the technical feasibility and effectiveness of these new weapon systems, and the costs involved. West German officials have also complained about the difficulty of simultaneously convincing public opinion of the need to install medium-range nuclear missiles and to raise military expenditure so as to reduce the reliance on nuclear weapons. At their meeting in December 1983, NATO defence ministers, although pressed by the US Defense Secretary to adopt specific weapon systems for future production, decided to continue their study of the use of emerging technology for weapon purposes (see also chapter 8).

The final communiqué from this meeting did not reaffirm the usual

NATO commitment to the 3 per cent target. Instead, the ministers "agreed to do their utmost to make available the resources needed", and emphasized the importance of making the most effective use of available resources.[7]

Yet, in a recent interview Rogers claimed that in practice NATO members have already committed themselves to a 4 per cent volume increase in their military expenditure. The only effective instrument available to NATO for persuading member countries to commit themselves to additional force improvements is, according to Rogers, the NATO Force Goals. Adopted by NATO defence ministers every even-numbered year, they become national commitments to force improvements in specific detail and by certain dates. The 4 per cent figure is calculated on the basis of NATO Force Goals for the period 1983–88, which were approved by NATO defence ministers in May 1982.

When commenting on the failure of individual west European NATO countries to reach the 3 per cent target, Rogers points to the US example of trimming social expenditures for the benefit of military spending. Nevertheless, he is not content with current US military spending trends: in view of the world-wide military commitments that the United States has taken upon itself, he finds it unlikely that the United States is going to fulfil the 1983–88 NATO Force Goals it has agreed to, in spite of the high volume increase in the FY (fiscal year) 1983/84 military budget.[8]

The high rate of growth in NATO Europe military expenditures for 1983 is entirely the consequence of the 11 per cent rise for the United Kingdom. It seems, however, as if the economic burden of rapidly rising military budgets has now become politically unacceptable, and in 1983 it announced that the 3 per cent target would be abandoned after FY 1985/86. West German and French military expenditure plans already provide for a less than 3 per cent growth rate. Belgium and Denmark have all along had great difficulties living up to the 3 per cent target. The Belgian government decided in 1983 that Belgium could not afford the $500 million required for the planned purchase of Patriot missile system units, which are to become a vital part of the NATO conventional air defence system in the late 1980s. It also asked for the Belgian share in the NATO common fund for infrastructure to be reduced. The Danish parliament voted in 1982 for the cancellation of Denmark's share in NATO infrastructure costs, but this was opposed by the minority government. Dutch military expenditure growth rates have averaged 0.9 per cent in the post-target period. However, in its 1983 Defence White Paper the Dutch government announced its commitment to annual defence budget increases of 2 per cent in real terms until 1987, and recommended a 3 per cent growth rate thereafter. The Norwegian government has also decided to increase the defence budget substantially—by 20 per cent in real terms over the period 1983–88. The planned increase in procurement expenditure is still higher, since its share of the defence budget is to increase from 20 to 25 per cent over the same period.

In general, however, the European NATO members fear that an increased defence burden would under current economic circumstances pose a security risk in the form of social unrest. Former West German Chancellor Helmut Schmidt went as far as to say: "The economic mess today is a greater danger right now to the coherence and political stability of the alliance than the Soviet threat."[9]

The United States

In 1983 President Reagan persisted in his commitment to large increases in military spending, pushing forward towards the proclaimed goal of a "rearmed America", which has been the centrepiece of his presidency. The FY 1984 (fiscal year 1983/84) military budget marked the sixth consecutive year of real growth in US military spending, an unprecedented development since World War II.

The FY 1985 DoD budget request submitted to the US Congress in February 1984 calls for $305 billion, a 13 per cent real increase over FY 1984 (table 3.2). If approved, this would be the largest annual military budget increase in the Reagan presidency. The total funding request for national defence, which includes atomic energy defence activities in the Department of Energy, is $313.4 billion. The Congress, in passing a FY 1984 DoD budget of $258.2 billion—$265.3 billion in total for national defence—had slowed the pace of the Administration's military build-up. The FY 1985 request marks a determined effort to make up for much of the 1984 reduction and bring the Reagan military programme back close to its planned five-year level of funding.

According to the DoD's long-range forecasts, another big budget increase of 9.2 per cent is planned for FY 1986. Subsequently, however, the annual increases would fall to the level of 3–4 per cent each year. Defense Secretary Weinberger projects that: "if we are allowed to continue on the path we have set, we can look forward to a time, only two fiscal years from now, when defense increases can begin to slow dramatically".[10] Such promises of future restraint may be helpful in getting Congressional support at present but whether the DoD can control spiralling defence costs remains to be seen.

Procurement

The US fiscal year 1985 defence budget includes a 20.5 per cent real increase in investment authority, comprising arms procurement, RDT&E

Table 3.2. US Administration budget estimates for fiscal years 1984–89 (as of 1 February 1984)

Figures are in $ billions.

	1984	1985	1986	1987	1988	1989
Total budget authority						
Total national defence, current prices	265.3	313.4	359.0	389.1	421.6	456.4
Total Department of Defense, current prices	258.2	305.0	349.6	379.2	411.5	446.1
Total Department of Defense, constant (1985) prices	269.9	305.0	333.0	344.7	357.9	371.7
Percentage change	*3.7*	*13.0*	*9.2*	*3.5*	*3.8*	*3.9*
Outlays						
Total national defence, current prices	237.5	272.0	310.6	348.6	379.7	409.1
Total Department of Defense, current prices	231.0	264.4	301.8	339.2	369.8	398.8
Total Department of Defense, constant (1985) prices	241.8	264.4	286.7	306.8	319.5	330.1
Percentage change	*8.8*	*9.3*	*8.4*	*7.0*	*4.1*	*3.3*

Source: FY 1985 Department of Defense Budget, News release from the Office of the Assistant Secretary of Defense (Washington, D.C., February 1, 1984); and *Budget of the United States Government FY 1985* (US Government Printing Office, Washington, D.C., 1984).

(research, development, testing and evaluation) and military construction. If approved, its share of the total defence budget will rise to 48.8 per cent against 45.5 per cent in 1984. Most of the outlays for weapon systems currently authorized will, however, fall on later years. Thus, during fiscal year 1985, only one-quarter of total investment outlays are intended for new programmes.

There is a strong emphasis on the modernization and expansion of nuclear forces in the current US rearmament programme. Of requested DoD budget authority for 1985, 21.5 per cent is devoted to nuclear forces, against 19.0 per cent two years ago. As a share of total national defence authority, costs for nuclear forces are to increase from 21.1 to 23.3 per cent over these three years.[11] The Scowcroft Commission and its supporters in Congress rescued from probable defeat the most controversial part of the Reagan military programme, the MX missile. Procurement funding and quantities of major nuclear weapon systems are summarized in table 1.4.

One of the first decisions of the Reagan Administration upon taking office at the beginning of 1981 was to initiate a major programme to modernize and expand the naval forces. As a result, the size of the US Navy has increased from 479 deployable battle force ships at the end of FY 1980 to 525 ships at the end of FY 1984. The 1985–89 ship-building programme, providing for an average of 28 new deployable ships per year, will, with allowance for the retirement of old ships, bring the size of the naval fleet to 545 ships by the end of FY 1985, the intention being to have built a 600-ship navy by the end of this decade.

Production numbers for other major conventional weapon systems are presented in table 3.3.

Long-term costs

A major question has been raised about the long-term costs of the Reagan military programme. Defense Department analyst Franklin Spinney and others point to the tendency on the part of DoD to underestimate weapon costs as well as the full budget costs of present programmes in future years.

In Congressional hearings during 1983,[12] Spinney testified that, because of basic structural problems which take a long time to remedy, unit costs of weapons do not decline as rapidly as assumed in DoD cost projections. As a result, either the allocations to an unchanged procurement programme have to be increased in later years or the production level be reduced. This is in fact what is happening. Between the defence plan for fiscal years 1983–87 and the first draft of the 1984–88 defence plan—a period of only five months—the cost estimates for 45 weapon systems were increased for two or more of the four common years. The production quantity was also reduced for 29 of these systems as well as for 15 other weapon systems.

Table 3.3. Production of selected major conventional weapon systems in the United States, fiscal years 1983–86

Designation	Description	1983[a]	1984[b]	1985[c]	1986[d]
Aircraft					
F-14 Tomcat	Fighter	24	24	24	24
F-15 Eagle	Fighter	39	36	48	60
F-16 Fighting Falcon	Fighter	120	144	150	216
F/A-18 Hornet	Fighter/strike	84	84	84	102
AV-8B Harrier	Fighter	21	27	32	46
C-5B Galaxy	Transport	1	4	10	16
KC-10A	Tanker	8	8	8	12
AH-64 Apache	Helicopter	48	112	144	144
UH-60 Black Hawk	Helicopter	96	84	78	78
Armoured vehicles					
M-1 Abrams	MBT	855	840	720	720
M-2/3 Bradley	MICV	600	600	710	900
LVT	Amphibious ASSV	453	416	244	–
LAV	APC	134	236	292	–
DIVAD Sergeant York	SP-AAG	96	130	132	144
Missiles and rockets					
AIM-9M Sidewinder	AAM	2 420	2 050	1 000	1 220
AIM-7M Sparrow	AAM/SAM	1 471	1 379	923	1 313
AIM-54A/C Phoenix	AAM	108	265	400	567
AIM-120A AMRAAM	AAM	–	–	174	1 042
AGM-65 (IIR) Maverick	ASM	900	1 980	4 690	8 200
Laser Maverick	ASM	12	263	600	1 500
AGM-88 HARM	ASM	289	722	1 674	2 461
AGM-114A Hellfire	ASM	3 971	4 870	6 464	7 880
BGM-71 TOW	ATM	13 000	20 200	21 822	22 014
MIM-104 Patriot: missiles	SAM	287	440	585	815
: launch units		12	12	15	18
MLRS: rockets		23 640	36 000	50 472	72 000
: launch units		72	76	44	29

[a] Actual.
[b] Planned.
[c] Proposed.
[d] Proposed for authorization.

Source: Secretary of Defense Caspar W. Weinberger, *Annual Report to Congress, Fiscal Year 1985* (US Government Printing Office, Washington, D.C., February 1984).

For the last completed five-year defence plan studied by Spinney, that for 1978–82, 9 per cent fewer tactical fighter aircraft than planned were purchased, in spite of there being no budget cuts that could affect cost growth. Indeed, actual appropriations exceeded the plan by 2 per cent. Spinney maintains that recent defence plans are based on unrealistic learning curve effects, which relate unit cost to increased production and experience. In the 1983–87 defence plan, declining unit costs were planned for 77 per cent of a sample of 111 weapon systems. For 10 per cent of these, the planned cost reduction was greater than 65 per cent, including the

MX missile with an 81 per cent decline in unit cost over this period. Spinney also charges that operation and maintenance cost estimates are too low, since the Defense Department assumes that the use of high technology will lower operating costs. Alice Rivlin, head of the Congressional Budget Office, agrees, stating that the Army "lacks the techniques to project comprehensive estimates of future operating and support costs for a modernized Army".[13] Rivlin has predicted that an influx of advanced new weapons could result in a substantial rise in operating costs, only part of which was being anticipated.

In 1983 the politics of scarcity began to be felt in the Pentagon as competition accelerated over the allocation of future military budgets. Navy Secretary Lehman and Deputy Defense Secretary Thayer quarrelled publicly over the Navy's share of future budgets and the viability of expensive surface warships. As a vast new programme to build defences against ballistic missiles began to take shape in response to President Reagan's call for a reorientation of US nuclear policy, costs of $18–27 billion for fiscal years 1985–89 were reported. Richard DeLauer, Under Secretary of Defense for Research and Engineering, characterized these costs as "staggering".[14] It was unclear where all the money for a new anti-ballistic missile (ABM) system would come from, on top of all the other programmes already under way.

Several actions were taken by Congress to force the Defense Department to be tougher in its contracting. Congress approved legislation establishing an independent arms testing office and requiring the Defense Department to secure guaranties on future weapons. Efforts by Congress to encourage greater competitiveness in defence procurement face severe limitations. Defense Secretary Weinberger himself has commented: "Unfortunately, competition does not always come easily to the defense marketplace. Once a firm has won a contract for the initial research on a complex weapons system, it has a head start—indeed an almost unbeatable advantage—in competing for later development and production contracts. In other words, there is usually only one bidder in these situations."[15]

A number of conflicts of interest regarding officials in the Defense Department were raised in 1983. The House Committee on Government Operations in a November 1983 report asserted that the DoD's advisory boards were stacked with business executives who promoted their companies' products, and many were selected from "the old-boy network within the military-industrial complex".[16]

Some defence officials were quick to point out that Congress itself plays a major role in pushing up levels of military spending. Former Deputy Defense Secretary Carlucci suggested that Congress was reponsible for about $20 billion in higher defence procurement costs because of "irrational" budgeting.[17] Secretary Weinberger proposed that there should be a two-year budget cycle, because too much time was being consumed in bargaining between members of Congress and the Defense Department every year and budget action was always too late.[18]

Important criticism continued to be voiced by the so-called military reformers. Critics such as Senators Gary Hart and Sam Nunn argued that too much emphasis was being placed on high technology weapons of excessive cost and uncertain reliability. Lawrence Korb, Assistant Secretary of Defense for Manpower, Reserve Affairs and Logistics, agreed that the Defense Department was "a house divided against ourselves", with admirals and generals preoccupied with force structure and weapon modernization. Korb states: "Since 1980, when this administration came into office, funds for modernization have almost doubled while funds for readiness and sustainability have gone up only 33 per cent".[19]

Military objectives

The Reagan Administration continues to strive towards its major military objectives:

1. Modernization of US strategic nuclear forces, with new submarines and submarine-based missiles, bombers, land-based ballistic missiles and a massive cruise missile programme.
2. Pursuit of expanded nuclear options at both the strategic and theatre levels, including improved command, control and communications capabilities, to provide a capability to fight and, perhaps, "prevail" in a prolonged nuclear war.
3. Acquisition of a 600-ship navy, with the objective of being able to take on the Soviet Navy and defeat it in areas adjacent to the Soviet Union.
4. Increased emphasis on US technological superiority through more spending on a wide variety of research and development programmes, including possible means of defence against ballistic missiles and greater use of space for military purposes.
5. Expanded capability for conducting warfare in Third World areas, particularly in the Middle East, the Persian Gulf and Central America, and an ability to fight in two or more wars simultaneously.
6. Continued improvements in conventional forces for war in Europe, in conjunction with US military allies, anticipating the possibility of a prolonged conventional war with the Soviet Union.
7. Increased compensation and prestige for military personnel, making a military career more attractive for the all-volunteer force.

The Carter Administration initiated many of the programmes the Reagan Administration is pursuing. The extreme zeal and scope of President Reagan's military effort, however, are distinctively his own.

It is widely alleged that the Reagan Administration is pursuing military objectives that far outstrip available capabilities. General David Jones, former Chairman of the Joint Chiefs of Staff, pointed out "the mismatch between strategy and forces to carry it out". This discrepancy, he said, "is greater now than it was before because we are trying to do everything".[20] This perception was heightened by the simultaneous US military involvement in Grenada and Lebanon.

The basic premise of Reagan's defence programme is that the Soviet Union presents a very dangerous military threat to the United States and its allies and that something close to an emergency had been created through alleged neglect of defence in the decade before Reagan was elected in 1980. The big increases in military spending that are to be sustained over a period of 5–10 years, the huge investment in new nuclear weapon systems and the expansion of the US Navy all flow from assessments of the US–Soviet military balance that stress Soviet strengths and US weaknesses.

An underlying pessimism about the capacity of the United States and its allies to defend themselves seems to condition the views of top Reagan officials. This was most explicitly stated by Richard Perle, the Assistant Secretary of Defense for International Security Policy: "Democracies will not sacrifice to protect their security in the absence of a sense of danger. And every time we create the impression that we and the Soviets are cooperating and moderating the competition, we diminish that sense of apprehension".[21]

In 1980 US public opinion by and large shared Reagan's fears. By 1983, however, more Americans believed that the USA and the USSR were approximately equal in military strength. The change in US public opinion following the Soviet shooting down of a South Korean airliner in September 1983, together with the generally favourable US public response to the invasion of Grenada, rekindled the Reagan Administration's commitment to a tough policy toward the Soviet Union and revived hopes that the mandate for military budgets had not yet been lost.

Congress and the 1983/84 defence budget

It appeared for a time in 1983 that the US defence build-up was losing support. The aggressive war-fighting rhetoric of the Reagan Administration's first two years had provided impetus to the creation of a nation-wide movement for a nuclear freeze. There was a growing apprehension that the Administration might be initiating more military projects than the country would be able or willing to pay for later in the decade. Many members of Congress, including some Republican supporters of President Reagan, argued for the need to moderate the military build-up to help reduce the enormous federal budget deficit, especially because big reductions had already been absorbed by many non-military federal programmes.

In Congress, the debate over military spending was framed primarily in terms of what the percentage increase should be between the FY 1983 and

1984 budgets. The budget process requires that overall ceilings on military funding be set. The Administration sought a 10 per cent real increase, while a variety of smaller increases were advocated in Congress. About 4–5 per cent eventually resulted from the lengthy Congressional budget process towards the end of 1983: an approved FY 1984 budget for national defence that rose about half as much as the Reagan Administration initially requested.

Judged purely in these terms, it would seem that the Administration had suffered a setback. But debates over percentages tend to distract attention from the central reality that the huge military build-up is continuing. The discussion was not so much concerned with cutting the military budget as with slowing the rate of increase. Congressional committees tinkered with the military budget, stretching out or delaying a programme here, cancelling or trimming a programme there. But only binary chemical weapons failed to receive support. All the major weapon programmes received substantial funding. Navy Secretary Lehman argued that it was too late for Congress to halt the drive for a 600-ship navy: "We've already accomplished it because we front-loaded the budget".[22] The huge increases in funding for procurement of weapons have tended to incorporate large future budgets and restrict the ability of Congress to change budget priorities.[23]

In November 1983 Secretary Weinberger summed up the results of Congress' actions on the FY 1984 military budget:

> Some 300 items were reduced in small amounts, but the general overall result is that we have endorsement, approval and appropriations for all of the President's major programs and weapons systems except the chemical warfare weapons that were requested. With the cuts that were made, primarily the effect of that will be that we will have all the weapons systems the President feels is essential but we will take a little longer to get them and they will cost quite a bit more because of the reductions that were made in the rate of acquisition and in the most economic quantity that we had requested in our budget.[24]

Since the forecast rates of inflation and fuel costs have been lowered and the MX programme altered, which helped cushion the impact of Congress cuts in the DoD budget, reductions are less severe than they appear. Nevertheless, Secretary Weinberger has requested a huge increase in his FY 1985 budget to try to make up for Congressional reductions and restore the Administration's full five-year defence build-up programme.

It is likely that Congress will continue to trim the edges of the military budget. Both Democrats and Republicans have reacted to the rapid increase requested for the fiscal year 1985 military budget, and the high budget deficits projected up to 1987. However, because there is still widespread suspicion about the Soviet Union and concern about the adequacy of US military forces in the light of the country's extensive overseas military involvements, it may be expected that the Reagan military build-up will continue.

III. Costs versus resources

In an increasing number of countries, the debate over resource allocation for military purposes is intensifying. On the one hand, low rates of growth and attempts by governments to limit budget deficits by cutting back expenditure exert pressure on defence budgets and accentuate the resource competition between the military and civil sectors. On the other hand, costs of goods and services purchased by the military are increasing, constituting an upward pressure on defence budgets which will probably increase during the 1980s.

The major source of cost growth in military expenditure items is the modernization of weapon systems. The incorporation of rapidly increasing levels of technological progress in weapons, especially in combination with decreasing production series, leads to higher fixed costs per unit, notably the costs for RDT&E. The ratio between military procurement and military RDT&E expenditures is now about 2 : 1 in both the United States and the United Kingdom.[25] As a result of these developments, the procurement requests of, for example, the US Air Force have increased between fiscal years 1974 and 1984 from an average of $6 million to $22 million per fighter aircraft. After adjusting for the general rate of inflation, this amounts to a cost increase in real terms of about 6 per cent per year, largely attributable to product improvements. Another example of the same phenomenon is the estimate that British procurement costs for the Tornado multi-role combat aircraft in the mid-1980s will absorb annual expenditures corresponding to 52 per cent of total 1979/80 outlays for air systems, implying that the air force has "to sacrifice other air systems, whilst the remaining services will have to accept older equipment so lengthening the queue for replacement weapons".[26] In FR Germany, the high and rising costs of the Tornado have already led to the cancellation and postponement of other major weapon programmes.[27] By 1975, the cost trends for military hardware items led a senior Pentagon official to make the forecast that "if the trends which have prevailed so consistently over the last half-century were to continue for a few more decades, we will reach a point in the year 2036 where the Defense Department will literally be able to afford only one aircraft".[28] This statement, for which the phrase the Final Law of Economic Disarmament has been coined, although very simplistic, captures the problem well. Even if quality may be substituted for quantity in some areas, not all quality increases are accompanied by decreased quantities, future costs are frequently underestimated and, even more important, the effectiveness of rising technological sophistication is increasingly being questioned even within military establishments.

With increased complexity and sophistication of weapons, the requirements for their operations and maintenance also increase. According to estimates made by the US Congressional Budget Office, the fielding of the M-1 Abrams battle tank will increase the annual costs of operating and supporting a tank battalion by 41 per cent compared to the requirements for a battalion equipped with M-60-A1 tanks. The modernization of mechanized infantry battalions through the replacement of the M-113 armoured personnel carrier with the Bradley Fighting Vehicle Systems is estimated to raise annual operating and support costs by 59 per cent.[29]

Further, more complex weapons also require more skilled manpower, resulting in increased costs for military personnel as well, both in training and remuneration. A recent collection of country case studies on this subject concludes that escalating personnel costs, which are likely to continue throughout the 1980s, will make it impossible for countries to maintain readily forces of the size that were hitherto possible.[30]

Decision makers faced with this cost-versus-resource dilemma may try to solve it by increasing the allocations for procurement at the expense of other sections of the military budget. This appears to be what has occurred in a number of NATO countries (table 3.4). The share of total military expenditure devoted to major purchases of military equipment has generally been rising in these countries during the past 10 years, reversing the previous trend. Over the period 1974–83, this share has trebled in Canada and increased by at least one-half in Belgium, FR Germany, the Netherlands, Norway and the United Kingdom. For the United States, the trend is less marked, but the plans are for major increases in the procurement share over the next five years, in spite of extraordinary increases in total military expenditure.[31] There is, however, a limit to this kind of solution to the problem, since it eventually leads to a decrease in the readiness and effectiveness of the forces.

In the longer term it can be expected, therefore, that current procurement policies and cost trends will result in a redistribution of resources in favour of the military sector. Throughout the 1970s, most of the countries listed in table 3.5 have increased the volume of military expenditure, the major exceptions being Australia and the United States. Still, with the exception of Spain, the shares of total central government expenditures devoted to the military sector have generally been declining during at least the first half of the 1970s, since welfare programmes have been given priority within rapidly expanding total budgets.

As can be seen from table 3.5, in most countries the share of military expenditure in total government expenditure has stopped falling, and in other countries it has been declining much more slowly. Only in the United

Table 3.4. Expenditure for major purchases of military equipment[a] as a share of total military expenditure, fiscal years[b] 1974–83

Figures are percentages.

Country	1974 or 1974/75	1975 or 1975/76	1976 or 1976/77	1977 or 1977/78	1978 or 1978/79	1979 or 1979/80	1980 or 1980/81	1981 or 1981/82	1982 or 1982/83	1983 or 1983/84
Belgium	8.8	9.0	11.0	11.9	13.9	13.1	14.4	14.0	13.6	14.9
Canada	5.9	6.3	8.0	8.5	10.0	13.8	15.4	15.9	17.4	18.8
Denmark	19.3	19.0	19.4	21.8	16.4	16.3	18.1	17.5	16.8	17.3
France[c]	44.7	42.6	41.1	39.2	40.2	43.0	44.5	46.0	47.8	46.9
FR Germany	11.9	11.8	13.2	12.5	13.0	13.7	14.8	17.3	17.3	17.6
Italy	15.2	13.9	13.1	15.3	16.2	15.1	17.5	17.3	13.2	18.5
Netherlands	13.2	15.7	15.5	21.0	18.3	20.2	18.0	18.8	20.4	22.0
Norway	11.6	11.6	11.4[d]	14.2[d]	18.3	19.5	19.3	19.0	19.5	18.3
UK	17.2	19.3	20.6	22.0	23.0	23.2	25.2	26.5	25.4	28.2
USA	18.1[e]	17.5[e]	17.4	17.5	20.0	19.5	20.3	21.3	23.9	26.1

[a] These figures "must be viewed with some reservation as they only cover 'major purchases of equipment', and it is often difficult to draw the line accurately between the purchase of equipment, and expenditure on buildings and installations. In most cases, total spending on equipment would be considerably higher than indicated in the table." (*NATO Review*, No. 1, February 1979).

[b] Calendar year for all countries except Canada and the United Kingdom (fiscal year: April–March); Denmark (fiscal years 1974/75–1977/78: April–March; fiscal year 1978: April–December; fiscal year 1979 onwards: January–December); Turkey (fiscal years 1974/75–1981/82: March–February; fiscal year 1982: March–December; fiscal year 1983 onwards: January–December); and the United States (fiscal years 1974/75–1975/76: July–June; fiscal year 1976/77 onwards: October–September).

[c] There are no comparable NATO figures for France. The figures used here are for capital expenditure (Titre V). 1974–80 *Budgét Définitif*; 1981–82 *La Loi de Programmation*; 1983 *Budgét Initial*. Figures for *La Loi de Programmation* and *Budgét Initial* are normally higher than *Budgét Définitif*.

[d] Excluding missiles.

[e] Including ammunition and explosives.

Sources: Successive NATO press releases on "Financial and Economic Data Relating to NATO Defence", also reproduced yearly in *NATO Review*. French sources: *Assemblée Nationale* No. 3150, Défense Tome I, 11 October 1977; No. 1979, Défense Tome I, 9 October 1980; *Sénat*, No. 95, Tome III, Annexe 42, 22 November 1982.

Table 3.5. Military expenditure as a share of central government expenditure[a] in OECD countries,[b] 1970–83

Figures are percentages.

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Australia	20.6	19.4	18.8	17.4	15.0	12.3	11.4	11.2	10.9	11.0	11.5	11.9	11.9	10.7
Austria	5.6	5.1	5.1	5.0	5.1	5.2	5.1	5.1	5.2	5.2	5.2	5.1	5.1	4.9
Belgium[c]	13.7	13.3	12.8	12.4	12.0	11.6	11.5	11.1	11.0	10.7	10.5	10.2	9.3	9.4
Canada	13.5	12.3	11.1	10.8	9.9	8.8	9.2	9.4	9.5	9.1	9.0	8.7	8.9	8.6
Denmark[d]	8.4	8.4	8.2	7.3	7.7	7.7	7.3	7.4	7.3	7.2	7.3	7.1	7.0	..
Finland	6.9	7.3	7.5	7.5	6.8	6.6	6.6	6.1	6.2	6.4	6.8	6.7	6.8	6.7
France	20.4	20.1	19.9	19.8	19.4	18.2	18.7	18.8	18.6	18.5	18.7	18.1	17.3	18.1
FR Germany	27.5	27.2	27.3	27.1	27.8	24.1	23.9	23.2	22.6	22.4	22.5	22.3	22.0	22.4
Italy	13.7	13.6	14.3	12.5	12.4	10.8	9.8	9.6	7.4	7.7	7.4	6.9	6.2	6.3
Japan	..	8.5	8.3	8.0	7.6	7.4	7.0	6.7	6.1	6.0	5.9	5.9	5.9	6.1
Netherlands	13.4	12.7	12.4	11.8	11.6	10.9	9.8	10.6	9.4	9.5	9.2	9.3	9.0	9.0
Norway[e]	10.8	10.1	9.4	9.1	8.7	8.9	8.2	8.0	7.2	7.1	6.7	6.7	7.0	6.3
Spain	12.3	11.8	12.7	13.4	13.7	13.8	14.2	13.3	11.7	11.9	11.5	11.3	11.0	10.0
Sweden	14.8	14.3	14.1	13.6	12.2	11.5	10.8	10.3	10.0	9.9	9.5	9.3	8.7	8.3
Switzerland[c]	32.3	31.4	30.0	27.6	26.1	25.9	26.1	25.0	24.1	24.6	23.8	25.0	25.3	25.3
UK	19.0	19.3	19.4	18.2	16.7	15.3	15.2	15.3	14.9	15.0	15.6	14.3	15.0	16.5
USA	38.1	33.9	31.8	29.7	28.7	25.5	23.6	24.0	23.7	24.0	23.9	24.7	25.7	27.2

[a] Central government expenditures are defined to include current and capital expenditure of central government, and to exclude social security funds. The exclusion of social security funds makes the figures conform better to national budget data for most countries.
[b] Excluding Ireland, New Zealand and Yugoslavia.
[c] Current disbursements only.
[d] National public accounts definition.
[e] Including social security funds.

Sources:

Military expenditure data:

SIPRI military expenditure registers, appendix 3A. The latest figures are budget estimates.

Central government expenditure data:

1970–81: OECD data as given in *OECD National Accounts 1964–81* (Paris, 1982), and in *OECD Financial Statistics*, 1983-I and II. The exceptions are Denmark, all years, and the 1981 figures for Belgium and Spain, for which national statistical yearbooks and budget documents have been used.

1982–83: Figures have been derived on the basis of the growth rates in central government expenditures according to a public accounts definition. The sources used include basically national statistical yearbooks and budget documents.

States and the United Kingdom has there been a significant rise in the share during the past two years. Expenditure plans in the United States confirm the marked reversal towards a rise in the proportion of total expenditures going to the military.

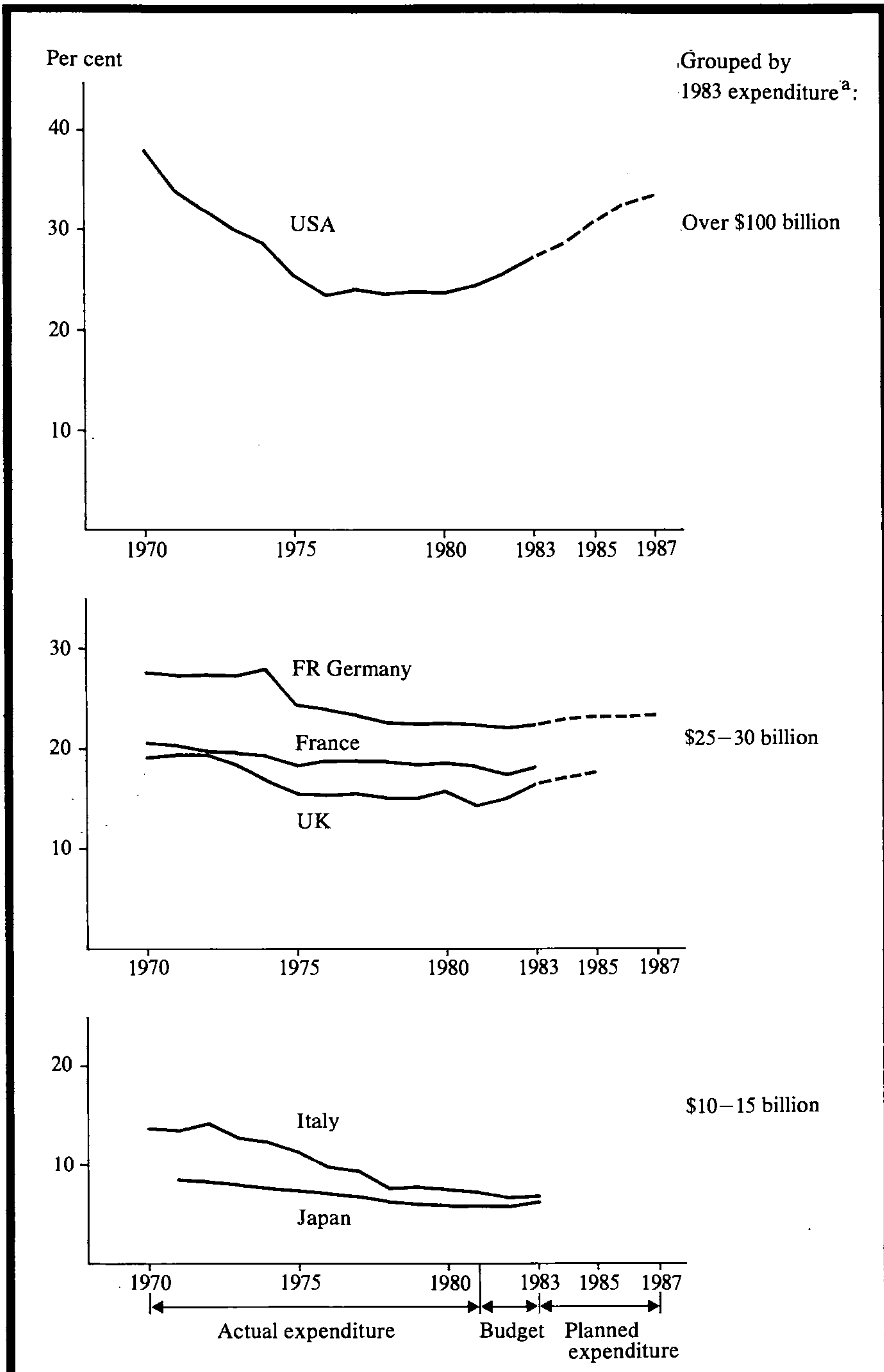
Moreover, according to government spending plans, the military sector is scheduled to absorb an increasing proportion of central government expenditures in several countries (figure 3.2). Again, the most extreme example is the United States. The approved budget for fiscal year 1984 provides for a rise in the share of DoD outlays in the total federal budget from an actual 25.1 per cent in FY 1982, on a public accounts basis, to 27.1 per cent in FY 1984, and a further rise is projected to 33.5 per cent in FY 1988.[32]

FR Germany

The expenditure plans for FR Germany also provide for a rise in the military expenditure proportion—by one percentage point over the period 1982–87.[33] Yearly nominal increases of 3.8 per cent are planned for the military, while the allocation for education and R&D is to increase by only one-half per cent per year, and reductions are planned for, among others, social security and public communications expenditures.

The 1984 budget includes a nominal increase over the previous year of 3.7 per cent for defence, while total federal expenditure is to rise at only half that rate. Allocations for military investment show a disproportionate rise of 7.1 per cent. At the end of 1983 two major arms projects were agreed upon. In November, the West German and French defence ministers signed an agreement to develop and manufacture an anti-tank helicopter. FR Germany plans to procure 212 of these, known as the PAH-2. In December an agreement was signed with the United States for the procurement of an air defence system to protect US and West German bases in FR Germany. The system will include 36 Patriot and 87 Roland missile systems, the former produced in the United States and the latter jointly by FR Germany and France. Parliamentary decisions on these two projects are due in the spring of 1984. Future plans also include the purchase of 200 units of the Multiple Launch Rocket System (MLRS), to be delivered during 1987–94. The total cost for FR Germany of these three weapon systems alone is currently estimated to be more than 12 billion DM ($8 billion). The new fighter aircraft planned for the 1990s involves far greater sums than that, and decisions are pending also for a new battle tank for the next decade. When this new expenditure is added to the as yet largely unpaid bills for previously approved programmes, annual financial requirements can be expected to accelerate in volume terms beyond the current 12.58 billion DM procurement budget.

Figure 3.2. Military expenditure as a share of central government expenditure in six Western industrial countries, 1970–87



The United Kingdom

Economic growth has been slower in the United Kingdom since the end of World War II than in any other major industrial country. Studies show that military spending has taken place not at the expense of current private consumption nor government spending on the social sectors but at the expense of investment in productive capacity.[34]

Since 1970, the share of military expenditure going to the purchase of equipment (defined more broadly than in table 3.4) has grown from 33 per cent to an estimated 46 per cent in 1982, while personnel costs have fallen from 47 per cent to 38 per cent. In general, equipment costs grow 6–10 per cent faster than general inflation and it has been calculated that current programmes could grow by a further 2–4 per cent per year in real terms unless cuts are made.[35] The government, taking note of this runaway situation, has recently announced that future increases in defence spending will be based on the general rise in prices in the economy rather than on the inflation rate specific to the military sector.

The 3 per cent goal will be dropped after FY 1985/86 and defence equipment expenditure subject to a cost-chasing exercise. Yet savings are to be achieved by technical adjustments "within acceptable limits" without cuts in major programmes or change in strategy. At the same time, for example, the purchase of 8–12 Type 23 frigates costing £100 million each is planned, principally for ASW (anti-submarine warfare) duties in the north Atlantic, but not unconnected with Britain's activities in the south Atlantic. These are a particularly heavy drain on Britain's resources, due to the logistic problems involved. Additional costs of £1 860 million have been agreed upon for the Falklands/Malvinas over the next three years,[36] though it is felt that the full costs of the re-equipment programme and the new airport have not been taken into account.

According to current plans the military budget is to grow at the expense of government spending in the welfare sector, since current political thought permits neither major tax increases nor increases in budget deficits. Expenditure plans show an increase in the military expenditure share (on a public accounts basis) from an actual 16.4 per cent in FY 1981/82 to a planned 18.0 per cent in FY 1983/84. Although no separate figures are presented for planned central government expenditures for the two years thereafter, these can be roughly deduced,[37] giving a further rise of about 0.5 per cent by FY 1985/86. Between the fiscal years 1981 and 1985 rising shares are planned also for law, order and protective services and for social security. Declining shares are scheduled for education, housing and other environmental services, industry, energy and trade and, to a lesser extent, for transport.

France

After a period of relative strength, French economic growth has stagnated in 1983 and the OECD (Organization for Economic Co-operation and Development) forecasts no real growth in 1984. Declining investment, balance-of-payments difficulties and inflation have also contributed to the government's economic problems. A temporary freeze on government expenditure in the autumn of 1982 resulted in delays and cancellations of 7.6 per cent of defence payment credits and 23 per cent of programme authorizations, and in February 1983, 20 per cent of the 1983 authorizations were delayed for nine months. Despite these obvious financial difficulties, the five-year defence plan published in April allows for a 2 per cent annual growth in defence spending in real terms over the period 1984–88. The overall economic five-year plan announced at the same time does not provide for any specific growth target.

The defence programme has been given special treatment in that the budgeted amounts and delivery dates of major purchases were passed as law, which is seen as guaranteeing that resources will be made available for its fulfilment. Within the programme, totalling 830 billion francs over these five years, 'absolute priority' has been given to procurement, which is to take a slightly growing share—from 49 to 51 per cent—of the total. Thirty per cent of the procurement budget will be spent on nuclear weapons and, while manpower is to be cut by 5 per cent over five years, remaining units will be re-equipped and a new 50 000-man Rapid Action Force (FAAR) created.

The share of central government spending going to the military reached a low point in 1982 and is planned to stay at about the same ratio until 1984.[38] Thereafter amounts are not specified for particular years. Already it seems likely that additional resources will be needed to finance the ambitious procurement programme, since budget estimates were made on the basis of optimistically low inflation forecasts. Thus, the defence plan is to be reconsidered in the autumn of 1985, and this is generally seen by observers as an opportunity to adjust budgets upwards in line with cost realities. The financing of equipment programmes is based on a forecast of 6.2 per cent inflation in 1984 and 5 per cent in each of the following four years, although inflation is currently 9 per cent. Pressure has therefore already been placed on the government to stick to the details of the programme regardless of the cost, and the Minister of Defence announced that despite economic difficulties "the sacrifice will not fall on defence".[39]

The 1984 military budget does not deviate from the five-year plan in nominal terms and has been allowed to grow slightly faster than the overall budget, while taxes and social security charges have risen. It is highly unlikely, however, that any real growth of military spending can be achieved without a budget supplement.

Japan

Japan is yet another example of a country in which a dichotomy has arisen between overall economic and defence planning. In accordance with a decision taken in November 1976, defence spending is not to exceed 1 per cent of GNP. More specifically, defence expenditure decisions are to be taken in the light of the growth of national income and of the government's budgetary situation.[40] While Japanese national income is growing faster than that of its competitors in the old industrial countries, current growth at about 3 per cent a year is much slower than during the expansionary period of the 1960s and 1970s. Defence plans, however, call for expenditure growth of between 6.3 and 8 per cent annually in real terms in the fiscal years 1983–87.

Mounting budget deficits led to the introduction of an austere budget for FY 1983/84 when total spending was projected to increase by only 1.4 per cent, the smallest rise for 28 years. Cuts were made in education, pensions and agricultural support, but military spending was allowed to increase by 6.5 per cent. Even this, however, was not enough to meet equipment targets, and a Defense Agency request for procurement under long-term contracts for new front-line equipment was cut by about 30 per cent.[41] Although military expenditure was allowed to rise despite budget constraints, the US Secretary of Defense commented that it was insufficient to achieve the stated goals and that an even greater defence build-up was needed. The Japanese Ministry of Finance presented a budget proposal for FY 1984 under which military expenditure would increase by approximately 5 per cent while total government spending increased by only 0.5 per cent. Following the intervention of Prime Minister Nakasone, the Defense Agency's request for a 6.55 per cent increase was agreed to by the Cabinet early in 1984.[42]

Other Europe

Austria is an exceptional case, where military expenditures have taken a virtually constant share of total government expenditures every year since 1970. Although the new Austrian chancellor has announced the introduction of a tighter budget policy, he is also pledged to continue the welfare policy of his predecessor, which points to no future change in trend. The replacement of Austria's SAAB 105 light jet aircraft with a new combat aircraft has been under discussion for some time. In 1981 the Austrian National Defence Council recommended the purchase of 24 Dassault–Bréguet Mirage 50 aircraft at a total cost corresponding to more than half of the Austrian defence budget at that time. Procurement has, however, been postponed for financial reasons, and the purchase is being reconsidered.

In *Sweden* the long-term halt in the share of government expenditures devoted to the military has not been interrupted. By 1983 a marked gap had, however, developed between approved military activities and the resources planned for these. The 1982 Defence Decision covering the period 1983–87 included a constant military budget in real terms over these five years, with guaranties of price compensation by use of a military price index specifically designed for this purpose. The Defence Decision provided for a continued modernization of the armed forces although at a somewhat reduced rate and at the expense of 5 800 defence employees over a 10-year period. A major project is the initiation of indigenous development and production of the JAS-39 Gripen second-generation multi-role combat aircraft for the Air Force. The government has decided to purchase 140 of these aircraft by the end of the century at a total cost (at 1981 prices) exceeding the current defence budget.

In 1983 the economic level for military defence was slightly reduced in relation to the 1982 Defence Decision in line with the overall restricted government budget, which did not provide cost compensation for the devaluation of the Swedish crown. This, in combination with increased costs arising from a higher dollar rate, devaluation and tax increases, has resulted in a debate about the economic crisis of the Swedish defence establishment.

In his 1984–89 plan for military defence,[43] the Supreme Commander of the Swedish armed forces concludes that the military's purchasing power has been so substantially reduced over the past year that the intentions of the 1982 Defence Decision in many respects cannot be achieved. In order to revert to the objectives set out in the 1982 Defence Decision, the Supreme Commander estimates that sums of the order of 5 billion Swedish crowns are required for the next three financial years in addition to the 58 billion crowns planned, over and above full price compensation. For each of the two years thereafter, a further 1 billion crowns would be required.

The government has promised a supplementary allocation for anti-submarine warfare which, according to the military, is much below what is required, but has also announced its intention to limit price compensation to 4 per cent—the expected rate of general inflation; this is strongly opposed by the military. Since major decisions are now required to reconcile planned military activities with planned resource allocations, the defence budget proposal was omitted from the annual general draft budget presented in January 1984. The government has since then tried to negotiate a deal with the parliamentary opposition on how to raise more money for the military, including measures such as increased petrol taxes and spending cut-backs for local authorities.

Conclusion

It has been argued for some time now that the provision of welfare at current levels in the Western industrial world is being eroded by economic stagnation. A further constraint on civil expenditure programmes is the escalating requirements of the military sector, especially the runaway costs connected with sophisticated military technology. This section has dealt only with the proportion of central government expenditure required for military purposes; the share of total resources going to military ends has not been discussed. There are signs that increasing proportions of government funds will be devoted to military purposes in the near future in a number of countries, leaving fewer monetary resources for welfare programmes within budgets.

The two related questions of the degree of military preparedness people wish to maintain and the sacrifice needed in terms of costs must be addressed by the electorates in each country. Since military demands are in many respects insatiable, arms procurement plans require an open debate. Major weapon programmes have long lead times and large sums of money are involved, making it difficult to stop them once they have been started. Neither governments nor electorates have therefore time to be complacent.

IV. The WTO

The total figure for WTO military spending is heavily dominated by the Soviet Union. The combined military expenditures of its east European allies amount to less than one-tenth of the total. The rate of increase for these countries levelled off between 1976 and 1981 to an average of 1.9 per cent per year. The estimate for 1982 shows a 4.7 per cent real growth, and in 1983 the increase is even greater. Part of the acceleration in recent years may, however, be explained by an increasing discrepancy between the official price index series, which SIPRI uses for deflation purposes, and actual price developments.

Among the Soviet allies, the German Democratic Republic has both the highest and the most rapidly increasing military budget. Since 1974 its military expenditure has increased at an average annual rate of over 6 per cent, and over the past four years it has approached 7 per cent. Hungary has announced a record military budget for 1983. With a real increase of almost 50 per cent over 1982, its share of the total state budget has increased from 4 to 6 per cent.

Poland and Romania have increased their military spending by less than 2 per cent per year over the past 10 years, one reason for this comparatively slow growth probably being economic constraints. Polish military spending actually declined over the period 1977–81. In spite of political turbulence and very rapid price increases in 1982, military spending was, however, raised by a full 13 per cent in real terms. The military budget announced for 1983 shows a nominal rise of 10 per cent, which will amount to a real decrease unless supplemental allocations have been made during the course of the year. Romania took the rather unusual step in 1983 of pledging to hold its military expenditure until 1985 at the 1982 level.[44] The pledge was accompanied by a call to all member countries of the two power blocs, particularly the Soviet Union and the United States, to halt the arms race.

The Soviet Union

The Soviet Union persists in reporting low defence budget figures, showing a slightly declining trend over the past decade to 17 054 million roubles in 1983.[45] No further information is provided. Since neither the levels nor the trend in the reported figures can possibly cover the sums required to finance the combined Soviet military effort as documented in Western sources, little attention is paid to this figure. Therefore, any assessment of Soviet military expenditure, its content and effects has by and large to rely on information published in Western sources, most of which originates from intelligence services. This is not without risks, since the examples of misestimation are plentiful.[46]

Soviet military expenditure estimates are published annually by the US Central Intelligence Agency, by the Defense Intelligence Agency (DIA) of the US Department of Defense, and by NATO. The estimates made by the CIA are derived mainly by use of the building-block method. About 1 000 distinct physical components of Soviet military activities are identified, counted and costed in dollar as well as in rouble terms.[47] The data on numbers of physical units and unit costs are based on intelligence information and are classified. Thus, it is only the methodology used which is open to debate. The dollar estimates are by and large rough measures of what it would cost to reproduce the combined Soviet military activities in the United States, for example at the pay scales of US volunteer military personnel and at US defence industry manufacturing efficiencies. These estimates suffer from such methodological deficiencies as to make them unsuitable for purposes of international comparison.[48] This is by now so widely acknowledged that it has led a senior NATO official to warn against their use as an argument for military expenditure increases in NATO member countries: "It is time to restore the confidence of Western public opinion in the estimates made by the intelligence services, but this cannot be accomplished if such disputable methods are continued as comparing Soviet expenditures in dollar terms with those of the USA and NATO. Public opinion will rarely be persuaded thereby to pay more for defence. Indeed, even the opposite effect might be achieved."[49] In line with this, NATO publishes only rouble estimates of Soviet military expenditures. It is more appropriate to use these estimates for assessing the growth rate in Soviet resource consumption for military purposes and the burden imposed by the military sector on the Soviet economy.

In March 1983, the CIA announced a major downward revision in its Soviet military expenditure estimates. Prior to this revision, the annual CIA reports had consistently concluded that the long-term volume trend in Soviet military expenditures on a dollar basis is 3 per cent, while on a rouble basis the growth rate has averaged 4–5 per cent per year. The difference in growth rates between dollar and rouble estimates has been explained by "the greater weight that the rouble valuation gives to faster growing elements, and the tendency of Soviet procurements to shift over time toward higher-technology weapons in which the US has a comparative advantage".[50] According to CIA estimates for the period 1967–77, the relatively fast-growing Soviet military investment costs (at about 4 per cent per year) represented over one-half of total Soviet rouble defence costs but only 30 per cent of dollar costs. On the other hand, the relatively slow-growing military manpower costs accounted for only one-sixth of total rouble costs, but 35 per cent of total dollar costs.[51]

According to the revised CIA estimates,[52] the long-term growth in total Soviet defence costs in rouble terms has slowed to 2 per cent per year since 1976 from a 4–5 per cent trend during the period 1966–76. This is due to the downward revision of CIA estimates for Soviet procurement of military equipment to an almost flat trend since 1976, which was only partially offset by the tendency for newer, more sophisticated arms to cost more. The exact trend in revised rouble procurement costs has, however, never been explicitly stated anywhere. Other resource categories have continued to grow at steady rates; 3–4 per cent for operations and maintenance, and slightly less than 2 per cent for personnel costs. The revised dollar estimates show a 2 per cent growth rate in costs for total Soviet military activities, and a flat trend for procurement costs since 1976.

DIA officials immediately disputed the CIA interpretation of Soviet military equipment trends. In spite of slower than expected arms production rates, previously estimated expenditure rates were not overstated, they claimed, since the dollar costs per weapon were higher owing to technological advances in Soviet weapons and inefficiency in production.[53] In the DIA's annual report to Congress some months later, however, a graph was presented in which the dollar estimates of Soviet military expenditures were shown to have shifted from a 4 per cent growth path over the period 1970–76 to a 2 per cent trend through to 1981. The only comment made on this marked change in trend was that "since 1970 the total dollar costs of Soviet defense programs has risen in real terms at an average annual rate of about 3 per cent, marking continuous growth in the overall level of Soviet military activity".[54] Thus, although the CIA and the DIA compile their physical estimates of military expenditure components independently of each other, they arrive at the same trends when applying the CIA dollar cost methodology to their physical numbers.

The DIA, however, considers its rouble estimates much more relevant than its dollar estimates for analysing Soviet priorities. In rouble terms, the DIA estimates that Soviet military expenditures have increased at a rate of 6.5 per cent per year from 1970 to 1981. This new and higher than previously reported rate of growth is expressed in current prices, contrary to the normal practice of calculating all growth rates in volume terms. It is based on the assumption that military spending has increased at the same rate as the total Soviet state budget, and on "other evidence".[55] However, no other evidence has been presented by the DIA to show that this is a realistic assumption.

On the DIA estimates, Soviet military expenditures increased over the period 1970–81 from 50 to 100 billion roubles in current prices. According to the DIA there was no slow-down in the nominal rate of growth in total military spending, in spite of an estimated deceleration in procurement rates from 9–11 per cent in the first half of the 1970s to 6–9 per cent in the latter half.[56] Further, it is their estimate that the military burden on the Soviet economy has increased over the period, with military expenditure as a share of GNP increasing from 12–14 per cent to 14–18 per cent in 1981. This is contrary to the CIA estimate of military expenditures as having taken a constant share of Soviet GNP since 1970.

The new and contradictory intelligence estimates are discussed and compared in a recent US Congressional study, which in part relies on classified intelligence material. The conclusion is that the DIA's rouble estimates for Soviet military spending and GNP "have limited utility for policymakers because they are not adjusted for inflation, are based on a definition of Soviet defense that is different from the definition of US defense, and contain wide margins of error. The DIA considers its methodology classified, making it difficult for outsiders to evaluate its measures."[57]

The revised military expenditure estimates for the Soviet Union have major policy implications for its adversaries. It is true that Soviet military spending even according to the new estimates is high and comfortably accommodates considerable additions to Soviet forces, but as regards Soviet priorities and intentions there is a difference in the conclusions to be drawn from pre- and post-revision estimates. When formulating the tenth five-year plan in 1975, the Soviet leadership, faced with declining economic growth rates, chose to reduce sharply the growth rate in civil investment. Since then, Western analysts have been wrestling with the question: why

Table 3.6. US Defense Intelligence Agency estimates of Soviet production of certain military items, 1978–82

Military item	1978	1979	1980	1981	1982
Ground forces matériel					
Tanks	3 000	3 500	2 100	2 000	2 500
Other armoured fighting vehicles	5 500	5 700	6 300	5 200	4 500
Towed field artillery	1 400	1 500	1 400	1 600	1 700
Self-propelled field artillery	700	500	300	400	500
Multiple rocket launchers	550	600	700	700	700
Self-propelled AA artillery	300	300	300	300	200
Towed AA artillery	100	–	–	–	–
Aircraft					
Bombers	30	30	30	30	30
Fighters/fighter-bombers	1 250	1 300	1 300	1 350	1 100
Transports	400	400	350	350	350
Trainers	50	25	25	25	25
ASW aircraft	10	10	20	10	10
Helicopters	650	750	750	750	750
Missiles					
ICBMs	225	225	250	200	175
IRBMs	100	100	100	100	100
SRBMs	250	300	300	300	300
SLCMs	600	700	750	750	800
SLBMs	250	200	200	175	175
ASMs	900	900	1 000	1 000	1 000
SAMs	53 000	53 000	53 000	53 000	53 000
ATGMs	35 000	40 000	45 000	60 000	62 500
Naval ships					
Submarines	13	12	13	11	8
Major combatants	11	11	11	9	9
Minor combatants	50	55	65	45	55
Naval support ships	5	7	8	5	4

Source: The Allocation of Resources in the Soviet Union and China—1983, Statement by Major General Schuyler Bissell before the Joint Economic Committee of the US Congress, 28 June 1983.

did the Soviet Union not restrain its military spending in 1975? This question has been the more intriguing since 1975 was a particularly good time for reducing the military expenditure growth rate.

The 1975 decision to sacrifice growth for defense came after the onset of détente, after SALT I and the Vladivostok agreement had recognized Soviet stategic parity with the United States, after the U.S. had suffered defeat in Vietnam, after substantial Soviet theater buildups in Europe and the Far East had improved the military balance, after a decade of rapid increases in Soviet defense expenditures and several years of declining United States spending, in real terms, for defense. The decision was roughly coincident with the Helsinki agreement that virtually ratified Soviet World War Two gains in Eastern Europe. Then, if ever, was a time when economic constraints might safely have been given their due weight against the claims of defense. Yet an opposite choice

Table 3.7. US DoD assessment of relative US/Soviet technological levels in deployed military systems[a]

Deployed system	1980 USA superior	1980 USA–USSR equal	1980 USSR superior	1982 USA superior	1982 USA–USSR equal	1982 USSR superior
Strategic						
ICBM		×			×	
SSBN/SLBM	× →					
SSBN					×	
SLBM				× →		
Bomber	× →			×		
SAM			×			×
BMD			×			×
Anti-satellite			×			×
Cruise missile				×		
Tactical land forces						
SAM (including naval)		×			×	
Tank			← ×		×	
Artillery	× →				×	
Infantry combat vehicle			×			×
Anti-tank guided missile		×			×	
Attack helicopter	× →				×	
Chemical warfare			×			×
Theatre ballistic missile		×			×	
Air forces						
Fighter/attack aircraft	×			× →		
Air-to-air missile	×			×		
PGM	×			× →		
Airlift	×			×		
Naval forces						
Nuclear-powered submarine		×			×	
Anti-submarine warfare	× →			×		
Sea-based air	× →			×		
Surface combatant		×			×	
Cruise missile		×			× →	
Mine warfare			×			×
Amphibious assault	× →			×		
C³I						
Communications	× →				×	
Command & control		×			×	
Electronic counter-measures		×			×	
Surveillance and reconnaissance	× →			× →		
Early warning	× →			× →		

was made, to maintain the growth rate of defense spending while sharply cutting the growth rate of investment. In effect, investment funds were diverted to defense.[58]

The revised Soviet military expenditure estimates do not support conclusions which are based on pre-revision estimates, such as that "the prolonged Soviet military build-up is relatively insensitive not only to changes in the international climate and in U.S. military policies, but also to changes in Soviet economic circumstances".[59]

Soviet arms production figures have been reported annually by the DIA since 1981. Figures for production are of course not identical to those for procurement. The former include military equipment produced for export and exclude annual Soviet imports of about 600–800 armoured vehicles from the east European countries. However, DIA data published before the revision for the period 1977–81 indicate that aggregate growth rates for arms procurement differ little from production rates, although the levels are significantly different, especially for vehicles, artillery, fighter and trainer aircraft, and minor surface combatants.[60]

The 1983 version of the DIA arms production data is reproduced in table 3.6. The number of weapons produced by the Soviet Union is shown to be very high. Indeed, for most weapon categories, the Soviet production levels by far surpass those of the combined NATO countries. Growth rates for production are, however, generally low. Over the period 1978–82 production rates have remained constant or have declined for 18 of the 25 weapon categories listed.

Various possible explanations have been given for the long-term deceleration in Soviet military procurement numbers and costs since 1976. According to the CIA, it is due to "a combination of factors including technological problems, industrial bottlenecks, and policy decisions".[61] Since the slow-down coincides with reduced growth rates also for Soviet GNP, total industrial production and the machinery and metal-working industry output, it has been suggested that "it is likely—but cannot be proved—that the defense slowdown is the result of economic constraints".[62]

Since the mid-1970s, the US Department of Defense has voiced its concern that the rapid Soviet investments in military R&D would erode the US lead in military technology. The studies of military technology

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[a] These are comparisons of system technology level only, and are not necessarily a measure of military effectiveness. The comparisons are not dependent on scenario, tactics, quantity, training or other operational factors. Systems farther than one year from IOC (Initial Operational Capability) are not considered.

The arrows denote that the relative technology level is changing significantly in the direction indicated.

Source: Holloway, D., *The Soviet Union and the Arms Race* (Yale University Press, New Haven, 1983), pp. 138–39. The original sources of these tables are the annual posture statements to the US Congress of the US Under Secretary of Defense, Research and Engineering.

trends and comparative levels are few and do not cover recent years. Again, the only source of information is official US assessments, the basis of which is unknown. The emerging picture is, as one recent publication puts it, that the United States is shown to enjoy a general technological lead in deployed military systems (table 3.7), although the lead is smaller than in basic technology areas. "This points to the success of the Soviet acquisition process in creating effective weapons on the basis of a generally lower technological level in industry."[63]

Starting with the 1976–80 development plan, the Soviet Union has embarked on a new strategy for economic growth which is based on high rates of technological progress instead of, as traditionally, on massive labour and capital investment. This has been necessitated by the recent sharp fall-off in labour supply due to low birth rates, and by the continuous decline in capital/output ratios. The expected results have, however, not been attained because of institutional obstacles in the Soviet economic structure.[64] Growth rates in both aggregate output and labour productivity have been decelerating during recent years. It remains to be seen whether economic reforms which have been intensely debated in the Soviet press during the past year will be implemented and effective. If not, the high priority given to the military sector in the Soviet Union will impose an increasing economic burden—which is already substantial—with the defence industry employing an increasing share of scarce labour resources.

V. China

China is the only major power committed to contain defence spending, to utilize military industrial plants for civilian purposes and to give priority to the modernization of industry, agriculture and science. Military spending has clearly been the subject of restraint since 1979, the year of the Viet Nam invasion, when the policy of the four modernizations was announced. In 1983 the official military budget fell in real terms and as a percentage of government spending (table 3.8). This, however, is not the whole picture. Costs for major equipment purchases and military R&D are embedded in other parts of the budget, the Chinese philosophy being that it is necessary to 'reside' resources in various sectors of the economy so that a transition from peace-time to wartime production can be made smoothly should the need arise.[65] The use of spare capacity in the defence industries to produce capital and consumption goods for the civilian sector has been emphasized this year, particularly the saving in foreign exchange which this has involved.[66] Clearly, Chinese authorities are finding it necessary to make more consumer goods available to the public and are prepared to sacrifice growth in heavy industry for the sake of adapting products to 'market demands'.[67] At the same time they are trying to modernize their armed forces using domestic resources, since, as Defence Minister Zhang Aiping stated in the spring of 1983, it is neither realistic nor possible to "buy defence modernisation from abroad".[68]

A solution to these conflicting goals can be found in the defence policy statements which emphasize the importance of nuclear deterrence, a re-evaluation of the position that any enemy could be defeated by the sheer weight of Chinese numbers. Funds are therefore to be concentrated on the domestic production of guided missiles, nuclear fuel and bombs and on a streamlined, more professional armed service.

Observers comment that, since China already has nuclear know-how, compared to bringing its forces up to scratch with conventional weapons of modern sophistication a nuclear programme may be cheaper. The economic consequences of this will depend on China's determination to stick to its priorities of raising living standards and creating a modern agricultural and industrial nation.

Table 3.8. China's military expenditure as a share of total government spending, 1977–83

Figures are in billions of yuan.

	1977	1978	1979	1980	1981	1982	1983
Government spending	84.4	111.1	127.4	121.3	109.0	115.3	126.2
Military spending (official budget only)	14.9	16.8	22.3	19.4	16.9	17.9	17.9
Share of military spending (%)	*17.7*	*15.1*	*17.5*	*16.0*	*15.5*	*15.5*	*14.2*

Sources: For government spending: *International Financial Statistics* (International Monetary Fund, Washington, D.C., November 1983). For military spending; SIPRI, *World Armaments and Disarmament; SIPRI Yearbook 1983* (Taylor & Francis, London, 1983), p. 158. The 1983 figures for both government and military spending are from *Fifth Session of the Fifth National People's Congress (November–December 1982)* (Foreign Language Press, Beijing, 1983); and *The First Session of the Sixth National People's Congress (June 1983)* (Foreign Language Press, Beijing, 1983).

VI. Latin America

In the past 10 years, the share of Third World military spending accounted for by Central and South America has risen from 10 to 12 per cent.[69] Spending in real terms has increased at an annual average rate of over 7 per cent. During the 1970s, Latin America experienced, for the most part, rapid economic growth, averaging 6 per cent annually. This expansion has been followed in the 1980s by severe recession.[70] Habits of military spending, however, remain unchanged. While GDP rose by only 0.2 per cent between 1980 and 1982[71] and prospects for 1983 were not encouraging, military spending in Latin America has grown annually at an average rate of over 11 per cent in the past three years. As a consequence, military expenditure as a percentage of GDP has risen between 1980 and 1983 in all but one of the Latin American countries for which there are figures.

The economic development of the 1970s was fuelled in part by the transfer of cheap and abundant foreign capital, the major part of which has come from commercial banks in the form of loans. It is estimated that almost half the Third World debt of $700 billion is owed by the countries of Latin America.[72] Their debt service ratio, that is, the percentage of export earnings used to pay interest on accumulated debt and principal repayments (amortization), has risen rapidly in recent years and for oil-importing countries of Latin America was 53 per cent in 1982 (table 3.9). If short-term debt is taken into account, debt service payments exceed export incomes in several major Latin American countries (table 3.10).

Table 3.9. Debt service ratios for all developing regions, 1970–82[a]

	1970	1980	1981	1982[b]
All developing countries	13.5	13.6	16.3	20.7
Low-income regions:				
Asia	13.3	7.9	8.4	10.1
Africa	6.5	8.8	11.6	28.3[c]
Middle-income regions:				
Oil importers	14.0	14.9	18.0	23.0
East Asia	6.7	7.0	7.6	8.6
Latin America	13.0	33.3	39.6	53.2
Oil exporters	13.9	13.0	15.7	19.1

[a] Debt service ratio is the percentage of export earnings used to pay principal repayments and interest on accumulated debt. For the purposes of this table, debt is defined as external public and publicly guaranteed debt with an original maturity of more than one year.
[b] Estimated.
[c] The sharp rise in 1982 reflects the accumulation of arrears and does not allow for any reschedulings in 1982.

Sources: World Bank Development Report 1983 (OUP, New York, 1983), p. 21; and *World Debt Tables*, 1982–83 edition (US Government Printing Office, Washington, D.C., 1983), p. xvii.

Table 3.10. Debt service ratios for four Latin American countries, 1981–82

Country	Medium- and long-term debt, 1981	Short-, medium- and long-term debt, 1982
Argentina	18	179
Brazil	32	122
Chile	27	116
Mexico	28	129

Source: Stallings, B., 'Latin American debt: what kind of crisis?' *SAIS Review* (Johns Hopkins University), Vol. 3, No. 2, Summer–Fall 1983, p. 29, from World Bank and Morgan Guaranty Trust sources.

Military spending in Third World Countries can be connected with current liquidity problems in two ways: first, debts have been and are being incurred, directly or indirectly, for the purchase of foreign military equipment and the financing of government deficits in part created by domestic military expenditure; and second, policies which maintain or expand levels of military expenditure can disrupt debt repayment and concomitant measures of fiscal stringency.

These problems have been identified obliquely by the World Bank[73] and more directly by the International Monetary Fund (IMF).[74] Another recent study concludes: "Around one fourth of all credit inflows could be avoided if there was no militarization through imports of high technology. Equally, around one fourth of the debt accumulated is due to weapons imports."[75] While it is difficult to relate debt to specific arms imports, the overall trend of military spending and of procurement programmes gives some indication of the resources being devoted to non-civilian purposes.

Central America

The regional expenditure of domestic resources for military purposes has doubled since 1974. Military assistance programmes have made a major contribution to the arming of the isthmus countries and Cuba, while Mexico's oil income has helped finance an almost 90 per cent growth in military spending in the 10 years up to 1982. The Mexican debt of $70 billion[76] is the second largest in the world after that of Brazil. Cuban debt is very much smaller, but equally a problem, and during 1983 both countries have had conditions for fiscal restraint imposed on them by international creditors. Remaining Central American debt of $11–14 billion is small compared to the Latin American total[77] since violence on the isthmus discourages lending by international commercial banks. The cases of Cuba and Mexico are discussed below; for other countries of the region, see chapter 14.

Cuba

Between 1979 and 1982, when Latin America's 12 main debtors were increasing their obligations to Western banks by 75 per cent, Cuba reduced its debts by 38 per cent. However, a failure of confidence shook Western creditors at the same time as the drop in sugar prices reduced Cuba's hard currency earnings to a minimum, and it was faced with a large and sudden reduction of short-term credit facilities. As a result, debt repayments were suspended in September 1982.[78] Cuba's total debt to Western creditors, estimated at $3 840 million, was finally renegotiated in spring 1983. In discussions with Western bankers, Cuba maintained that no hard currency is spent on arms; all weapons are gifts from the USSR and other

Socialist countries.[79] It is further reported that Cuba's foreign military presence in Africa is funded directly or indirectly by the USSR[80] or by the developing countries themselves.[81]

The impact of Cuban military spending would therefore seem to fall largely on the internal economy. Information on military spending is in the form of a single figure published in the budget, combining defence and internal security. Figures for functional spending are not available and it can be assumed that both equipment and trained work forces from other sectors contribute unspecified amounts to the defence sector. At the same time it is known that at least some of the defence and internal security forces contribute to production in, for example, the agricultural sector. Military spending still remains a relatively small element in the national budget for a country in such a vulnerable position, but it has been rising in recent years (table 3.11). Following the invasion of Grenada, the Minister of Defence called for a major increase in Cuban military spending.[82]

Table 3.11. Cuban military expenditure as a percentage of government expenditure, 1978–83

1978	1979	1980	1981	1982	1983
8.6	8.9	8.5	7.5	9.4	11.2

Sources: 1978–81: *Economia y Desarrollo*, January–February 1982, Table 15; 1982: *Granma*, 10 October 1982; 1983: *Latin American Regional Report: RC-83-01*, 21 January 1983.
Figures are average annual percentage increases.

The political price which Cuba pays for its high state of preparedness is a heavy dependence on Soviet military aid. Observers have been surprised by the sophistication of the matériel received, including fighter planes, missiles, submarines and amphibious assault craft. Some 5 500 Soviet soldiers and military advisers are reportedly stationed on Cuba.[83] Some of the equipment may have been intended for them, but the major portion must have been for the use of Cuban forces. Should the Soviet Union feel unable to maintain its economic commitment to the island, Cuba will find itself in possession of military forces which both in size and degree of sophistication far exceed its economic means.

Mexico

Military expenditure showed planned increases of 27 per cent in 1981 and 11 per cent in 1982 before the bubble of Mexican borrowing burst in mid-1982 and highlighted the peculiar problems of Latin American debt. Between 1978 and 1981 real per capita income rose by 25 per cent, but the policy of rapidly increasing living standards and reducing unemployment ran into difficulties when it could no longer be paid for by foreign loans and oil revenues. Mexico was forced to take an increasing number of short-term loans at high interest rates and in 1982 experienced a series of financial crises. A programme of economic adjustment announced in April 1982 was not fully implemented, particularly as regards the control of government spending,[84] and no cut-back in military spending was reported. Mexico was obliged to turn to the IMF in November 1982 and the conditions for the 'rescue' loan included a reduction of Mexico's budget deficit from 17.5 to 3.5 per cent of GDP by 1985. The 1983 budget involved cuts of an estimated 17 per cent in real spending but no details were given concerning military spending. Plans were announced simultaneously for the acquisition of 19 ships for the Navy and Coast Guard and for work on two naval bases.[85] It is therefore not clear to what extent sacrifices will be made by the military during Mexico's current financial difficulties.

South America

Three countries which illustrate problems typical for the region are Argentina, Brazil and Peru. The new government of Argentina has inherited negative growth, high unemployment, high inflation and a large military-related debt. Hope of concentrating resources on economic reconstruction are bedevilled by the unsolved Falklands/Malvinas issue. Brazil, the world's biggest debtor, is felt to have great potential and its debts are less obviously military-related. However, involvement of the military in the economic affairs of the country ensures the diversion of resources into non-productive channels. Peru's military expenditure is fuelling a major budget deficit and its procurement programme contributes directly to its debt problems.

Argentina

Budgeted military spending in Argentina still reflects the war economy of 1982, although inflation at double the target rate of 160 per cent set by the International Monetary Fund in January[86] and a peso devaluation of 300 per cent during 1983 make the estimation of a military expenditure figure particularly hazardous. The new government has announced a commitment to spending on education and health while a ceiling of 25 per cent of government spending is to be placed on the military budget. It may, however, prove very difficult to restrain military spending in view of the threat to security which Argentina feels is posed by the "installation of the military and nuclear fortress by the United Kingdom in the Malvinas, as well as the maritime and air exclusion zone declared by the illegitimate occupier".[88] The President has declared that the conflict would be fought on the diplomatic rather than the military front. But even if some of the most recent orders for aircraft, armoured vehicles, guided missiles or warships could be reduced or even cancelled, the bill has yet to be paid for Argentina's rearmament programme in the latter half of the 1970s and in the aftermath of the Falklands/Malvinas conflict. The Central Bank estimated early in 1983 that at least $5 billion in foreign debts had been incurred for arms purchases between 1978 and the end of 1982, and that the figure was still growing.[90] The 75 modern strike aircraft lost in the Falklands/Malvinas conflict are being replaced by 107 new acquisitions, four Hercules transport planes replace the one lost, and 71 Pucara ground attack aircraft replace the 21 lost. The picture is the same for the Army where lost equipment will be replaced several times over; the Navy's modernization programme, originally begun in response to the Beagle Channel dispute with Chile, has been accelerated and complemented.[91] The cost of this re-equipment programme is estimated at $2 billion plus a further $1–2 billion remaining to be paid for orders placed before 1982.[92]

In addition to paying for these unproductive purchases with scarce foreign currency, the new government is also anxious to restructure the armed forces, to retrain and professionalize personnel and to retire others, often very costly reforms. Unlike Brazil and Mexico, Argentina did not develop its productive potential during the heyday of capital imports to form a basis for future growth and employment and a source of income out of which debts could be paid.[93] It is therefore particularly unfortunate that so many of the country's resources have been and are still being committed to military ends.

Brazil

Although Brazil renegotiated its debt during 1983, it was reportedly near bankruptcy again by the end of the year,[94] with an external debt of over $100 billion.[95] However, the military-based government is showing a particular reluctance to curtail military spending, despite serious budget deficits. The planned real increase of the 1983 military budget was 24 per cent[96] although, with an annual inflation of 211 per cent, far in excess of the forecast, it is difficult to estimate final expenditure. However, two considerations suggest that military spending has not fallen in real terms. First, the aftermath of the Falklands/Malvinas conflict has led to an extensive rearmament and modernization programme for Brazil's armed forces.[97] Second, Brazilian military, who are making indecisive steps towards a hand-over to civilian rule, are first securing their own position in terms of both personnel and equipment. To this end, it is reported that the strength of the armed forces is to be increased from 277 000 to 290 000–

300 000 men,[98] and that huge budget increases are being demanded by the Defence Department for 1984.[99]

The problems of obtaining fresh credits and the 300 per cent devaluation in 1983 of the cruzeiro have not passed unnoticed in military circles. The importance of expanding domestic arms production is emphasized for both economic and strategic reasons. Brazil is now a leading Third World arms producer and its arms exports exceed in value that of one of its traditional export products, coffee.[100] Because of these export earnings and import substitution, procurement is not an obvious element in Brazil's debt problems. However, unrestrained military expenditure puts a major burden on domestic resources and reduces Brazil's chances of escaping from its financial problems with its social and economic structure intact.

Peru

Peru has a particularly dismal record for 1983, with a fall in GDP of 11 per cent, an inflation rate of 125 per cent and about $13 000 million in debt. While natural disasters and low prices for traditional exports have contributed to the economic result, two IMF studies in November 1983 stress the issue of military expenditure as a major factor in the sharp deterioration in the country's finances. Debt service and military spending are now said to be taking 68 per cent of the total budget.[101] Of the $2 600 million loans contracted in 1982, over 25 per cent are reported to be for defence purposes.[102] Despite its economic problems, Peru is said to be involved in arms purchases worth $4 000 million, including up to 26 Mirage 2000 fighter aircraft, 40 AM-39 Exocet missiles and support equipment. Ordered in December 1982, this package alone is worth between $800 and $900 million. Peru has also bought quantities of counter-insurgency equipment, in particular helicopters from both the USA and the USSR. Peruvian debt to the Soviet Union is estimated to be in the region of $800 million.[103]

VII. South Asia and the Far East

Despite the downturn in their growth rates, the Asian countries—which account for two-thirds of the population of the developing world—increased their per capita incomes each year between 1980 and 1982.[104] Prudent fiscal management combined with a high degree of political stability has made them more economically resilient than the countries of Africa and Latin America during the current world recession, and Asian countries have continued to attract the capital necessary for their development. The developing countries in South Asia and the Far East (excluding China) have raised their share of Third World military spending[105] from

15 to 20 per cent between 1974 and 1983, but the growth of military expenditure has slowed in recent years in the major countries of the area, except in North Korea and Pakistan (table 3.12). With the exception of the very poorest countries and possibly Indonesia, military spending has continued to grow as a percentage of GDP and takes the same share of resources as in the industrial countries, where per capita income is some 10 times higher.

Table 3.12. Major countries in South Asia and the Far East: estimated volume increase of military expenditure, 1974–83

Figures are average annual percentage increases.

Country	1974–80	1980–81	1981–82	1982–83
India	6.2	5.6	8.6	1.8
Pakistan	4.0	11.6	15.4	6.8
Indonesia	. .	14.6	7.8	2.0
North Korea	9.9	9.4	7.7	11.1
South Korea	17.1	−4.9	15.5	1.4
Malaysia	11.6	19.2	6.1	5.6
Taiwan	12.6	0.7	12.0	10.8
Thailand	12.8	1.6	8.0	8.5

South Asia

Relations among the countries of South Asia are strained, and this is reflected in the steady growth of military expenditure in recent years. Between 1976 and 1980, military spending grew at a rate of 3.3 per cent per year in real terms, while since then it has been growing at 6.8 per cent. Immigration from Bangladesh into the Indian province of Assam and racial tension in Sri Lanka between Tamils of Indian extraction and the local population have in 1983 added to tension in the region, which is otherwise dominated by enmity between India and Pakistan.

Pakistan's position as a border state to both Afghanistan and Iran has led the United States and the Arab countries to offer more financial support than previously. Thus the USA is giving Pakistan more than $1 500 million in military assistance in the coming five years, while Arab countries are contributing $1 000 million.[106] Furthermore, about six of the 40 F-16 Fighting Falcon aircraft, ordered from the USA in 1981, were delivered in 1983 (see also chapter 7).

The acquisition of such advanced technology has created a reaction in India, since the primary task of the armed forces of each of the two countries is seen as dealing with the potential threat from the other. India aims increasingly to produce its own arms but continues to import the larger and more sophisticated weapons which in the past have been mainly supplied by the Soviet Union. Now India is also turning to

Western suppliers. This is due not only to a desire to reassert its position of non-alignment and to be able to choose from a wider range of technologies, but also to problems in Soviet–Indian trade. India has had a barter trade agreement with the USSR since 1954, denominated in non-convertible roubles. India cannot, under the agreement, use these roubles, in surplus since 1971, to repay outstanding Soviet credits given for the purchase of Soviet capital goods and arms. The Soviet response to the rouble surplus has been to cut imports, which has had serious repercussions on both the industrial and agricultural sectors in India.[107] India is now looking to the West, including the commercial banks, to finance its economic development and military aspirations. Currently described as having a 'manageable' external debt,[108] India's debt structure is expected to deteriorate in the next few years, necessitating restraint on the part of Indian authorities and continued massive aid from the rest of the world.

Pakistan's debt position is apparently sound, with a debt service ratio of less than 10 cents for each dollar of exports. Yet its economy is heavily bolstered by foreign aid and remittances from Pakistani workers abroad. Pakistan is already using 70 per cent of the aid it receives from industrialized countries in debt servicing[109] and, since the flow of foreign remittances is beginning to slow, its creditworthiness may be expected to deteriorate in future years. As their credit position weakens, countries of this region should be aware that, with limited supplies of foreign currency, the 'guns or butter' issue has to be faced.

The Far East

The economies of the Far East are currently among the most flourishing in the world, with only the Philippines causing concern to its creditors. Malaysia, Singapore, Taiwan and Thailand all have growth rates in excess of 6 per cent. The country with the fastest growth, South Korea, is also the country with the region's largest debts, balanced by a sound liquidity position.

South Korea's military spending, while high as a percentage of GDP (8 per cent) and government spending (30 per cent), has grown at a much slower rate over the period 1978–83—3 per cent per annum—than in the previous five years, when growth was 26 per cent per year in real terms. In a major—and very successful—effort to contain inflation, military spending for FY 1983/84 was allowed to grow at only half the rate of central government spending and in 1984/85 it was to increase by a nominal 0.9 per cent.[110]

The growth in military spending in the region as a whole, excluding China, has also slowed from 9.0 per cent per year between 1973 and 1978, to 5.2 per cent from 1978 to 1983, although even this figure implies a doubling of real expenditure in 14 years. The countries of the Far East remain nervous of the intentions of the superpowers in the area and maintain their armed forces at a high state of readiness to deal with domestic subversion and external aggression. To this latter end, Singapore, Indonesia and possibly Malaysia are expanding their surveillance capability. Indicative of the region's financial situation is Singapore's intention of buying four E-2C Hawkeye surveillance aircraft for cash.[111]

VIII. The Middle East

The rapid growth rates prevailing up to 1976 in Middle East military expenditure were resumed between 1980 and 1982. The volume decline of almost 5 per cent in 1983 is preliminary. It is the consequence of Saudi Arabia's decision to reduce its military spending in FY 1983/84 because of the sharp decline in its oil revenues. The four other major spenders in the region—Iran, Iraq, Israel and Syria—are all involved in military conflict. These five countries have continued to receive and order military equipment at high levels throughout 1983. Information about the financing arrangement of these arms purchases is, however, insufficient for a judgement on whether the 1983 decline in military expenditures will be reversed as actual expenditure figures become available.

The slack in Middle East military spending between 1976 and 1980 was the effect mainly of drastically reduced military budgets in Iran, first during the last chaotic years of the Shah's regime and, in 1979, as a consequence of the decisions made by the new Islamic Revolutionary Council to halve the size of the Iranian armed forces, to cancel most orders for military equipment made by the Shah, and to lower the level of the military budget by about one-half.

Since the outbreak of the Iran–Iraq War in September 1980 military spending in these countries has risen rapidly, although a clear picture is not yet available. Their arms purchases are described in chapter 7. In financing the war and the related damage, Iran is by and large confined to the use of its own resources, while Iraq is reported to have received massive aid from other Arab countries.

The other military conflict in the Middle East, that which has been waged on Lebanese territory since June 1982, is not reflected in any boost in SIPRI military expenditure estimates for Israel and Syria. These are, however, based on provisional estimates or approved budgets for the most recent years. In Israel actual military expenditure has in earlier years exceeded original defence budgets by a wide margin, since excessive rates of inflation have made fiscal planning difficult. Further, both Israel and Syria receive extensive military aid which, at least in the short run, serves to alleviate the domestic resource requirements for military purposes. While little is known about the payment conditions associated with the inflow of Soviet military equipment to Syria, more is known about US aid to Israel.

Israel

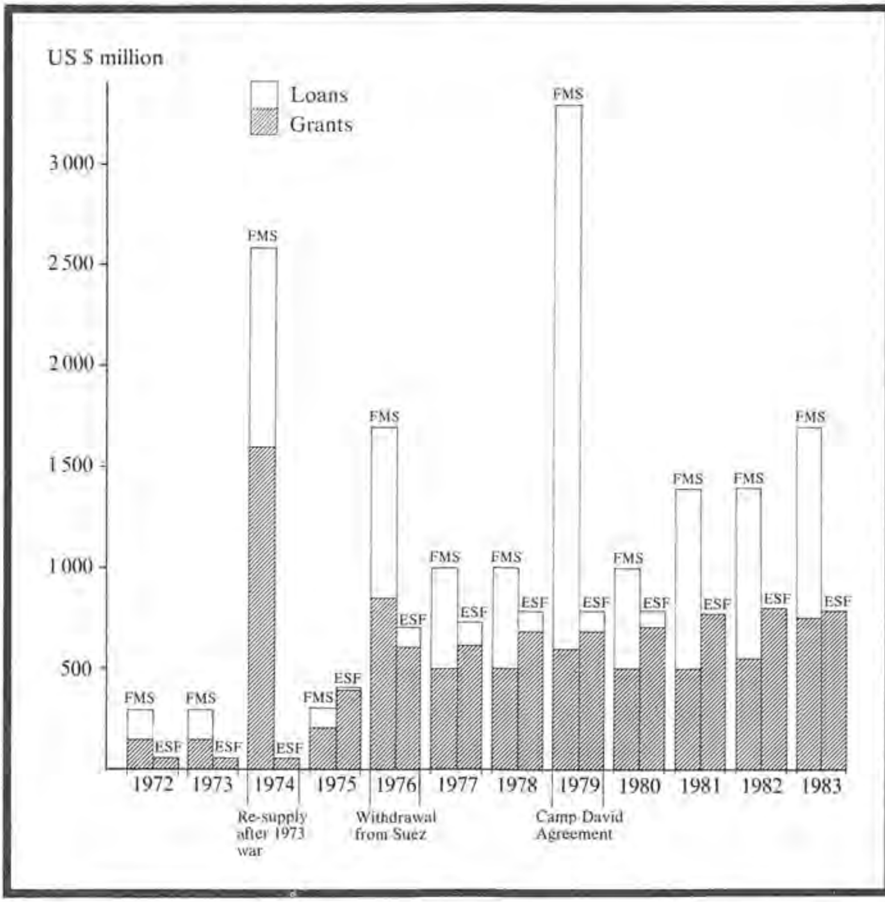
Military expenditure has always been a substantial burden for the Israeli economy and people. In relation to national product, public spending and population, Israel's military spending is among the highest in the world. Inflation has been accelerating since 1978 and has been over 100 per cent per year since 1980. The foreign debt is growing rapidly—by $2 000 million over the 12 months ending September 1983—and now stands at $30 000 million. It has proved difficult to curb government spending to reduce inflation, since military expenditure and debt servicing each account for about one-third of total spending. The Lebanon invasion further aggravated the economic situation. Estimates of its costs have ranged between $1 200 million and $2 500 million. Some of it is being financed from private sources abroad and by commercial borrowing, but most of the money will be raised from domestic sources, through increased taxes, reduced subsidies and a compulsory interest-free war loan from wage earners and companies, the result of which has been to fuel inflation even further. By the end of 1983 price increases were approaching 200 per cent.

Yet, catastrophic effects of Israel's military sector have so far been avoided because of the massive inflow of military and economic assistance from the United States. Most of the foreign purchases of military equipment are financed by US Foreign Military Sales (FMS) loans and grants. Between fiscal years 1977/78 and 1981/82 about one-third of the Israeli defence budget was funded by the United States, the share increasing to 37 per cent in 1982/83.[112] Not only has Israel since 1974 received more US military assistance than any other country, but it is also privileged in that this assistance has been given on very favourable terms.

US military loans and grants to Israel are shown in figure 3.3. Those loans which are not forgiven have a repayment period of 30 years, starting with a 10-year period of grace, during which only interest has to be paid, against the ordinary maximum repayment period of 12 years for most other recipients.

In addition to FMS assistance, Israel also receives US financial assistance through the Economic Support Fund (ESF), previously the Security Supporting Assistance Program. This aid is not tied to specific development projects, its purpose being rather to support economic stability in the face of Israel's heavy defence burden, mainly by helping Israel to pay for its balance-of-payments deficit. Israel is also the largest recipient of ESF

Figure 3.3. US Foreign Military Sales (FMS) and Economic Support Fund (ESF) assistance to Israel, US fiscal years 1972–83



Source: US Assistance to the State of Israel, Report by the Comptroller General of the United States (US General Accounting Office, 24 June 1983), pp. 8, 30.

aid, receiving 30 per cent of the total in US fiscal year 1982/83. Since FY 1980/81, all ESF aid to Israel has been in grant form.

Because the periods of grace for the first major military loans are now expiring, Israel's debt servicing requirements are beginning to accelerate. Its military debt repayment to the United States is projected to increase from $772 million in 1982 to $1 100 million in 1992, and it will continue to rise as the grace period expires for successive years' loans. A recent US study[113] concluded that Israel most probably will need to ask the United States for even more liberal financing terms than hitherto in order to maintain what it considers to be adequate defence while at the same time repaying past loans.

This prediction has materialized perhaps earlier than expected. In late 1983 Israel asked to have all its military aid for US FY 1983/84 in grant form and a 50 per cent increase in ESF assistance. US Administration requests to Congress, although generous, pruned these amounts to $1 400 million in FMS grants and $850 million in ESF grants, but if Congressional action follows past records, the sums actually approved will be higher.

The Reagan Administration concessions to increased aid to Israel are one aspect of a seemingly major shift of attitude. Other aspects include permission to let Israel use $550 million of US military aid for the development of the Lavi fighter aircraft for indigenous production, resumed US deliveries of cluster bomb artillery, declared US willingness to negotiate a duty-free trade accord between the two countries, and, not least, a planned strategic co-operation agreement. This agreement was subsequently strongly condemned by the United Nations General Assembly, which demanded that all countries "refrain from taking any step that would support Israel's war capabilities and consequently its aggressive acts".[114]

Saudi Arabia

The two rounds of unprecedented oil price rises, in 1973–74 and 1979–80, have permitted a rapid growth of government spending in all the major oil-exporting countries. Not only have ambitious development projects and welfare programmes been launched in most of these countries, but many of them have also embarked on rapidly growing military expenditure schemes. This is particularly true for the Gulf countries. Following the latest round of oil price increases and the recession in the industrial world, the combined OPEC (Organization of Petroleum Exporting Countries) oil exports dropped in 1981 to its lowest level in 10 years. Expansionary policies had to be reversed. After 1981 many countries began to cut public spending, while others became more restrictive. The increasing pressure on oil prices finally led, with the March 1983 London accord, to the first official oil price cut in OPEC's history.

Saudi Arabian expenditures for its defence and security forces have increased at an annual average rate of about 25 per cent over the period 1974–82. Military spending has in recent years averaged about 30 per cent of total public spending. Since about 90 per cent of government revenues are from oil exports, there is a close link between oil export earnings and military expenditures. In 1981 the decline in the volume of Saudi Arabian oil exports was offset by higher prices, but in 1982 oil revenues declined by 35 per cent. After long discussions in early 1983, Saudi Arabian authorities therefore decided to reduce government expenditure in the FY 1983/84 budget by 17 per cent compared to the budget for the previous year, although in reality this represented a 7 per cent nominal increase, since the FY 1982/83 budget was considerably underspent. Still, a deficit was budgeted for the first time since the first major oil price rises. Allocations to all sectors except health and education were reduced. Thus, defence and security allocations were cut by 19 per cent. Already in May all spending agencies had their allocations further cut and were told not to embark on any new projects. Thus, actual expenditures for 1983/84 will also be less than budgeted. Whether this is true also for defence and security allocations is uncertain. If the military sector has been allowed to grow at budgeted rates, its share of total public spending will have increased to 38 per cent in both of the most recent years, against about 29 per cent budgeted.

It is clear, however, that the restrictions on launching new projects did not apply to the military sector, since a major military contract was signed with France in January 1984. This low-level air defence package is worth 35–40 billion francs, compared to the Sawari contract signed with France in 1980, worth 14 billion francs, the second part of which was also contracted during the current fiscal year.

Saudi Arabia is in the process of building up the most advanced air defence system of any Third World country. Including the air defence package approved by the US Congress in 1980,[115] 62 F-15 fighter aircraft, and an advanced command, control, communications and intelligence (C^3I) system, its total cost is estimated at well over $12 000 million. A new air base is being built at Al Kharj which is to become the permanent base for the five AWACS surveillance aircraft and the six KC-707 tankers. Other major infrastructure projects are also being carried out. Near the border with Iraq, a military city is being built at a total cost of $7 000 million, large military complexes are being upgraded at Tabuk, Khamis Mushyrat and Dhahran, and deep water naval bases will soon be completed at Jubil and near Jeddah. Modernization of the Saudi National Guard, making it capable of complementing the regular army, will be completed by 1989 with US assistance.

Since the London accord, Saudi oil export earnings have picked up again, and in the Saudi development plan for 1985–90 they are expected to continue at these new levels. Even if they do not, it seems unlikely that Saudi Arabia will experience any absolute financial constraints on military spending. It can be expected, however, that Saudi planners will become more cost-conscious. An indication of this is the recent demand that US companies winning contracts for the C^3I system should be required to invest in joint ventures in civil Saudi industries in order to offset some of the contract costs to Saudi Arabia.

IX. Africa

Military expenditure for the African continent (excluding Egypt) has increased at an average annual rate of about 6 per cent between 1974 and 1980. Data are not yet available for most countries for the years after 1980. The current, very uncertain estimates for this period indicate, however, that the aggregate military spending of African countries has levelled off, and it is quite possible that there has been no real growth in African military expenditures since 1980.

Most countries in sub-Saharan Africa are among the poorest in the world. Of the 33 sub-Saharan countries included in the SIPRI registers, 20 belong to the group of 34 countries with the world's lowest per capita income in 1981, and most of the others are almost as poor. Although military spending as a share of gross domestic product is relatively modest in most of these countries, it still represents a significant diversion of very scarce resources.

Almost 40 per cent of total African military expenditures in 1980 are accounted for by the two major spenders—Libya and South Africa. Adding the next three in size—Nigeria, Morocco and Algeria—this share increases to almost 75 per cent. Due to lack of data, no estimates are included for Angola. According to one source, the Angolan defence and security budgets for the years 1978–80 averaged somewhat less than $300 million,[116] while President dos Santos has claimed that Angola has invested more than $10 billion for defence purposes during its first seven years of independence.[117]

South Africa's military expenditure more than doubled in real terms between 1973 and 1977. The 1977 United Nations mandatory arms embargo against South Africa resulted in volume declines in the military budgets for 1978/79 and 1979/80, since South Africa's arms procurement was thereby restricted in spite of numerous violations of the embargo. By 1980 the reduction was brought to a halt by a rapid expansion of the domestic armaments industry, under the responsibility of the state-owned Armaments Development and Production Corporation (ARMSCOR). In both fiscal years 1980/81 and 1981/82 the original cash votes for the Defence Department were exceeded. Actual expenditures for the two most recent budget years are not yet available. The voted military budget for FY 1982/83 represented a 7 per cent volume reduction over the original budget of the previous year, while for FY 1983/84 a 1 per cent increase was budgeted.

The South African Defence Department expenditure figures used by SIPRI do not, however, cover all South Africa's military-related expenditures. All costs of construction and maintenance of military bases are paid by the Department of Public Works, all housing for military personnel is provided by the Department of Community Development, and the welfare of war casualties is the responsibility of the Department of Health, Welfare and Pensions.[118] The major source of divergence between the regular military budget and total military expenditures is, however, the Special Defence Account, which is "intended for the retention of funds for armaments required until such armaments become available".[119] The amounts drawn from this account in fiscal years 1979/80 and 1980/81 were equal in size to more than one-half the regular military budget. Expenditures for unforeseen operations have previously been covered by withdrawals from this account. Since these reserves are being exhausted owing to improved procurement possibilities, supplementary defence budgets have been required in recent years for the financing of such operations.

South Africa's military expenditure is largely determined by its occupation of Namibia, which has been "converted into a huge military garrison",[120] and the associated raids into neighbouring countries. South Africa now has more than 40 military bases in Namibia and maintains a force of between 75 000 and 100 000 South African troops in this territory, excluding locally recruited forces, the 110 000 white settlers in Namibia which have been armed, and additional reinforcements frequently airlifted into the area. The 1982 estimates of manpower requirements included plans for an increase in South African forces in Namibia over the next three years, and the programme of forced conscription of black Namibians is also continually expanded. The high level of direct military activity is reflected in the high and increasing share of the military budget required for operational costs. According to the 1982 Defence White Paper, this share was expected to increase from 55.6 per cent in 1979/80 to 66.7 per cent in 1982/83, and a continuation of this trend is planned for the next five years.[121]

South Africa aims for complete self-sufficiency in its armaments requirements. It was 85 per cent self-sufficient in 1982, according to the chairman of ARMSCOR. In order to be able to respond to a possible increase in domestic procurement demands, the manufacturing capacity has been expanded beyond domestic requirements in several areas, the reserve production capacity being used for arms exports. South African authorities believe its weapons can penetrate the highly competitive international arms market by virtue of the fact that they are operationally tested and evaluated. Thus, a plan was approved in 1982 to boost arms exports over the next few years to about $150 million per year, a substantial increase over the 1981 value of $14 million. In 1982, however, the value of its arms exports fell to $9 million because of the loss of its best customer, as Zimbabwe won independence.

Libyan military expenditure has increased rapidly during the 1970s because of extensive purchases of military equipment. Arms procurement, in the Libyan case, means imports, since Libya has not succeeded in building up a domestic arms industry, although it has had the ambition to do so for at least a decade. Since the signing of a co-operation agreement with the Soviet Union in 1974, the Soviet Union has been the major arms supplier, followed by Italy, France and FR Germany.[122] The value of its arms imports rose steeply during the 1970s, but there seems to have been a drop in 1980. Although the SIPRI estimates of Libyan military expenditure are high in comparison with other sources, they probably understate the actual Libyan resources used for military purposes. The officially reported armed forces expenditures of the administrative budget are not believed to cover much more than remuneration of military personnel, while defence equipment and loans and grants are financed through special allocations not provided for in a formal budget.[123] SIPRI therefore adds to armed forces expenditures the value of Libya's arms imports, which are paid for in cash in hard currency, and to some extent also by oil shipments to the supplying countries.[124] No attempts are made, however, to estimate the value of Libyan military assistance to other countries, some of which is financed through the Jihad Fund and the Defence and Arab Co-operation Fund, but much of which is believed to be hidden elsewhere in the budget. The list of forces to which Libya is reported to have given matériel and financial military assistance is long. One major example is the Polisario movement in Western Sahara (now the Democratic Saharan Arab Republic), for which Libya is the major supplier of military equipment.

It is Libya's oil incomes which have made its sizeable arms imports possible. In spite of Libya's ambitious development plans, oil revenues have by far surpassed government expenditures, creating large reserves of foreign exchange. Since 1980, Libya's oil revenues have been declining and foreign exchange reserves more than halved. Although the weapons already imported exceed Libya's absorption capability, the government has taken measures to prevent reduced oil revenues from having any major impact on its military activities. Thus, in 1982, new regulations were introduced which allowed the government to allocate a considerable proportion of its employees' salaries to the Jihad Fund and to the armed forces.[125] In connection with the approval of its 1983 budget, 14 resolutions were passed on ways to achieve a continued quantitative and qualitative military build-up, one of which was to make "oil revenues available for buying arms in big quantities".[126] The Libyan government thus appears determined to maintain its military effort in spite of drastically reduced revenues.

Notes and references

[1] This figure has been estimated by applying the US inflation rate since 1980 to the constant price world total. Had the total for 1983 been estimated using 1983 dollar exchange-rates,

the figure would have been significantly lower. One major reason for this difference is the strength of the dollar in 1983. Measured against all other major currencies, the dollar has risen in value by about 20 per cent between 1980 and 1983.

[2] The NATO data are liable to subsequent revisions, especially for the most recent years. Thus, compared to the original estimates, the 1982 real growth rates have been revised from 6.9 to 6.2 per cent for total NATO, while the growth rate for NATO Europe is unchanged, in spite of substantial revisions for most individual countries in this group.

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[96] *Financial Times*, 1 September 1983.
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[102] *Latin America Weekly Review*, 4 February 1983.
[103] *Comercio Exterior* (Mexico), Vol. 33, No. 11, November 1983.
[104] *World Bank Development Report 1983* (note 73), p. 7.
[105] Note 69.
[106] *Guardian*, 13 June 1983; *Financial Times*, 25 March 1983; *Asian Recorder*, 9–15 April 1983.
[107] *Far Eastern Economic Review*, 2 June 1983.

[108] *India* (Grindlay's Bank Group, Economics Department, London, July 1983).
[109] *Financial Times* (note 106).
[110] Inflation was reduced from an annual level of 20 per cent in 1981 to about 3 per cent in 1983. *Far Eastern Economic Review*, 27 October 1983.
[111] *Military Technology*, July 1983, p. 80 and January 1984, p. 17; *Far Eastern Economic Review*, 3 December 1982 and 9 June 1983.
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[113] Note 112.
[114] *International Herald Tribune*, 21 December 1983.
[115] For further details, see SIPRI (note 27), p. 182.
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Appendix 3A

World military expenditure, 1974–83

For the sources and methods for the world military expenditure data, see appendix 3B. For the conventions used in the tables and for footnotes, see page 130.

Table 3A.1. World military expenditure summary, in constant price figures

Figures are in US $ mn, at 1980 prices and exchange-rates. Totals may not add up due to rounding.

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
USA	143 656	139 277	131 712	137 126	137 938	138 796	143 981	153 884	167 673	186 544
Other NATO[a]	97 606	99 582	101 524	103 214	107 037	109 355	112 297	113 234	116 153	(120 627)
Total NATO	241 262	238 859	233 236	240 340	244 975	248 151	256 278	267 118	283 826	(307 171)
USSR	[120 700]	[122 600]	[124 200]	[126 100]	[128 000]	[129 600]	[131 500]	[133 700]	[135 500]	[137 600]
Other WTO	10 166	10 942	11 418	11 735	12 073	12 228	(12 400)	(12 550)	(13 135)	[13 530]
Total WTO	[130 866]	[133 542]	[135 618]	[137 835]	[140 073]	[141 828]	[143 900]	[146 250]	[148 635]	[151 130]
Other Europe	12 903	13 423	14 047	14 029	14 232	14 979	15 470	15 348	15 291	(15 338)
Middle East	28 481	35 076	38 670	37 256	37 017	38 893	(40 695)	(45 990)	[52 350]	[50 000]
South Asia	4 569	5 006	5 681	5 497	5 739	6 220	6 460	6 895	7 620	7 865
Far East (excl. China)	[17 970]	[19 930]	[21 750]	[23 220]	[25 630]	[26 610]	[27 600]	[28 790]	[31 100]	[32 950]
China[b]	[35 000]	[36 800]	[37 600]	[36 200]	[40 500]	[52 700]	[42 600]	[36 300]	[37 700]	[35 800]
Oceania	3 976	3 845	3 831	3 848	3 913	4 029	4 270	4 488	4 623	4 868
Africa (excl. Egypt)	9 489	11 416	12 618	12 971	13 198	(13 526)	(13 555)	[13 590]	[13 800]	[14 100]
Central America	1 351	[1 502]	[1 700]	2 173	2 312	2 468	2 484	2 625	2 815	(2 825)
South America	7 998	8 911	9 444	10 170	9 980	9 941	10 230	10 584	[15 745]	(14 745)
World total	**493 865**	**508 310**	**514 195**	**523 539**	**537 569**	**559 345**	**563 542**	**577 978**	**613 500**	**636 790**
Industrial market economies[c]	258 406	255 354	249 849	257 175	262 836	267 659	276 931	287 357	304 573	328 944
Non-market economies[c]	168 252	173 151	176 341	177 654	184 557	198 868	190 991	187 335	191 486	192 661
Major oil-exporting countries[c]	25 282	32 990	36 962	35 508	37 102	37 807	40 221	45 235	51 510	48 745
Rest of the world[c]	40 817	45 583	49 698	51 774	51 495	53 375	53 701	56 274	64 011	64 408
With 1981 *per capita* GNP:										
< US $410	6 878	7 225	7 756	7 379	8 004	8 458	8 646	9 132	9 964	10 207
US $410–1 699	11 437	13 792	14 859	15 778	14 064	14 835	13 963	14 781	15 777	16 641
> US $1 700	22 502	24 566	27 083	28 617	29 427	30 082	31 092	32 361	38 270	37 560

Table 3A.2. World military expenditure, in constant price figures

Figures are in US $ mn, at 1980 prices and exchange-rates. Totals may not add up due to rounding. Constant price military expenditure estimates differ somewhat from those given in *SIPRI Yearbook 1983*, even when the local currency, current price estimates have not been changed. This is due to minor revisions in the International Monetary Fund's consumer price index data associated with the change of base year.

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
NATO[a]										
North America:										
Canada	4 128	4 070	4 341	4 622	4 792	4 550	4 703	4 785	5 254	5 426
USA	143 656	139 277	131 712	137 126	137 938	138 796	143 981	153 884	167 673	186 544
Europe:										
Belgium	3 028	3 299	3 473	3 562	3 798	3 882	3 958	3 995	3 862	3 723
Denmark	1 417	1 539	1 518	1 525	1 584	1 593	1 618	1 636	1 683	. .
France	20 788	21 709	22 635	23 916	25 384	25 962	26 425	27 066	27 623	28 042
FR Germany	25 335	25 219	25 044	24 952	26 007	26 355	26 692	27 114	26 759	27 355
Greece	1 781	2 288	2 508	2 658	2 715	2 630	2 276	2 693	2 746	2 748
Italy	8 304	7 728	7 687	8 257	8 608	9 154	9 578	9 781	10 463	10 892
Luxembourg	36.1	38.4	41.1	40.3	43.8	45.1	52.5	54.3	54.8	55.9
Netherlands	4 572	4 806	4 746	5 287	5 106	5 413	5 269	5 325	5 306	5 330
Norway	1 331	1 444	1 479	1 507	1 612	1 651	1 669	1 686	1 752	1 780
Portugal	1 572	1 083	846	779	788	800	868	864	865	873
Turkey	1 793	2 870	3 295	3 173	2 906	2 578	2 442	3 015	3 296	3 214
UK	23 522	23 490	23 910	22 936	23 694	24 744	26 749	25 221	26 489	29 443
Total NATO (excl. USA)	97 606	99 582	101 524	103 214	107 037	109 355	112 297	113 234	116 153	(120 627)
Total NATO	241 262	238 859	233 236	240 340	244 975	248 151	256 278	267 118	283 826	(307 171)
WTO[d]										
Bulgaria[e]	(619)	(705)	(780)	(774)	[811]	[833]	. .	. .	. .	. .
Czechoslovakia	2 119	2 316	2 345	2 292	2 380	(2 338)	(2 431)	(2 415)	. .	. .
German DR[f]	3 004	3 186	3 390	3 507	3 686	(3 859)	(4 167)	(4 508)	(4 765)	(5 030)
Hungary[f]	635	684	644	668	760	754	755	778	765	(1 129)
Poland	2 654	2 793	2 897	3 089	2 964	(2 984)	(2 863)	(2 673)	(3 021)	. .
Romania[f]	1 135	1 258	1 363	1 405	1 472	1 460	1 263	1 254	(1 108)	. .
USSR	[120 700]	[122 600]	[124 200]	[126 100]	[128 000]	[129 600]	[131 500]	[133 700]	[135 500]	[137 600]
Total WTO (excl. USSR)	10 166	10 942	11 418	11 735	12 073	12 228	(12 400)	(12 550)	(13 135)	[13 530]
Total WTO	[130 866]	[133 542]	[135 618]	[137 835]	[140 073]	[141 828]	[143 900]	[146 250]	[148 635]	[151 130]
Other Europe										
Albania[g]	87.1	93.3	112	115	117	126	131	134	134	. .
Austria	712	795	813	840	918	963	950	931	971	987

Finland	599	649	661	613	642	717	771	787	848	883
Ireland	240	266	283	290	319	344	362	347	355	332
Spain	3 169	3 297	3 529	3 544	3 526	3 699	4 007	4 104	4 357	4 544
Sweden	3 714	3 801	3 783	3 829	3 943	4 074	4 008	4 012	3 960	3 918
Switzerland	1 998	1 882	2 133	2 015	2 026	2 120	2 108	2 105	2 116	2 140
Yugoslavia	2 386	2 641	2 734	2 784	2 742	2 937	3 134	(2 928)	(2 551)	(2 400)
Total Other Europe	12 903	13 423	14 047	14 029	14 232	14 979	15 470	15 348	15 291	(15 338)
Middle East										
Bahrain	50.9	27.3	35.7	46.6	114	148	157	192	[220]	[240]
Cyprus	28.5	31.2	30.4	39.3	31.4	40.5	[34.0]	[29.0]	[48.0]	[68.0]
Egypt	[4 389]	[4 267]	[3 711]	[3 882]	[2 179]	[2 068]	(1 465)	(1 490)	(1 680)	(1 905)
Iran	10 613	13 528	14 659	11 898	11 039	6 578	[4 995]	[5 530]	[6 160]	[5 220]
Iraq[e]	2 210	2 247	2 204	2 303	2 179	2 668	[3 045]	. .	. .	. .
Israel	(4 163)	(4 441)	(4 433)	(4 431)	(3 943)	(4 155)	(4 256)	(4 565)	[4 382]	. .
Jordan	333	329	535	438	434	494	459	500	(521)	[532]
Kuwait	858	1 017	1 247	1 361	1 168	1 159	1 265	[1 380]	. .	. .
Lebanon[g]	87.3	91.7	95.2	74.2	143	215	266	307	[363]	. .
Oman[g]	342	698	785	686	767	779	1 178	1 511	1 682	[1 781]
Saudi Arabia	(4 433)	(6 770)	(9 200)	(9 920)	(12 240)	(16 405)	(19 261)	(22 315)	(25 745)	[23 385]
Syria	779	1 397	1 416	1 395	1 510	2 513	(2 144)	[2 018]	[1 841]	[1 890]
United Arab Emirates	21.6	33.4	84.2	520	814	1 185	1 707	[2 082]	[2 384]	. .
Yemen Arab Republic	116	136	168	188	344	371	339	423	. .	. .
Yemen, People's Democratic Rep. of	56.7	62.7	67.1	74.6	112	115	123	157	. .	. .
Total Middle East	28 481	35 076	38 670	37 256	37 017	38 893	40 695	(45 990)	[52 350]	[50 000]
South Asia										
Afghanistan	58.7	61.6	78.6	82.9	84.2	. .	. .	. .	. .	. .
Bangladesh	77.5	95.2	163	179	168	176	187	(195)	221	236
India	3 272	3 681	4 256	4 042	4 233	4 585	4 691	4 952	5 377	5 476
Nepal	10.9	13.1	17.3	17.5	[17.8]	[19.5]	[19.6]	20.3	23.1	[24.4]
Pakistan	1 116	1 121	1 125	1 131	1 197	1 290	1 411	1 574	1 817	1 941
Sri Lanka	33.8	34.3	41.4	45.3	38.9	61.3	58.7	53.8	[68.3]	75.6
Total South Asia	4 569	5 006	5 681	5 497	5 739	6 220	6 460	6 895	7 620	7 865
Far East										
Brunei	34.5	62.2	99.3	91.9	109	187	(191)	183	(197)	. .
Burma	142	162	155	181	212	227	(245)	. .	. .	. .
Hong Kong	36.0	35.3	63.4	97.4	142	156	287	. .	. .	. .
Indonesia	[1 604]	[1 996]	2 001	1 935	2 088	1 944	1 517	1 739	(1 876)	(1 915)
Japan	7 886	8 205	8 233	8 468	8 987	9 574	9 767	10 041	10 429	10 939

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Korea, North[a]	1 790	2 143	2 366	2 409	2 694	2 946	3 161	3 459	3 726	4 140
Korea, South	1 465	1 695	2 435	2 892	3 604	3 363	3 772	3 586	4 143	4 201
Malaysia	804	883	923	1 059	1 108	1 249	1 557	1 856	1 970	2 080
Mongolia[a]	(124)	(128)	(140)	(139)	(145)	(165)	(146)	(216)	(276)	(281)
Philippines	728	877	999	987	907	822	776	793	879	881
Singapore	339	396	481	538	523	524	576	648	719	831
Taiwan	1 315	1 475	1 719	[2 047]	[2 332]	2 460	2 679	2 698	3 022	[3 347]
Thailand	594	645	791	948	1 201	1 355	1 223	1 243	1 342	1 456
Total Far East	16 862	18 700	20 405	21 793	24 051	24 971	25 898	27 015	29 176	(30 912)
Total Far East (incl. Kampuchea, Laos and Viet Nam)	[17 970]	[19 930]	[21 750]	[23 220]	[25 630]	[26 610]	[27 600]	[28 790]	[31 100]	[32 950]
Oceania										
Australia	3 618	3 480	3 479	3 492	3 536	3 643	3 854	4 044	4 164	4 407
Fiji	1.7	2.3	3.4	3.7	4.1	4.3	5.9	4.4	4.7	4.5
New Zealand	356	363	348	353	373	382	410	440	455	457
Total Oceania	3 976	3 845	3 831	3 848	3 913	4 029	4 270	4 488	4 623	4 868
Africa										
Algeria	540	597	837	729	792	812	890	792	846	..
Benin[a]	7.3	8.6	8.3	10.1	16.0	19.1	24.5	..	..	..
Burundi	16.9	16.2	19.4	26.5	26.1	22.1	22.8	..	..	..
Cameroon	74.0	78.4	82.4	79.2	75.6	76.9	82.6	89.7	95.6	104
Central African Republic	16.1	14.7	14.4	12.7	(13.9)	(17.0)	[13.3]	..	..	..
Chad[a]	17.4	19.2	28.3	24.9	24.5	27.9	..	..	..	..
Congo	50.5	53.2	56.8	54.4	54.9	48.0	47.6	..	..	..
Ethiopia	165	260	207	187	304	364	(359)	[360]	[350]	..
Gabon	28.5	30.9	34.8	45.2	(69.8)	64.0	74.8	(47.9)	..	..
Ghana	472	446	398	229	170	[116]	[102]	..	..	..
Ivory Coast	113	100	114	90.4	124	119	118	(109)	..	..
Kenya	97.9	98.6	141	237	307	334	272	217	(224)	(244)
Liberia	6.4	6.9	7.8	12.1	11.9	14.6	25.9	(30.5)	(25.2)	..
Libya[e]	(1 090)	(1 090)	(1 780)	(2 040)	(2 585)	(3 160)	[3 175]	..	..	..
Madagascar	49.6	47.6	55.4	73.4	75.1	97.4	(91.4)	(85.2)	..	..
Malawi	7.3	14.1	14.8	21.5	28.9	30.6	[29.6]	..	..	..

Mali	29.6	40.4	48.3	47.1	39.0	44.3	38.6	..	..	..
Mauritania	13.5	42.7	109	123	94.8	104	80.6	..	..	..
Mauritius	1.5	1.9	2.2	2.2	2.3	2.9	5.5	..	..	..
Morocco	461	676	948	1 088	966	971	1 118	[1 130]	[1 510]	[1 835]
Mozambique[g]	..	12.0	(35.2)	38.0	72.9	74.6	95.0	112	124	..
Niger	9.6	12.8	12.7	13.2	16.0	17.9	..	..	..	..
Nigeria	2 691	4 018	3 432	3 274	2 578	2 270	2 280	1 995	1 563	[1 510]
Rwanda	17.5	15.8	17.6	17.0	18.9	19.7	21.9	..	..	..
Senegal	58.7	54.0	64.4	64.6	70.9	69.3	64.2	67.4	(64.8)	(71.6)
Sierra Leone	10.7	10.6	9.7	11.9	17.1	14.8	[12.1]	[10.9]	..	..
Somalia	70.1	63.1	62.9	69.0	157	134	95.5	(92.7)	(75.3)	..
South Africa[h]	1 680	2 097	2 594	(2 819)	(2 732)	(2 644)	(2 618)	(2 800)	[2 730]	[2 770]
Sudan	226	188	239	271	233	212	[254]	..	..	[193]
Tanzania	186	175	184	228	(420)	(449)	..	..	..	..
Togo	15.2	15.4	19.7	24.5	26.4	24.8	24.4	(23.8)	..	..
Tunisia	77.1	95.7	118	161	181	178	194	235	[240]	[250]
Uganda[i]	315	315	279	193	140	..	..	..	..	..
Upper Volta	14.1	30.5	40.1	37.2	44.6	36.2	35.4	38.5	..	..
Zaire	507	338	212	151	[191]	[168]	[164]	..	..	..
Zambia	[163]	[118]	[117]	[97.7]	[96.3]	[181]	[134]	..	..	..
Zimbabwe	191	214	276	369	424	492	(459)	(359)	(360)	[320]
Total Africa	9 489	11 416	12 618	12 971	13 198	(13 526)	(13 555)	[13 590]	[13 800]	[14 100]
Central America										
Costa Rica	14.5	17.4	23.3	32.8	30.2	(32.3)	30.9	27.1	29.8	20.9
Cuba[j]	386	(446)	..	957	1 028	1 103	1 053	976	1 017	1 178
Dominican Republic	87.5	91.8	100	100	111	127	99.4	108	..	..
El Salvador	57.2	51.3	65.3	77.3	80.2	(86.9)	94.8	105	115	116
Guatemala	51.5	71.3	74.7	103	112	116	128	(136)	[147]	165
Haiti	14.3	14.7	15.4	15.8	[19.6]	[22.1]	[21.6]	..	..	..
Honduras	28.2	33.6	35.5	43.9	56.0	57.3	[113]	[111]	[116]	[114]
Jamaica	24.3	30.4	36.8	35.0	[31.2]	[27.8]	[23.0]	..	..	..
Mexico[k]	623	670	752	702	714	796	756	977	1 076	[894]
Nicaragua	38.4	45.6	61.0	75.7	91.5	60.6	119	[89.8]	[95.3]	[118]
Panama	19.1	20.5	20.5	[19.2]	[20.9]	[21.6]	[24.0]	..	..	..
Trinidad and Tobago	8.5	9.9	11.1	11.9	[16.8]	[17.6]	[21.2]	..	[27.4]	..
Total Central America	1 351	[1 502]	[1 700]	2 173	2 312	2 468	2 484	2 625	2 815	(2 825)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
South America										
Argentina	2 766	3 454	3 896	3 977	4 026	3 980	3 942	4 185	[8 797]	(7 262)
Bolivia	76.2	104	114	109	118	121	106	141	117	(124)
Brazil[h]	1 874	1 987	2 211	2 017	1 866	1 665	1 303	1 354	1 534	[1 771]
Chile	1 201	923	971	1 285	1 443	1 728	2 038	1 761	[2 099]	[2 196]
Colombia	228	253	260	238	284	324	363	339	426	463
Ecuador	148	182	166	276	206	211	222	(223)	(180)	[196]
Guyana	29.4	55.5	78.7	47.1	(34.2)	[42.5]	[51.0]	[48.1]	. .	[39.2]
Paraguay	41.7	52.2	54.1	57.9	60.9	56.3	[60.7]	[74.3]	[77.3]	. .
Peru	516	681	772	1 121	851	667	(980)	(1 212)	(1 218)	(1 287)
Uruguay	238	224	187	200	242	(299)	258	336	[379]	. .
Venezuela	880	997	734	842	851	847	907	912	(876)	873
Total South America	7 998	8 911	9 444	10 170	9 980	9 941	10 230	10 584	[15 745]	(14 745)

Table 3A.3. World military expenditure, in current price figures

Figures are in local currency, current prices.

	Currency	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
NATO[a]											
North America:											
Canada	*mn dollars*	2 862	3 127	3 589	4 124	4 662	4 825	5 499	6 289	7 655	8 388
USA	*mn dollars*	85 906	90 948	91 013	100 925	109 247	122 279	143 981	169 888	196 345	225 345
Europe:											
Belgium	*mn francs*	57 739	70 899	81 444	89 480	99 726	106 472	115 754	125 689	132 127	137 163
Denmark	*mn kroner*	4 439	5 281	5 680	6 343	7 250	7 990	9 117	10 301	11 669	. .
France	*mn francs*	47 878	55 872	63 899	73 779	85 175	96 439	111 672	129 708	148 021	164 248
FR Germany	*mn marks*	35 644	37 589	38 922	40 184	43 019	45 415	48 518	52 193	54 234	57 131
Greece	*mn drachmas*	31 499	45 936	56 963	67 738	77 861	89 791	96 975	142 865	176 270	212 768
Italy	*bn lire*	2 852	3 104	3 608	4 533	5 301	6 468	8 203	9 868	12 294	14 729
Luxembourg	*mn francs*	710	836	983	1 029	1 154	1 242	1 534	1 715	1 893	2 100
Netherlands	*mn guilders*	6 144	7 119	7 662	9 092	9 146	10 106	10 476	11 296	11 921	12 302
Norway	*mn kroner*	3 938	4 771	5 333	5 934	6 854	7 362	8 242	9 468	10 956	12 078
Portugal	*mn escudos*	25 108	19 898	18 845	22 082	27 354	34 343	43 440	51 917	63 817	79 021
Turkey	*mn lira*	15 831	30 200	40 691	49 790	66 239	93 268	185 656	313 067	447 790	556 738
UK	*mn pounds*	4 160	5 165	6 132	6 810	7 616	9 029	11 510	12 144	13 849	16 090
WTO											
Bulgaria	*mn leva*	(486)	(554)	(613)	(614)	[650]	[700]	[820]	[870]	. .	. .
Czechoslovakia	*mn korunas*	16 772	18 458	18 821	18 646	19 666	(20 050)	(21 470)	(21 500)	(23 020)	. .
German DR	*mn marks*	7 083	7 512	7 994	8 261	8 674	(9 110)	(9 875)	(10 705)	(11 315)	(11 970)
Hungary	*mn forints*	10 564	11 811	11 671	12 607	14 983	16 200	17 700	19 060	20 050	(32 044)
Poland	*mn zlotys*	48 229	52 274	56 605	63 315	65 653	(70 780)	(74 285)	(84 450)	(191 100)	(210 900)
Romania	*mn lei*	8 744	9 713	10 575	10 963	11 713	11 835	10 394	10 503	(10 773)	(11 725)
Other Europe											
Albania	*mn leks*	610	653	783	805	818	885	915	940	935	. .
Austria	*mn schillings*	6 565	7 946	8 728	9 515	10 767	11 711	12 292	12 864	14 140	14 844
Finland	*mn markkaa*	1 140	1 452	1 695	1 767	1 996	2 396	2 876	3 287	3 871	4 376
Ireland	*mn punt*	49.9	67.1	84.0	98.0	116	142	176	203	244	252
Spain	*mn pesetas*	84 749	103 064	127 028	158 568	189 104	229 401	287 276	336 974	409 284	478 332
Sweden	*mn kronor*	8 686	9 758	10 719	12 082	13 674	15 163	16 951	19 023	20 386	21 993
Switzerland	*mn francs*	2 795	2 813	3 242	3 110	3 151	3 414	3 533	3 756	3 989	4 157
Yugoslavia	*mn dinars*	21 100	28 815	33 234	38 766	43 379	56 330	78 060	(101 893)	(118 000)	(150 600)

	Currency	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Middle East											
Bahrain	*mn dinars*	9.3	5.8	9.3	14.3	40.5	53.9	59.2	80.7	[100]	[112]
Cyprus	*mn pounds*	6.7	7.4	7.5	10.4	8.9	12.6	[12.0]	[11.4]	[20.0]	[30.0]
Egypt	*mn pounds*	[1 530]	[1 631]	[1 564]	[1 845]	[1 150]	[1 200]	(1 025)	(1 150)	(1 490)	(1 940)
Iran	*bn rials*	315	453	547	564	585	385	[353]	[485]	[640]	[660]
Iraq	*mn dinars*	422	470	520	593	587	(788)	[990]	[1 350]	..	..
Israel	*mn pounds*	(1 395)	(2 073)	(2 721)	(3 660)	(4 905)	(9 217)	(21 808)	(50 715)	[107 270]	..
Jordan	*mn dinars*	51.2	56.7	103	96.5	102	133	137	161	(180)	[195]
Kuwait	*mn dinars*	148	191	247	292	276	293	342	[400]	..	..
Lebanon	*mn pounds*	300	315	327	255	491	738	915	1 056	[1 246]	..
Oman	*mn riyals*	118	241	271	237	265	269	407	522	581	[615]
Saudi Arabia	*mn riyals*	(7 226)	(14 865)	(26 325)	(31 685)	(38 685)	(52 388)	(64 076)	(75 725)	(87 695)	[84 330]
Syria	*mn pounds*	1 682	3 345	3 778	4 160	4 740	8 287	(8 415)	[9 378]	[9 778]	[10 729]
United Arab Emirates	*mn dirhams*	79.9	124	312	1 928	3 019	4 394	6 330	[7 720]	[8 840]	..
Yemen Arab Republic	*mn rials*	197	286	411	572	1 180	1 606	1 545	2 025	2 404	..
Yemen, People's Democratic Rep. of	*mn dinars*	12.5	15.4	17.1	20.0	30.8	36.1	42.6	56.0	55.1	..
South Asia											
Afghanistan	*mn afghanis*	1 563	1 834	2 353	2 673	2 938	..	..	..	..	..
Bangladesh	*mn taka*	670	1 022	1 579	1 915	2 036	2 407	2 887	(3 406)	4 229	4 805
India	*mn rupees*	20 044	23 823	25 400	26 159	28 091	32 336	36 889	44 000	51 535	58 128
Nepal	*mn rupees*	89.2	116	148	165	[180]	[204]	[236]	271	345	[410]
Pakistan	*mn rupees*	5 932	7 212	7 751	8 697	9 780	11 408	13 970	17 439	21 316	24 026
Sri Lanka	*mn rupees*	326	410	432	478	460	804	971	1 051	[1 500]	1 800
Far East											
Brunei	*mn dollars*	53.2	97.9	167	175	203	372	(410)	416	(477)	..
Burma	*mn kyats*	779	886	1 041	1 197	1 320	1 491	(1 622)	..	..	..
Hong Kong	*mn dollars*	118	118	219	354	545	666	1 422	..	..	..
Indonesia	*bn new rupiahs*	[406]	[602]	723	777	906	1 029	951	1 224	(1 445)	(1 609)
Japan	*bn yen*	1 166	1 356	1 488	1 653	1 822	2 010	2 215	2 388	2 547	2 729
Korea, North	*mn won*	1 557	1 864	2 058	2 096	2 344	2 563	2 750	3 009	3 242	3 602
Korea, South	*bn won*	321	465	771	1 008	1 438	1 587	2 291	2 642	3 273	3 420
Malaysia	*mn ringgits*	1 345	1 542	1 654	1 987	2 183	2 547	3 389	4 432	4 978	5 479
Mongolia	*mn tughriks*	(362)	(373)	(407)	(405)	(421)	(480)	(426)	(630)	(803)	(816)
Philippines	*mn pesos*	2 930	3 812	4 614	4 924	4 863	5 240	5 829	6 746	8 300	8 800
Singapore	*mn dollars*	591	708	843	975	992	1 035	1 234	1 501	1 730	2 011

Taiwan	*bn dollars*	32.4	38.3	45.7	[58.3]	[70.2]	80.7	96.5	113	132	[146]
Thailand	*mn baht*	7 264	8 307	10 609	13 682	18 697	23 199	25 049	28 680	32 578	36 062
Oceania											
Australia	*mn dollars*	1 672	1 849	2 100	2 365	2 587	2 906	3 385	3 897	4 459	5 032
Fiji	*mn dollars*	0.8	1.2	2.0	2.3	2.7	3.1	4.8	4.0	4.6	4.7
New Zealand	*mn dollars*	160	187	209	243	288	334	421	520	625	695
Africa											
Algeria	*mn dinars*	1 088	1 312	2 001	1 956	2 490	2 842	3 417	3 481	3 893	..
Benin	*mn francs*	1 548	1 819	1 759	2 133	3 384	4 031	5 175	..	..	..
Burundi	*mn francs*	605	672	860	1 256	1 533	1 767	2 048	..	..	..
Cameroon	*mn francs*	8 334	10 023	11 582	12 769	13 700	14 876	17 460	21 068	25 347	31 353
Central African Republic	*mn francs*	1 667	1 774	1 915	1 880	(2 289)	(3 061)	[2 816]	..	..	..
Chad	*mn francs*	3 685	4 052	5 977	5 255	5 186	5 890	..	..	..	..
Congo	*mn francs*	5 810	7 178	8 205	9 000	10 000	9 450	10 050	..	..	..
Ethiopia	*mn birr*	155	259	265	280	519	722	(744)	[790]	[810]	..
Gabon	*mn francs*	2 556	3 612	4 807	7 107	(12 160)	12 036	15 806	(11 000)	..	..
Ghana	*mn cedis*	73.7	90.6	126	157	202	[213]	[280]	..	..	..
Ivory Coast	*mn francs*	9 900	9 834	12 536	12 640	19 579	21 854	25 031	(25 100)	..	..
Kenya	*mn pounds*	16.6	19.9	31.8	61.2	92.6	109	101	90.0	(112)	(137)
Liberia	*mn dollars*	3.7	4.5	5.4	8.9	9.4	12.8	25.9	(33.0)	(29.0)	..
Libya	*mn dinars*	(215)	(235)	(405)	(495)	(810)	(935)	(940)	..	..	..
Madagascar	*mn francs*	6 231	6 470	7 895	10 800	11 775	17 420	(19 315)	(23 500)	..	..
Malawi	*mn kwachas*	3.3	7.4	8.1	12.2	17.8	21.0	[24.0]	..	..	..
Mali	*mn francs*	5 600	8 100	10 456	12 751	14 080	15 331	16 295	..	..	..
Mauritania	*mn ouguiyas*	340	1 200	3 497	4 350	3 605	4 301	3 700	..	..	..
Mauritius	*mn rupees*	4.5	6.6	8.8	9.4	10.8	15.7	42.6	..	..	..
Morocco	*mn dirhams*	1 057	1 673	2 548	3 294	3 209	3 495	4 400	[5 000]	[7 400]	[9 300]
Mozambique	*mn meticais*	..	600	(1 760)	1 900	3 650	3 733	4 754	5 595	6 188	..
Niger	*mn francs*	938	1 361	1 667	2 143	2 862	3 430	..	..	..	..
Nigeria	*mn nairas*	505	1 008	1 070	1 219	1 139	1 115	1 247	1 319	1 111	[1 200]
Rwanda	*mn francs*	731	860	1 020	1 131	1 414	1 704	2 035	..	..	..
Senegal	*mn francs*	6 780	8 234	9 913	11 074	12 554	13 471	13 559	15 075	(17 005)	(20 375)
Sierra Leone	*mn leones*	5.0	5.9	6.3	8.7	13.3	14.0	[12.8]	[14.2]	..	..
Somalia	*mn shillings*	135	145	165	200	502	533	601	(843)	(846)	..
South Africa[h]	*mn rands*	658	931	1 281	(1 548)	(1 653)	(1 810)	(2 039)	(2 512)	[2 810]	[3 210]
Sudan	*mn pounds*	39.2	40.2	52.0	68.9	70.9	84.7	[127]	..	..	[195]
Tanzania	*mn shillings*	612	728	818	1 130	(2 324)	(2 828)	..	..	..	..
Togo	*mn francs*	1 604	1 960	2 799	4 268	4 615	4 661	5 155	(6 031)	..	..

	Currency	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Tunisia	*mn dinars*	20.3	30.3	36.0	52.2	61.8	65.4	78.6	104	[120]	[140]
Uganda	*mn shillings*	535	642	835	1 089	1 078	[1 465]	[2 565]	[5 605]	. .	. .
Upper Volta	*mn francs*	1 509	3 871	4 667	5 627	7 305	6 814	7 470	8 742	. .	. .
Zaire	*mn zaires*	81.9	70.4	79.7	96.0	[180]	[330]	[460]	. .	. .	. .
Zambia	*mn kwachas*	[57.6]	[46.0]	[54.0]	[54.0]	[62.0]	[128]	[106]	. .	. .	. .
Zimbabwe	*mn dollars*	69.3	85.6	122	180	227	300	(295)	(261)	(290)	[305]
Central America											
Costa Rica	*mn colones*	71.8	101	140	205	201	(235)	265	318	665	785
Cuba	*mn pesos*	282	(326)	. .	700	784	841	811	842	924	1 116
Dominican Republic	*mn pesos*	47.6	57.2	67.4	75.8	87.1	109	99.4	116	. .	. .
El Salvador	*mn colones*	65.1	69.7	94.8	125	147	(185)	237	300	369	413
Guatemala	*mn quetzales*	27.4	42.9	49.8	77.1	91.0	105	128	(152)	[165]	183
Haiti	*mn gourdes*	42.3	50.9	55.8	60.9	[73.5]	[93.8]	[108]	. .	. .	. .
Honduras	*mn lempiras*	33.8	42.8	47.4	63.6	86.2	99.1	[226]	[245]	[280]	[300]
Jamaica	*mn dollars*	13.6	20.0	26.6	28.2	[34.0]	[39.0]	[41.0]	. .	. .	. .
Mexico[h]	*mn pesos*	4 740	5 870	7 630	9 190	10 980	14 460	17 340	28 700	50 200	[75 300]
Nicaragua	*mn cordobas*	154	191	262	363	459	450	1 200	[1 700]	[2 250]	[3 500]
Panama	*mn balboas*	13.0	14.7	15.3	[15.0]	[17.0]	[19.0]	[24.0]	. .	. .	. .
Trinidad and Tobago	*mn dollars*	9.5	13.0	16.0	19.3	[30.0]	[36.0]	[51.0]	. .	[84.0]	. .
South America											
Argentina	*bn pesos* (law 18.188)	8.1	29.2	180	509	1 419	3 642	7 242	15 720	[87 500]	(289 000)
Bolivia	*mn pesos*	787	1 157	1 325	1 375	1 636	2 012	2 592	4 561	8 500	(27 000)
Brazil[h]	*mn cruzeiros*	9 690	13 259	20 960	27 465	35 247	48 015	68 712	146 750	329 200	[987 600]
Chile	*mn pesos*	651	2 383	7 815	19 850	31 223	49 875	79 488	82 184	[107 700]	[147 300]
Colombia	*mn pesos*	2 950	4 023	4 975	6 066	8 502	12 113	17 143	20 439	32 000	41 414
Ecuador	*mn sucres*	1 790	2 522	2 563	4 813	4 097	4 638	5 539	(6 247)	(5 867)	[9 540]
Guyana	*mn dollars*	38.1	78.9	120	77.5	(65.0)	[95.0]	[130]	[153]	. .	[164]
Paraguay	*mn guaranies*	2 482	3 316	3 588	4 204	4 892	5 793	[7 644]	[10 581]	[11 566]	. .
Peru	*mn soles*	15 605	25 464	38 527	77 246	92 514	121 000	(283 000)	(613 470)	(1 013 760)	(2 274 000)
Uruguay	*mn new pesos*	128	218	274	464	811	(1 676)	2 362	4 126	[5 540]	. .
Venezuela	*mn bolivares*	2 022	2 520	1 997	2 472	2 673	2 993	3 893	4 550	(4 800)	5 060

Table 3A.4. World military expenditure as a percentage of gross domestic product

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
NATO[a]										
North America:										
Canada	1.9	1.9	1.8	1.9	2.0	1.8	1.8	1.8	2.1	2.1
USA	6.1	5.9	5.4	5.3	5.1	5.1	5.6	5.8	6.5	6.9
Europe:										
Belgium	2.8	3.1	3.1	3.2	3.3	3.3	3.3	3.4	3.4	3.4
Denmark	2.4	2.4	2.3	2.3	2.3	2.3	2.4	2.5	2.5	..
France	3.7	3.8	3.8	3.9	4.0	3.9	4.0	4.2	4.2	4.2
FR Germany	3.6	3.6	3.5	3.4	3.3	3.3	3.3	3.4	3.4	3.4
Greece	5.6	6.8	6.9	7.0	6.7	6.3	5.7	7.0	7.0	7.1
Italy	2.6	2.5	2.3	2.4	2.4	2.4	2.4	2.5	2.6	2.8
Luxembourg	0.8	1.0	0.8	0.8	0.8	0.8	0.9	0.9	..	..
Netherlands	3.2	3.4	3.2	3.3	3.1	3.2	3.1	3.2	3.3	3.3
Norway	3.0	3.2	3.1	3.1	3.2	3.1	2.9	2.9	3.0	3.1
Portugal	7.4	5.3	4.0	3.5	3.5	3.5	3.5	3.5	3.4	3.4
Turkey	3.9	5.8	6.2	5.8	5.2	4.3	4.3	4.9	5.2	4.9
UK	5.0	4.9	4.9	4.7	4.6	4.7	5.1	4.9	5.1	5.6
WTO										
Bulgaria[k]	(2.8)	(3.0)	(3.1)	(3.0)	[3.1]	[3.1]	[3.1]	[3.1]	..	..
Czechoslovakia[k]	3.0	3.2	3.1	3.1	3.1	(3.0)	(3.1)	(3.2)	(3.2)	..
German DR[k]	4.0	4.0	4.1	4.0	4.1	(4.1)	(4.2)	(4.4)	(4.5)	..
Hungary	2.4	2.5	2.2	2.2	2.4	2.4	2.5	2.6	2.6	..
Poland[k]	2.8	2.8	2.6	2.7	2.6	(2.7)	(2.8)	(2.9)	..	..
Romania[k]	2.1	2.2	2.2	2.1	2.1	2.0	1.7	1.6	..	..
Other Europe										
Austria	1.1	1.2	1.2	1.2	1.3	1.3	1.2	1.2	1.2	
Finland	1.3	1.4	1.5	1.4	1.4	1.5	1.5	1.6	1.6	
Ireland	1.7	1.8	1.8	1.8	1.8	1.9	2.0	1.9	2.0	
Spain	1.7	1.7	1.8	1.7	1.7	1.7	1.9	2.0	2.1	
Sweden	3.4	3.3	3.2	3.3	3.3	3.3	3.2	3.3	3.3	
Switzerland	2.0	2.0	2.3	2.1	2.1	2.2	2.1	2.0	2.0	
Yugoslavia[l]	5.5	5.7	5.6	5.3	4.8	4.8	5.0	(4.6)	..	

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Middle East										
Bahrain	3.0	1.6	1.7	2.2	. .	. .	. .	. .	. .	
Cyprus	2.2	2.9	2.3	2.4	1.7	2.0	[1.6]	[1.3]	[2.0]	
Egypt	[36.5]	[33.6]	[24.9]	[22.5]	[11.8]	[9.6]		6.2	(7.0)	
Iran	10.9	13.2	12.4	10.5	11.2	6.6	[5.6]	. .	. .	
Iraq	12.5	11.7	10.7	10.4	. .	. .	. .	. .	. .	
Israel	(25.6)	(26.7)	(26.4)	(24.5)	(20.5)	(20.2)	(20.4)	(20.2)	[19.2]	
Jordan	20.7	17.6	23.9	18.4	15.9	17.3	13.7	13.3	(13.2)	
Kuwait	4.5	5.4	6.6	7.3	6.6	4.8	4.7	[5.8]	. .	
Lebanon	3.7	4.2	. .	3.1	5.6	6.6	. .	. .	. .	
Oman	20.8	33.3	32.8	26.9	29.6	22.9	21.2	22.3	. .	
Saudi Arabia	(6.0)	(9.8)	(14.2)	(14.7)	(16.3)	(16.5)	(14.1)	(14.5)	. .	
Syria	10.5	16.2	15.2	15.3	14.5	21.1	(16.1)	[14.8]	. .	
United Arab Emirates	0.3	0.3	0.6	3.0	5.0	5.5	5.8	[6.4]	. .	
Yemen Arab Republic	6.0	6.6	7.2	7.8	12.8	14.5	11.8	14.6	. .	
Yemen, People's Democratic Rep. of	12.8	15.4	13.4	12.5	17.5	17.5	18.3	. .	. .	
South Asia										
Bangladesh	0.7	0.9	1.5	1.6	1.5	1.5	1.6	(1.7)	1.7	
India	3.0	3.3	3.2	3.0	2.9	3.1	3.0	3.1	3.1	
Nepal	0.6	0.7	0.9	0.9	[0.9]	[0.9]	[0.9]	0.9	. .	
Pakistan	6.0	5.9	5.5	5.4	5.3	5.3	5.4	5.7	6.4	
Sri Lanka	1.4	1.5	1.4	1.3	1.1	1.5	1.5	1.2	[1.5]	
Far East										
Brunei	2.1	3.6	4.9	4.2	4.7	6.4	(4.2)	. .	. .	
Burma	4.3	3.9	3.9	4.1	3.6	4.1	(4.2)	. .	. .	
Hong Kong	0.3	0.3	0.5	0.6	0.8	0.8	1.4	. .	. .	
Indonesia	[4.6]	[5.2]	5.1	4.5	4.3	3.7	2.4	2.5	. .	
Japan	0.9	1.0	0.9	0.9	0.9	1.0	1.0	1.0	1.0	
Korea, North	9.1	9.8	10.1	9.6	9.7	9.7	9.4	9.8	. .	
Korea, South	4.3	4.7	5.8	5.9	6.2	5.4	6.5	6.0	8.2	
Malaysia	5.9	6.9	5.9	6.1	6.0	5.6	6.5	7.8	8.2	
Philippines	2.9	3.3	3.4	3.2	2.7	2.4	2.2	2.2	2.4	
Singapore	4.7	5.3	5.8	6.1	5.6	5.2	5.2	5.5	. .	
Taiwan	8.1	7.7	7.9	[8.7]	[8.6]	8.2	8.1	7.9	7.9	
Thailand	2.7	2.8	3.1	3.5	4.0	4.2	3.7	3.6	3.8	

Australia	3.0	2.8	2.7	2.7	2.7	2.7	2.7	2.8	..
Fiji	0.2	0.2	0.3	0.3	0.4	0.4	0.5	..	..
New Zealand	1.6	1.7	1.6	1.6	1.7	1.7	1.8	1.9	..
Africa									
Algeria	2.2	2.3	2.9	2.4	2.4	2.3	2.1	..	..
Benin	1.5	1.6	1.3	1.4	2.0	2.1	..	..	..
Burundi	2.2	2.1	2.2	2.5	2.7	2.4	2.3	..	4.1
Cameroon	1.6	1.6	1.6	1.3	1.1	1.0	..	..	..
Chad	3.2	2.7	3.8	3.2	..	..	..	..	..
Congo	..	4.4	4.6	..	5.0	..	2.8	..	..
Ethiopia	2.8	4.5	4.1	4.0	6.8	8.8	(8.6)	[8.8]	..
Gabon	0.7	0.8	0.7	1.0	(2.3)	1.9	..	..	..
Ghana	1.6	1.7	1.9	1.4	1.0	[0.8]	[0.7]	..	..
Ivory Coast	1.3	1.2	1.1	0.8	1.1	1.1	..	..	..
Kenya	1.6	1.7	2.2	3.3	4.5	4.8	3.8	3.0	(3.3)
Liberia	0.7	0.7	0.9	1.3	1.2	1.5	2.8	(3.9)	..
Libya	(5.5)	(6.2)	(8.3)	(8.6)	(14.2)	(11.9)	(9.0)	..	..
Madagascar	1.7	1.6	1.9	2.4	2.5	3.0	(2.9)	..	..
Malawi	0.7	1.4	1.3	1.7	2.2	2.4	[2.4]	..	..
Mauritania	2.1	6.3	15.3	17.9	14.4	15.5	11.7	..	..
Mauritius	0.1	0.2	0.2	0.2	0.2	0.2	0.6	..	..
Morocco	3.1	4.6	6.2	6.6	5.8	5.6	6.3	[6.5]	..
Nigeria	3.4	5.2	4.4	4.5	4.0	3.0	2.9	3.0	..
Rwanda	2.5	1.6	1.7	1.6	1.7	1.8	1.9	..	..
Senegal	2.2	2.2	2.3	2.3	2.6	2.5	2.2	2.3	..
Sierra Leone	0.9	1.0	0.9	1.1	1.4	1.3	[1.0]	..	..
South Africa	2.7	3.4	4.1	(4.5)	(4.1)	(3.8)	(3.3)	(3.6)	[3.5]
Sudan	2.8	2.4	2.5	2.6	..	..	..	..	..
Tanzania	3.8	3.8	3.5	3.8	(6.9)	(7.7)	..	..	..
Togo	1.2	1.5	2.1	2.5	2.4	2.2	2.2	(2.4)	..
Tunisia	1.3	1.8	1.9	2.4	2.5	2.2	2.3	2.6	..
Uganda	3.3	2.9	3.2	2.2	1.7	..	..	..	..
Upper Volta	1.2	2.7	2.9	2.9	3.4	2.7	..	..	..
Zaire	4.6	3.7	2.8	2.4	[3.3]	[3.0]	[2.7]	..	..
Zambia	[3.0]	[2.9]	[2.9]	[2.8]	[2.8]	[4.9]	[3.5]	..	..
Zimbabwe	3.7	4.3	5.6	8.1	9.7	10.8	(8.4)	(5.8)	..
Central America									
Costa Rica	0.5	0.6	0.7	0.8	0.7	(0.7)	0.6	0.6	0.7
Cuba[l]	3.6	(3.7)	..	7.3	7.6	7.8	7.2	7.5	8.0

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Dominican Republic	1.6	1.6	1.9	1.7	1.8	2.0	1.5	1.6	..	
El Salvador	1.7	1.6	1.7	1.7	1.9	(2.1)	2.6	3.4	4.0	
Guatemala	0.9	1.2	1.1	1.4	1.5	1.5	1.6	(1.7)	[1.9]	
Haiti	1.4	1.7	1.5	1.3	[1.6]	[2.1]	[1.8]	..	..	
Honduras	1.6	1.9	1.8	1.9	2.3	2.3	[4.5]	[4.7]	[5.0]	
Jamaica	0.6	0.8	1.0	0.9	[0.9]	[0.9]	[0.9]	..	..	
Mexico	0.5	0.5	0.6	0.5	0.5	0.5	0.4	0.5	0.5	
Nicaragua	1.5	1.7	2.0	2.3	3.1	3.4	6.0	[6.3]	[6.7]	
Panama	0.7	0.8	0.8	[0.7]	[0.7]	[0.7]	[0.7]	..	..	
Trinidad and Tobago	0.2	0.2	0.2	0.2	[0.3]	[0.3]	[0.4]	..	[0.5]	
South America										
Argentina	1.7	2.0	2.4	2.4	2.7	2.6	2.6	2.9	[6.4]	
Bolivia	1.8	2.4	2.3	2.1	2.1	2.2	1.9	2.6	2.5	
Brazil	1.3	1.3	1.2	1.1	0.9	0.8	0.5	0.5	0.6	
Chile	6.7	5.7	5.3	6.2	6.4	6.5	7.4	6.4	[8.5]	
Colombia	0.9	1.0	0.9	0.8	0.9	1.0	1.1	1.0	1.3	
Ecuador	1.9	2.3	1.9	2.9	2.1	2.0	1.9	(1.8)	(1.4)	
Guyana	4.0	6.6	10.7	6.9	(5.1)	[7.2]	[8.6]	[9.6]	..	
Paraguay	1.5	1.7	1.7	1.6	1.5	1.3	[1.4]	[1.5]	[1.6]	
Peru	3.5	4.6	5.0	7.3	5.5	3.9	(5.7)	(7.2)	(6.8)	
Uruguay	2.8	2.6	2.1	2.3	2.7	(2.9)	2.5	3.3	[3.4]	
Venezuela	1.5	1.5	1.0	1.0	0.9	1.4	1.5	1.6	(1.6)	

Conventions

.. Information not available or not applicable
( ) Uncertain data
[ ] Estimates with a high degree of uncertainty

Notes

[a] Spain is not included in NATO but in Other Europe, since military expenditure data according to the NATO definition are not yet available for Spain.
[b] The Chinese series is given in constant prices from 1975.
[c] The economic groupings used here are as follows.

Industrial market economies: Australia, Austria, Belgium, Canada, Denmark, Finland, France, FR Germany, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, UK and USA.

Non-market economies: Albania, Bulgaria, China, Cuba, Czechoslovakia, German DR, Hungary, North Korea, Mongolia, Poland, Romania and USSR.

Major oil-exporting countries: Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Oman, Saudi Arabia, United Arab Emirates and Venezuela.

Rest of the world: Excluding Kampuchea, Laos and Viet Nam. Countries are grouped in accordance with the classification used by the World Bank in their *World Development Report 1983* (Oxford University Press, New York, 1983), p. lX and table 1, p. 148.

[d] The SIPRI practice of using official consumer price indices, which tend to understate actual price changes in WTO countries, especially for recent years, results in overstated volume expenditure increases for the WTO countries, excluding the USSR.

[e] At 1979 prices and 1979 exchange-rates.

[f] Exchange-rates have been revised for the German DR, Hungary and Romania. Therefore the level, though not the trend, of constant price military expenditures differs from that given in the *SIPRI Yearbook 1983* for these countries.

[g] At current prices and 1980 exchange-rates.

[h] The SIPRI estimate in square brackets is based on planned military expenditure in real terms.

[i] At 1978 prices and 1978 exchange-rates.

[j] The current price series is deflated from 1977 using Cuban figures for inflation. Between 1974 and 1977 it is assumed that there was little or no inflation.

[k] Per cent of gross national product.

[l] Per cent of gross material product.

F

Appendix 3B

Sources and methods for the world military expenditure data

Superscript numbers refer to the list of notes and references at the end of the chapter.

This appendix describes the sources and methods used in the preparation of the tables on military expenditure (appendix 3A). Only the main points are noted here. The tables are updated and revised versions of those which appeared in the *SIPRI Yearbook 1983*. It is important to note that these revisions can be quite extensive—not only are significant changes made to figures which were previously estimates, but entire series are altered when new and better sources come to light.

I. Purpose of the data

The main purpose of the SIPRI data is to give some measure of the resources absorbed by the military sector in various countries, regions and in the world as a whole—that is, the 'opportunity cost' of military spending. The purpose is not to provide a measure of military strength. For a large number of reasons (*inter alia*, because of differences in coverage, the difficulty in finding appropriate exchange-rates, the fact that price conditions vary widely between countries, because money may be spent on ineffective weapons, and because there is no reason to suppose that defence necessarily costs the same as offence), expenditure figures are inappropriate for this purpose.

II. Definitions

The data for NATO countries are estimates made by NATO to correspond to a common definition. These include military research and development, include military aid in the budget of the donor country and exclude it from the budget of the recipient country, include costs of retirement pensions, of paramilitary forces and of police when judged to be trained and equipped for military operations, and exclude civil defence, war pensions and payments on war debts.

The NATO definition is used as a guideline for all countries. In practice, however, it is far from possible to adhere to a common definition of military expenditure for all countries and throughout the time period covered in the SIPRI military expenditure series, since this would require much more detailed information than is available about the content of military budgets as well as about military expenditure items covered under other budget headings. There are many shortcomings, but those of the greatest magnitude concern military aid received and expenditure for paramilitary forces. Although the sums received in military aid are available for many countries, it is not clear to what extent these sums are included in the military budgets of the recipient countries. Further, there are countries which rely on foreign economic support for more than half of their total government budget. Although this budget support is not classified as military aid, it is evident that not all of the military expenditure is domestically financed in these countries. This is an area which requires much research in order to adjust military expenditure in accordance with the NATO definition. The same is true of expenditure for paramilitary forces. It is known that such expenditure is included in the internal security budgets for some countries, but so far it has not been possible to estimate the size of these expenditures for all countries and to add them to the military expenditure series. For other countries, the budgets of the defence and the interior ministries are lumped together in the official statistics without any information about the relation between them or the content of the internal security budget.

In the light of these difficulties, priority is given to the choice of a uniform definition over time for each particular country in an effort to show a correct time trend, rather than to adjusting the figures for single years according to the common definition.

Thus, at best, the ambition to adhere to a common definition amounts in practice to a consistent choice between alternative statistical series or, in a few cases, to the identification and adjustment of one of the components included in the definition. The source from which the military expenditure estimates for the Warsaw Treaty Organization (WTO) countries other than the USSR are taken makes an adjustment for Czechoslovakia, the German Democratic Republic and Poland to include some estimates for military research and development expenditure financed outside of defence budget appropriations, and to exclude an estimated 'civilian' portion of internal security for the German Democratic Republic, whose published budget appropriation figures up to and including 1976 reflect defence and internal security taken together. There are, however, other items for which adjustments have been impossible. "No attempt has been made to assess industrial investments related to armaments production. Nor has any attempt been made to include here the various military related outlays known to be financed outside the defense budgets proper, such as benefits to soldiers' families and paid leave for reservists. Investment expenditures made directly by ministries of defense, however, are implicitly included".[1]

For calculating the ratio of military expenditure to national product, gross domestic product (GDP) at purchasers' values has been used. GDP is defined as "the final expenditure on goods and services, in purchasers' values, *less* the c.i.f. (cost, insurance, freight) value of imports of goods and services".[2] For the WTO countries, military expenditure is expressed as a percentage of estimates of gross national product (GNP) at market prices, which for these countries cannot be more than negligibly different from the ratio to GDP.

Coverage

The tables of military expenditures cover 127 countries.

The countries are presented by region in the following order: NATO (North Atlantic Treaty Organization), WTO (Warsaw Treaty Organization), Other Europe, Middle East, South Asia, Far East, Oceania, Africa, Central America and South America. The individual countries are listed alphabetically within each of these regions.

Data are provided for the years since 1974. Series for the years since 1950 are published in previous volumes of the *SIPRI Yearbook.*

III. Sources

The estimates of military expenditure for NATO countries are taken from official NATO data, published annually in, for example, *NATO Review* and *Atlantic News*. The estimates for WTO countries other than the USSR are taken from two references[3] for the years up to and including 1980. For the years after 1980, the official budget percentage changes were used to extend the series. For the Soviet Union, a 'compromise' figure has been taken, which corresponds neither with the official figures nor with the US Central Intelligence Agency estimates; the reasons are explained in the *SIPRI Yearbook 1979* (page 28).

Official figures for China for 1977–83 do not include expenditure on military research and development and have therefore been increased by 10 per cent to allow for this.

When possible, estimates are made on the basis of budgets, White Papers and statistical documents published by the government or the central bank of the country concerned.

For the remaining countries, the prime sources are the *Government Financial Statistics Yearbook* (GFSY), published by the International Monetary Fund; the United Nations' *Statistical Yearbook* (UNSY); the

United Nations' *Statistical Yearbook for Asia and the Pacific* (UNSYAP); the annual report by the US Agency for International Development to Congress on the *Implementation of Section 620(s) of the Foreign Assistance Act of 1961, As Amended*; and the *Länderberichte*, published by the Federal Statistical Office of FR Germany in the series *Statistik des Auslandes*.

Annual reference works are most often not very useful, since they tend to quote each other when giving military expenditure figures. An exception is the *Europa Year Book* (London) which is useful especially for small nations.

The countries for which figures have been impossible to find in these sources present difficulties. The estimates of their military spending have been derived from other sources, mainly journals and newspapers, and are therefore highly approximate. This is true also of the most recent years for most countries, since the above sources do not include figures for these later years.

The figures for 'constant price' military expenditure become more unreliable when inflation is rapid and unpredictable. Supplementary allocations, made during the course of the year to cover losses in purchasing power, often go unreported, and recent military expenditure can appear to be falling in real terms. This is a particular problem in Latin America where, for example, the two major military powers in the region, Argentina and Brazil, have had particularly high inflation since the mid-1970s.

The data on GDP, consumer price index and exchange-rates are taken principally from *International Financial Statistics*, published by IMF, and from the United Nations' *Monthly Bulletin of Statistics*.

For the WTO countries, the exchange-rates given in Alton *et al.*[4] are used. Updating is done by using the basic and non-commercial rates. Figures for the ratio of military expenditure to GNP at market prices calculated in domestic currencies are cited directly from this source[4] for the years up to and including 1978; for the years from 1979, they are calculated using the net material product series.

IV. Methods

All figures are presented on a calendar-year basis. Conversion to calendar years was made on the assumption of an even rate of expenditure throughout the fiscal years. Figures for the most recent years are budget estimates.

When the latest figures differ from the previous series chosen, the percentage change from the latest source is applied to the existing series in order to make the trend as correct as possible.

In order to provide time series estimates of total world military expenditure at constant prices, so as to allow for volume comparisons, all national expenditures must be converted into a common currency. The US dollar is the most widely used currency for this purpose, and SIPRI has adopted this practice. It is also necessary to adjust for the effect of price changes. The figures in this *Yearbook* are presented at 1980 price levels and 1980 exchange-rates. The Chinese rate of exchange is arrived at by considering Chinese costs in terms of US prices and vice versa. This very roughly approximates to a rate of 2 dollars to the yuan for 1980.

The adjustment for changes in prices is made by applying the consumer price index in each country. In many countries this is the only price index available. As an index of the general movement of prices, it is a reasonable one for showing the trend in the resources absorbed by the military, in constant prices. For the most recent year, the estimate of the consumer price increase is based on the figures for the first 6–10 months only.

The calculations of the ratio of military expenditure to GDP/GNP are made in domestic currencies. In international comparisons this procedure tends to underestimate the defence burden in the centrally planned economies due to the pricing policies practised there. This has been explained with reference to the WTO countries other than the Soviet Union as follows:

> Comparisons based on such shares will be meaningful only if the basis of valuation of the defense and non-defense (civilian) components of GNPs of various countries is more or less uniform. However, in the East European centrally planned economies, the price of civilian consumption goods and services, because of the heavy incidence of turnover taxes, most probably are relatively high in relation to prices of military hardware and other procurement items, on which turnover taxes generally are not imposed. Also very probably, the production of defense items is heavily subsidized through financial transfer at the state budget or lower levels.[5]

Notes and references

[1] Alton, T. P., Lazarcik, G., Bass, E. M. and Znayenko, W., 'East European defense expenditures, 1965–78', in *East European Economic Assessment, Part 2*, a compendium of papers submitted to the Joint Economic Committee, US Congress (US Government Printing Office, Washington, D.C., 1981), pp. 419–20.

[2] *Statistical Yearbook* (United Nations, New York, 1974), p. XVII.

[3] Alton *et al.* (note 1), pp. 413–14; and Alton, T. P., Lazarcik, G., Bass, E. M. and Znayenko, W., *Military Expenditures in Eastern Europe, Post World War II to 1979* (L.W. International Financial Research, Inc., New York, 1980).

[4] Alton *et al.* (note 1), pp. 413–14.

[5] Alton *et al.* (note 1), p. 412.

4. Spain's new defence policy: arms production and exports

EVAMARIA LOOSE-WEINTRAUB

Superscript numbers refer to the list of references at the end of the chapter.

I. Introduction

The present constitutional regime in Spain has evolved from a 40-year dictatorship with a heavy military bias and strong military backing.

In the general elections held on 28 October 1982, the majority was gained by the Socialist Worker's Party, the PSOE (Partido Socialista Obrero Español). The principal domestic objective of Prime Minister Felipe González and his party is to consolidate the still fragile democracy, since the Spanish armed forces continue to pose major problems.

As far as defence is concerned, the three most important areas affected by the country's new political direction are Spain's membership of the NATO alliance, relations between the government and the armed forces, and programmes to modernize the three military services.

The army will receive military hardware following the guidelines of the major 1982–90 procurement plan which was introduced by the former government. Apparently to reassure the army, no alterations in the plans to acquire new main battle tanks and surface-to-air missiles have been made, but instead of purchasing new arms, co-production and licensed production are to be negotiated. The Spanish defence industry is making great efforts to produce weapons, both indigenously and in co-production with foreign countries, especially in the ship, aircraft and armoured vehicle sectors. The interest of Spanish policy makers and defence industries in foreign markets such as the Middle East, Africa and Latin America is not new. What is new, however, is the rapid growth in sales of arms and defence technology abroad. According to Spanish statistics Spain increased its arms exports in 1982 by about 57 per cent from a total of about $393 million in 1981 to $620 million in 1982.[1]

II. Spain's security policy

NATO

Since its creation, the PSOE has favoured a policy of non-alignment. Shortly before the election, however, the return to democracy had permitted Spain's admission to NATO. Its status is at present like that of Greece in the late 1970s, a member of the Alliance but not of the military organization.

The programme adopted by the PSOE at its most recent Congress in 1981 included a declaration of Spain's neutrality and a stipulation that Spain should have an independent defence policy. It was argued that NATO membership would involve Spain in the East–West conflict and endanger valuable relations with Third World nations, particularly Arab and Latin American countries with which Spain wishes to maintain special relationships.

A national referendum is to be held, possibly in 1985. Currently, three choices could be put to the electorate: (*a*) full membership of NATO; (*b*) withdrawal from NATO; and (*c*) maintenance of "the present situation, that is, Spain belonging to NATO but not to its military structure".[2] The PSOE will take a stand on this issue at its next Congress in December 1984. If it does not change its current policy, the party will campaign against NATO membership.[3] A public opinion poll in June 1983 showed 56 per cent to be opposed to NATO membership, while 27 per cent of the respondents were not even aware of the issue.

US–Spanish base agreements

Another much-debated security policy issue is that of the US bases, which were established on Spanish soil in 1953 and have far-reaching consequences for Spain's position in any conflict involving the United States in Europe or the Middle East.

The negotiations concerning the renewal of the 1953 bilateral agreement between the USA and Spain were completed on 27 July 1982, and on 20 April 1983 the new Spanish government ratified the Agreement of Friendship, Defence and Co-operation—but with some important modifications. Following the change of government, a protocol was agreed upon with the United States removing any requirement about Spain's integration into NATO's military structure. If Spain were to change its status with respect to NATO, the USA would be bound to invoke another round of negotiations. Spain has given the United States the right to continue to use various facilities on Spanish territory which serve both US and NATO ends. The major facilities involved are the naval base complex at Rota and the Torrejon, Zaragoza and Moron air bases.[5] In exchange, the United States announced that Spain is to receive up to $415 million per year in assistance, of which $400 million will be in Foreign Military Sales (FMS) guaranteed credits, $12 million in Economic Support Funds (ESF) and $3 million in International Military Education and Training (IMET).[6]

Parallel to this, Spain has signed defence contracts worth $3.5 billion with the USA during 1982–83.[7] In some respects the agreements are seen as restricting Spain's options, since Spain wishes to co-produce advanced technological equipment. This would help to boost its infant electronics industry, but the USA, unlike potential west European partners, does not wish to encourage this.

III. Civil–military relations

One of the aims of NATO membership held by the more progressive elements of the Spanish military hierarchy was to reduce their isolation. The coup attempt in 1981 accelerated the shake-up of the high command, but a number of high-ranking army officers are still strongly committed to the values of the Franco era. The changes in training, education and officer selection have been very gradual and when the Socialist Defence Minister Narciso Serra announced major changes in the military organization he was at the same time cautious not to offend the traditional military hierarchy.

In order to contain internal unrest within the military, two important reforms have been put to parliament by the Socialist government: the modernization of the land force programme (also known as *Meta*) and the national defence law. While the first programme was originally drawn up by the army chiefs of staff, it was the new government that has put it into operation. Under the *Meta* programme, manpower will be reduced from 230 000 to 150 000 by 1990, and the officer corps will be reduced by 25 per cent; a flexible promotion system, substituting seniority by merit, will be introduced and compulsory military service will be reduced from 18 to 12 months; and there will be a reduction from nine to six military command zones.[8]

At least as important as the *Meta* programme is the national defence law which the government announced in parliament at the end of 1983 as part of the military reorganization programme. The law radically changes the present command structure and lays down that national defence issues are the responsibility of the Prime Minister, thus affirming civil ascendancy over the armed forces.

IV. Military expenditure and arms procurement policy

According to SIPRI figures, which are corrected for inflation, Spain's military expenditure during the period 1974–83 increased at an average annual rate of 4.1 per cent—considerably more than the 1.6 per cent growth rate of the gross domestic product. Military expenditure increased by 4.3 per cent in 1983 under the new Socialist government.

In 1980, the Joint Chiefs of Staff drew up a Joint Strategic Plan (PEC) and at the same time determined a Joint Forces Objective (OFC) to be reached by the end of 1990. When quantifying the economic resources available for the OFC, the government fixed a ceiling for the defence budget during the period 1983–90, reflected in the Law on Budget Estimates. Under the terms of this law, credits for investment and maintenance are to be increased annually by a minimum of 4.43 per cent in real terms. At the same time, a maximum increase for all Defence Ministry budgets was established at an annual average of 2.5 per cent in real terms, for the same period.[9]

This means that the law provides for a selective rate of growth: it encourages procurement rather than personnel expansion.

Procurement

On the whole, the new government has closely followed the guidelines of the major procurement programme with its substantial increase in orders. The emphasis is on a new naval combat group, the procurement of new-generation combat, transport and maritime patrol aircraft, improvement in Spain's air defence system, and the purchase of new battle tanks.

The new criteria for the defence industry are to 'naturalize' as far as possible the various types and systems of arms used by the armed forces; to avoid the outright purchase of foreign arms and, where this is inevitable, to negotiate co-production agreements. This trend has been demonstrated by several defence co-production plans which have been signed or renewed with France, FR Germany, Greece and Italy, as well as by Spain's interest in participating in the Eurofighter project. This programme has been launched by France, FR Germany, Italy and the UK, and Spain's requirement is for 100 aircraft.[10]

Between June 1982 and July 1983, Spain ordered weapon systems from the United States—including 72 F/A-18 Hornet aircraft at $2.6 billion for the FACA (Future Attack and Combat Aircraft) programme—12 AV-8B Harrier aircraft, 10 SH-60B Seahawk helicopters and 12 launch units for RGM-84 Harpoon ship-to-ship missiles for the naval programme amounting to $0.9 billion.[7]

Under the current naval programme Spain is constructing the aircraft carrier *Príncipe de Asturias*, as well as five FFG-7 Class frigates under licence from the United States. The execution of the latter work has been delayed due to the emphasis placed on the aircraft carrier construction. Four S-70 Class patrol submarines are also being produced under licence from France.[11]

The Army is investigating a new generation of licence-built main battle tanks (MBT). The West German Leopard-2 MBT is competing with the French AMX-32 MBT and the order will eventually total 500–750 vehicles including large-scale technology transfers, co-production and offset contracts.[12]

Another important project is the acquisition of a low-level anti-aircraft defence system. The competition between the US Chaparral, the Franco-German Roland and the British Rapier missiles was, according to some sources, won by the Euromissile Roland-2 SAM system. The acquisition of an anti-tank missile, for which the TOW and HOT Euromissile are competing, has still to be decided upon.[13]

V. Military industrial policy

Arms production

Recent arms imports, as well as the emphasis on indigenous production, have given a strong impetus to the expansion of the Spanish defence industry (see table 4.1). In addition to aircraft, naval vessels and armoured vehicles, ordnance and small arms are produced domestically. Increased production has also induced increased exports. While Spain is still not a defence giant by European standards, it is a strong and growing member of the 'second string' of European defence manufacturers.

In accordance with the modernization efforts and the manufacture of military equipment, two organizations have recently been strengthened: the Advisory Commission on Armaments and Matériel (CADAM) and the General Directorate of Armaments and Materials (DEGAM) was created in May 1982 to advise the Defence Ministry on industrial policy for arms, equipment and services. It was designed as a meeting point between the armed forces and national military industries. DEGAM is empowered to co-ordinate programmes of procurement and exports of defence equipment; it is responsible for promoting defence products and administering the research plans carried out in organizations under the Defence Ministry and in state or private centres.

Among Spain's 20 largest industrial groups is the Instituto Nacional de Industria (INI), a state holding company which promotes and makes investments directed at the sector of basic industries and the development of advanced technology. Two INI firms are under contract with the Ministry of Defence: Empresa Nacional de Autocamiones S.A. (ENASA) and Empresa Nacional Bazán de Construcciones Navales Militares.

Table 4.1. Production and exports of major weapon types in Spain, 1974–84

Weapon category	Manu-facturer	Number of employees	Weapon designation	Weapon description[a]	Year of first prototype	First year of production	Number: Planned	Number: Produced	Exported: Yes	Exported: No	Comments
Aircraft	CASA	8 300	C-101 Aviojet	Trainer/strike	1977	1979	88	79	×		For Spanish Air Force the requirement is 120 aircraft
			C-212 Aviocar	Transport	1978	1979		360	×		Also assembled by Nurtanio, Indonesia
			CN-235	Transport	1984	1984	130				Co-produced with Nurtanio, Indonesia; options from Argentina, Puerto Rico and Saudi Arabia
Armoured vehicles	ENASA	10 000	BMR-600	ICV	1975	1979	500		×		
			AMX-30	MBT		1974[b]		400			Spain obtained licence from France in 1980
	Talbot S.A.	500	M-41E TUA Cazador	TD	1983	1983					Shown for the first time at Paris Air Show, 1983
Ships	E.N. Bazán	14 000	F-30 Class	Frigate		1974	9	8	×		1 500 t displacement
			FFG-7 Class	Frigate		1981	5			×	Licence-produced with USA
			Príncipe de Asturias	Aircraft carrier		1977	1			×	90% indigenous; commissioning 1986
			S-70 Class	Submarine		1975	8	2	×		French Agosta Class
			Halcón Class	PC		1980		11	×		85% indigenous
			Cormoran Class	FAC		1980	6	4	×		370 t displacement
			Piranha Class	PC		1981		3			130 t displacement
			Barcelo Class	PC		1975		6	×		135 t displacement
			Lazaga Class	PC/FAC		1975		6		×	275 t displacement

[a] Abbreviations and acronyms used are explained in appendix 7D.
[b] Assembly 1974–80.

Source: SIPRI arms trade and production registers.

INI also includes a series of firms that directly or indirectly produce military material, among them Construcciones Aéronauticas S.A. (CASA), Compañía de Estudios Técnicos de Materiales Especiales S.A. (CETME), Empresa Nacional de Optica S.A. (ENOSA)—optics and optronics for armoured vehicles—and Empresa Nacional Santa Bárbara (ENSA).

Aircraft

Spain's aircraft industry is centred primarily on one firm, CASA, whose six factories employ about 8 300 people. The 60-year old company includes the former Hispano Aviación and Empresa Nacional de Motores de Aviación (ENMESA). Apart from undertaking maintenance and modernization work for the Spanish Air Force, its principal current activities concern overhaul and maintenance of McDonnell Douglas F-4 Phantom fighter aircraft as well as of various US-built helicopters for the US Air Force in Europe.[14]

CASA is also assembling Messerschmitt–Bölkow–Blohm (MBB) Bo-105C helicopters for the Spanish Army, 30 of which had been delivered by the end of 1983. Of the 39 remaining helicopters, 28 will be armed with HOT anti-tank missiles.[15]

CASA has also recently completed delivery of 24 Bo-105C helicopters assembled for Iraq, and the contract with MBB has been increased to cover a further 32 of these helicopters—almost certainly to accommodate a follow-on order by Iraq.[16]

CASA's own project office has designed the C-212 Aviocar transport and the C-101 Aviojet trainer, both of which are currently in production. By the end of 1982 the total sales of several versions of the C-212 Aviocar at home and to other nations had totalled more than 360 aircraft, and currently both aircraft are on order for Iraq, while Saudi Arabia has 40 C-212A Aviocar on order. The C-101 Aviojet was primarily designed to meet the main training needs of the Spanish Air Force, for which 79 of an order of 120 had been delivered by 1983.[17]

In order to promote sales in the Far East, CASA established a C-212 Aviocar assembly line in Indonesia in partnership with P. T. Nurtanio. A new company was formed by CASA and Nurtanio—Aircraft Technology Industries (Airtec)—to produce the Airtec CN-235 transport aircraft. Design of the Airtec CN-235 began in 1981. Two prototypes were built, one in each country, and simultaneous first flights took place at the beginning of 1984. Deliveries from both production lines are intended to begin in the second half of 1984. So far, firm orders for 106 aircraft in addition to 23 more on option have been received,[18] and Saudi Arabia is the first export customer to have shown interest in acquiring the CN-235 transport.

CASA's total military sales in 1983 amounted to $185 million, or 76 per cent of their total sales figure of $244 million.[19] Among CASA's primary foreign customers are Chile, Honduras, Indonesia, Panama, Uruguay and Zimbabwe as well as several customers in the Middle East.

Naval vessels

Empresa Nacional Bazán was set up in 1942 and is completely dependent upon INI; it has three shipyards and employs about 14 000 people. While the Ferrol yard builds cruisers and frigates and specializes in the construction of steam turbines, the Cartagena yard builds medium-sized ships such as submarines, destroyers and corvettes and has therefore always maintained a highly specialized technology. The San Fernando yard (Carraca) specializes in light ships such as patrol craft. There is an ordnance factory which constructs cannons for on-board installation and collaborates in the manufacture of anti-submarine rockets and launchers.[20]

Spanish shipbuilders attach great importance to attaining self-sufficiency in all details of ship design and construction, although until the end of the 1970s they mostly built and manufactured from foreign designs under licence.[21]

The F-30 Class ('Descubierta') frigates, four of which were ordered for the Spanish Navy in 1973 and four more in 1976, can be taken as an example. These frigates are based on the Portuguese Joah Coutinho units originally designed by Blohm & Voss in FR Germany. The designs have been considerably modified by Bazán and the proportion of domestically supplied materials and systems has grown to 83 per cent.[22] In addition to the F-30 Class frigates built for the Spanish Navy, two have been ordered by Egypt, and Morocco has one frigate on order, commissioned during 1983.

The decision to build a light aircraft carrier in Spain, *Príncipe de Asturias*, was formalized in an order on 29 June 1977. The preliminary design, drawn up by the US firm Gibbs & Cox, was purchased by Bazán, which adapted it to meet the requirements of the Spanish Navy. The detailed design was thus prepared by the USA and Spain, with Bazán's share being 90 per cent. After construction in Spain, the ship was launched in May 1982 and commissioning is expected during 1986.[23]

The construction of a series of four S-70 Class submarines was started in 1975, the second pair being ordered in June 1977. These submarines are based on the French 'Agosta' design and about 67 per cent of the equipment and construction are from Spanish sources. Two ships were completed by May 1983 and the last two will be commissioned by 1985. In 1982 Egypt ordered two S-70 Class submarines.

Light naval craft built at the Bazán San Fernando shipyard for the Spanish Navy and a number of foreign navies were also first based on foreign designs, but the degree of use of domestic products for the ships is now very high, in some cases reaching 85 per cent of the value of the finished ship. This is partly a result of specialization: the cannons are manufactured by the shipyard's Fabrication and Ordnance Division, and the propulsion engines by the engine factory in Cartagena.[24]

Economic and political considerations stemming from the trend towards general acceptance of a 200-nautical mile exclusive maritime economic zone have led to increased exports of smaller ships: Argentina and Mexico received the last of five and six respectively of the Halcón Class patrol craft during 1983, and the Congo received the last of three Piranha Class ships in 1983. The Cormoran Class fast attack craft has been exported to Morocco, and Egypt has six ships of this type on order. Another export item is the Barcelo Class patrol craft, one of which was delivered to Mauritania in 1982.

Armoured vehicles

As the first Spanish-designed tank, a new tank destroyer (TD)—the M-41 TUA Cazador, armed with a retractable TOW missile launcher—was shown abroad for the first time at the International Aeronautics and Space Exhibition in France in May 1983.

The basis for this TD is the US light tank M-41 of which the TOW version was developed by Automoviles Talbot S.A.—formerly Chrysler España. Talbot has spent its own resources in designing the TD. It is the only private Spanish company working in the field of armoured vehicles, whereas there are two nationalized companies—Empresa Nacional de Autocamiones S.A. and Empresa Nacional Santa Bárbara.[25]

Since 1974, these two latter companies have been building the French-designed AMX-30 MBT. Although initially the AMX-30 was assembled from parts provided by France, in 1980 Spain purchased the entire licence from France in order to continue manufacture itself. The Spanish Army had received about 400 AMX-30 MBTs by the end of 1983, but the vehicles are already considered obsolescent and the Army would prefer to transfer to the West German Leopard-2 MBT instead of continuing development of the French-designed tank. At present, the possibility of converting the Santa Bárbara facilities for Leopard-2 production is being studied.[16]

In addition to the AMX-30 MBT for the Spanish Army, the AMX-30s sold to Venezuela carry Spanish-built engines from ENASA.[26]

ENASA's Valladolid factories, in which the Pegasus firm is integrated, is responsible for the development of the BMR-600 infantry combat vehicle (ICV) with its different versions. This ICV is amphibious, has a range of 800 km, and can be transported by air. The Spanish Army has requested 300–500 vehicles.[27] Both Egypt and Iraq have placed orders for the BMR-600 ICV.

Other arms production

As a result of expertise gained in recent years the Spanish arms industry has acquired a high level of technological competence in some areas.

One example is the Spanish-designed Meroka Naval Air Defence System, developed by CETME (Centro de Estudios Técnicos de Materiales Especiales). This system is a multi-barrelled 20-mm gun system for close-in air defence. The operational evaluation was completed by December 1983, and Bazán is producing a preliminary series of seven systems to meet the needs of the *Príncipe de Asturias* as well as of the FFG-7 Class frigates under construction at Bazán.

CETME also conducts research and development in the field of small arms and exchanges its own technology with other countries, for example, France, FR Germany, Italy, Switzerland and the USA. It has brought out prototypes such as the CETME 7.62-mm NATO assault rifle, and among the latest important products is the CETME 5.56-mm assault rifle.[28]

Arms exports

In view of the comparatively modest domestic requirements for military equipment, Spain has during recent years been encouraging arms exports to existing and new markets in order to maintain and increase its arms production base. This obviously raises the question of arms export regulations. Does Spain have such a policy for regulating arms exports? It does, but it is relatively uncomplicated. There is a list of banned countries (among them South Africa) and Spain will not sell to areas of tension, a reservation so vague as to be largely meaningless, as demonstrated by the sale of aircraft, helicopters and armoured vehicles to Iraq.

According to Spanish statistics, the turnover of the Spanish defence industry increased by more than 300 per cent between 1981 and 1983, including ordnance, small arms and explosives. The public sector accounted for 92 per cent of the total exports. Table 4.2 shows the value of Spain's exports of major weapons to Third World countries.

The most important contract so far signed by the Spanish defence industry was transacted in 1982. At the time, several firms received orders from Egypt to a total of $1 billion.[29] The order to ENASA included up to 600 BMR-600 ICVs, armoured personnel carriers in several versions and military trucks. The order to Bazán was for eight warships, including two F-30 Class frigates and six Cormoran Class fast attack craft. An option

Table 4.2. Exports of major weapons to Third World countries by Spain, 1977–83

Figures are SIPRI trend indicator values, as expressed in US $ million, at constant (1975) prices.

Year	Spanish exports	Total Third World imports	Percentage of total Third World imports
1977	12	9 699	*0.1*
1978	17	11 147	*0.2*
1979	21	9 599	*0.2*
1980	8	10 660	*0.1*
1981	44	8 954	*0.5*
1982	259	9 120	*3.0*
1983	332	8 764	*3.8*

for another two frigates is to be renegotiated at the beginning of 1984.[30] While a Saudi Arabian bank consortium is to guarantee the entire value of the contract, 85 per cent of it will be financed by an export credit supplied by Banco Exterior de España and the other 15 per cent by FAD (Fondo de Ayuda al Desarrollo) over periods of 10 and 20 years, respectively.

Although not yet finalized, according to official sources and industry officials, another important contract was drawn up following a visit to Spain of Saudi Arabia's Defence Minister, Prince Sultan Ibn Abdul Aziz, when Saudi Arabia contracted to buy military and naval equipment worth $150 million from the Spanish defence industry, including CN-235 transport aircraft and armoured vehicles.[31]

Still another new project under negotiation is Bazán's plan to build warships in Brazil for Latin American and African markets. This is a result of Spain's concern about its overall trade with Brazil, which declined during 1982 and from which a growing deficit is accumulating.

Bazán is planning to set up a joint venture to produce the ships in collaboration with the Brazilian Navy in the state of Bahia. The chairman of Bazán, Mr Félix Alonso Majagranzas, has expressed hopes that a joint company, Construcoes Navias de Aratu, will be set up during 1984.[32]

VI. Conclusions

Although Spanish defence policies now being instituted include many elements that were drawn up by the previous government, it was the new Socialist government that summoned the political strength to push the military reforms through. While the new military law creates the framework for a modern defence structure in the Western tradition, the military personnel reform, aimed at shifting deployment to concentrate on defence equipment rather than on manpower, must be seen as part of a plan to neutralize the threat to democracy posed by the army. At the moment, the government is expending much time and political effort in examining the thorny question of NATO membership and the results remain to be seen.

At the same time as the government is trying to create a modern democracy in Spain, it is broadening its defence technology base both in Europe and, to a lesser extent, in the United States. In the defence electronics sector particularly it is trying to benefit from co-production with other European countries to naturalize as well as to expand its own defence industry. The same trend characterized Italy's arms production industry in the early 1970s.

The production of arms and the development of a growing defence industry entail a major commitment of economic resources and this in turn has increased Spain's arms export efforts considerably during recent years. Spain has established a market for its arms products in the Third World and aims to increase both the defence industry's self-sufficiency and arms exports.[33]

Whatever the political future of Spain, developments are unlikely to affect the Spanish defence industry's continued growth which will obviously lead to Spain's increasingly visible role as an arms exporter.

Notes and references

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[4] *El País*, 27 November 1983, p. 9.
[5] *United States Military Installations and Objectives in the Mediterranean*, Committee on International Relations, 95th Congress, 1st Session (US Government Printing Office, Washington, D.C., 1977).
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[7] *El País*, 17 November 1983, p. 15.
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[12] *Milavnews*, October 1983, p. 22.
[13] *El País*, 8 January 1984.
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[21] *Conway's All the World's Fighting Ships, 1942–82*, Part I, 'The Western Powers (Conway's Maritime Press Ltd., London, 1983), p. 108.
[22] Note 11, p. 420.
[23] Note 20, p. 29.

[24] Note 20, p. 27.
[25] *Defense & Armies*, No. 21, July–August 1983, pp. 38–45.
[26] *Defence and Foreign Affairs*, December 1982, p. 7.
[27] *Jane's Armour and Artillery, 1982–83* (Macdonald & Co., London, 1983), p. 317.
[28] Note 3, p. 68.
[29] Note 1, p. 44.
[30] *African Defence*, September 1983, pp. 50–53.
[31] *Financial Times*, 5 January 1984.
[32] *El País*, 26 March 1983.
[33] This has prompted the Spanish Ministry of Defence and the Barcelona Fair to organize the first international aerospace show, Cosmo 84, to be held in Barcelona in June 1984.

5. Multinational weapon projects and the international arms trade

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Superscript numbers refer to the list of notes and references at the end of the chapter.

I. Introduction

This chapter describes the relationships between international co-operation in the acquisition of weapons and the sale of arms to third countries by looking at multinational west European weapon projects. An 'international or multinational weapon project' is defined here as a project in which industries from two or more nations co-operate in or co-ordinate their research, development and/or manufacture of a particular weapon system. 'Third country sales' mean sales of international weapon systems to customers other than Western industrialized nations.[1]

So far, this aspect of international weapon procurement has been largely overlooked, even in recent studies.[2] Although the links between international weapon acquisition and third country sales are complicated and detailed data is often sparse, making definite conclusions difficult to draw, a few case studies of aircraft, helicopters and missiles should make it possible to draw preliminary conclusions about whether or not international weapon projects reduce the economic incentives for third country sales. For instance, does co-operation increase arms sales from countries with restrictive export policies? Does co-operation facilitate conventional arms control in any way?

Co-operative or co-ordinated weapon acquisition in NATO has long been presented as a magic formula with reference to concepts such as 'standardization' and 'a two-way street'. It is generally accepted that there are military, war-fighting merits in having at least interoperable, if not standardized, equipment. Economically, more homogeneous weapon inventories lead at least theoretically to economies of scale from longer production runs, reduced duplication in research and development and ultimately lower prices for the weapons. In fact, however, international weapon acquisition is not as common as these benefits would make one believe. One explanation is that the military and economic benefits are often at odds with national concerns over division of labour, industrial policy, technological dependencies and innovation. Balance of trade is another such concern, and one aspect of this is the prospect for continued arms exports to third countries.[3]

The links between increased NATO co-operation and third country sales are far from uncontroversial. At least four possible links may be defined. The first two are basically economic, while the latter two include considerations of a political nature.

First, multinational co-operation may reduce third country sales owing to the larger European or Atlantic market and more rational, i.e. less costly, weapon acquisition. This is the effect that most export-dependent industries or governments often stress. At the same time, however, this is considered a positive effect by those striving for a reduction in the international arms trade. General Josef van Elsen of the Netherlands, for instance, stated at a hearing on European defence co-operation in 1976:

> The failure to rationalize our defense resources has meant that we have always looked to outside markets, particularly in underdeveloped and developing countries, to recover our investments. In this sense, we have contributed in a major way to the wasteful and potentially dangerous escalation in the present expenditure on armaments in the world today. A rational and cohesive armaments policy within the Alliance could remove the necessity for seeking outside sales to the degree it happens now.[4]

This point was further elaborated by Senator John Culver: "And to that extent it would have, hopefully, a healthy consequence in terms of bringing some sort of international arms control policies of a saner character on this larger issue".[5]

The conclusion that increased NATO co-operation in the acquisition of arms will lead to reduced third country sales was also drawn in a Western European Union study in 1979.[6] Perhaps the strongest political expression so far based on this reasoning is the Fergusson Report from the European Parliament Political Affairs Committee, approved in 1983. After having suggested different means for increasing west European co-operation, the European Parliament called upon the Council to establish rules governing the export of arms from member states to third countries, and to agree on restrictions to be placed on the export to certain third countries of specific types of arms.[7]

Second, multinational weapon projects may lead to increased third country sales because the efficiency achieved from increased co-operation could be used to make European arms more attractive to third countries. This argument was, in fact, used by the Economic and Monetary Committee of the European Parliament in its reactions to the Fergusson Report.[8] The important point in this argument is that there is no reason to believe that an enlarged European or Atlantic market will automatically lead to reductions in third country sales.

Third, the prospects for future multinational weapon programmes may be reduced unless rules for third country sales can be agreed upon by the

Alliance partners, especially by the major arms exporters. This possibility is therefore of particular importance in transatlantic projects involving the United States, France and Great Britain. Since sales to countries outside NATO are perceived as necessary to sustain national industries in some west European countries, they might be unwilling to produce a NATO system if NATO were to place restrictions on sales of the system to non-NATO countries. The US General Accounting Office (GAO) noted in 1978 that this dependence on arms exports could be the largest impediment to standardization.[9] In 1981 the GAO noted that a desire to increase NATO co-operation in weapon acquisition and the perceived need of the United States government to maintain control over military technology may not be able to coexist if the United States is to move forward in standardization.[10] In other words, instead of the other way around, west European third country sales policies might become 'a spoke in the wheel' for realization of one of the oldest goals of the NATO Alliance.

Fourth, the interest in co-operation may lead countries to abandon restrictive arms export policies. A case in point is FR Germany. In 1971, the same year the West German government opted for a very restrictive arms export policy, it signed an agreement with the French government that exempted co-produced weapons from West German export regulations. In such cases, co-production could be a driving force behind increased arms exports.

II. Case studies

The Jaguar aircraft

The Jaguar project began in Great Britain, and France became a partner in 1965. The Sepecat company was established in 1966 to administer the project. Total orders for the Jaguar stood at nearly 600 aircraft by 1983, including a total of about 200 for Third World countries (see table 5.1). In July 1979, the first Jaguars were delivered to India, where most are assembled from British-supplied parts. The first flight of an Indian-assembled Jaguar took place in March 1982. India is expected to produce additional Jaguars from Indian-manufactured components. Twelve Jaguars were ordered by Oman in 1974, when Oman was involved in fighting a rebellion.

Both France and Great Britain are involved in programmes to increase the Jaguar's effectiveness. Recent improvements, including a more powerful engine, a maritime version and various subsystem modernizations, will probably lead to additional sales.

Although Sepecat was planned to be a joint marketing organization, no attempt seems to have been made to co-ordinate British and French

Table 5.1. Selected multinational weapon projects and export sales

Project	Year of agreement	Partners	Project shares (per cent)	Joint managing company	Numbers ordered by 1983 from: Third World countries	Other industrialized countries	Producer countries	Third World share of orders (per cent)
Aircraft								
Jaguar	1965	UK (British Aerospace) France (Dassault)	*50* *50*	Sepecat, UK	175	0	402	*30*
Alpha Jet	1969	France (Dassault) FR Germany (Dornier)	*50* *50*		123	33	350	*24*
Tornado	1968	UK (British Aerospace) FR Germany (MBB) Italy (Aeritalia)	*42.5* *42.5* *15.0*	Panavia, FR Germany	0	0	809	*0*
Helicopters								
SA-330 Puma/ SA-332 Super Puma	1967	France (Aérospatiale) UK (Westland)	*72.5* *27.5*	Heli-Europe Industries, UK	394	49	204	*61*
SA-341/342 Gazelle	1967	France (Aérospatiale) UK (Westland)	*65* *35*		244	255	571	*23*
WG-13 Lynx	1967	UK (Westland) France (Aérospatiale)	*70* *30*		50	62	234	*14*
Missiles								
Milan	1965	France (Aérospatiale) FR Germany (MBB)	*50* *50*	Euromissile, France	Total orders: 300 000[a]			[*54*[b]]
HOT	1965	France (Aérospatiale) FR Germany (MBB)	*50* *50*	Euromissile, France	Total orders: 50 000[a]			[*64*[b]]
Roland	1966	France (Aérospatiale) FR Germany (MBB)	*50* *50*	Euromissile, France	Total orders: 25 000[a]			[5[b]]

[a] According to Euromissile.
[b] Share of actual exports to all countries in relation to procurement by France and FR Germany up to the end of 1982.
Source: SIPRI files.

marketing of the aircraft. Dassault and the French government have shown more interest in marketing the national Mirage fighters than in supporting the bilateral Jaguar. By becoming a partner France put itself in competition not only with Great Britain but also with itself. In comparing the potential gains from marketing the Mirage or the Jaguar, France placed its bet on the Mirage. To offer the French government economic compensation for lost export opportunities, a solution suggested for instance by the Klepsch report,[11] would probably not have changed the attitude of the French government.[12] It seems likely, therefore, that the marketing of future versions of the Jaguar will be done in open competition between BAe and Dassault-Bréguet.

The Tornado aircraft

In comparison with the trinational MultiRole Combat Aircraft (MRCA) Tornado, the Jaguar has sold well—there are as yet no third country sales of the Tornado. The comparison is not quite fair, however, since the Tornado is a more advanced aircraft than the Jaguar, therefore more expensive, and not a 'standard' follow-on aircraft in many air forces outside western Europe. Current Tornado production involves a total of 809 aircraft, all for the Italian, West German and British Air Forces plus the West German Navy.

From an arms control perspective, therefore, the Tornado has been more 'successful' than any of the other projects under study. But, since the high cost of the aircraft is regarded as an important factor explaining the lack of Third World orders, and since the producers are eager to export, Panavia—the Tornado contractor and managing organization formed in 1969—is considering a 'stripped down' version of the Tornado in an attempt to expand the market. Panavia has already received expressions of interest from the oil-rich governments of Saudi Arabia and Iraq. According to the agreement among the partners, all three have a say in the export of the aircraft. This means that Panavia has to comply with West German export regulations, the most restrictive arms sales policy of the three. As of today, any sale to Iraq is, therefore, out of the question. It has been reported, however, that FR Germany's partners have asked the West German government again to modify the export regulations to make possible sales to Iraq and perhaps also to other countries.[13]

The Alpha Jet aircraft

The first version of the Franco-West German Alpha Jet trainer/attack aircraft rolled off the production line in 1977. A Belgian version, similar to the French Alpha Jet, is intended primarily as a trainer with only a secondary weapon-carrying and ground-attack capability. West German Alpha Jets, however, are replacing G-91 aircraft in close air support and battlefield reconnaissance roles.

Both countries have equal shares in the development of the Alpha Jet. In order to simplify the direction of the project, France was given executive authority. Dassault–Bréguet was chosen as the main contractor with design authority, while Dornier became the subcontractor. This arrangement differs from, for instance, the Sepecat and Panavia organizations, where all partners are main contractors. The principle of work division, however, follows that established for the Jaguar; that is, two final assembly lines fed by components from single-source production centres. Both countries agreed not to regulate exports from the other country but retained an obligation to hold consultations about exports.

The Alpha Jet had good export potential from the start because of the many nations operating older trainer and light attack aircraft. Expanded capabilities of the aircraft have also attracted the interest of nations seeking more sophisticated equipment. It seems that the Franco-West German team has been able to offer favourable financial terms to foreign customers, thereby subsidizing their own exports. The main contractor–subcontractor arrangement has, moreover, been presented as a possible way to circumvent West German export regulations[14] and to stimulate third country sales.

By the end of 1982 a total of over 500 orders had been placed by some 10 nations (see table 5.1). Known third country orders amount to 123 aircraft from seven nations, with Egypt as the main customer. Of the aircraft exported to the Third World, only those for the Nigerian Air Force came from the West German assembly line.

In 1981 Egypt signed an agreement with France for licensed manufacture of Alpha Jets, the first of which left the Egyptian factory in 1982. Fifteen new-generation Alpha Jets are designed for precision ground attack, developed by Dassault as a private venture only for export. Four of these new aircraft were delivered to Egypt in 1983, and the remaining 11 aircraft will be manufactured in Egypt together with 30 basic Alpha Jets. Additional aircraft are also expected to be built in Egypt as the result of follow-on procurements with an increasing share of domestically produced components and parts.

Heli-Europe Industries

The Anglo-French helicopter co-operation between Westland Helicopters and Sud-Aviation began in 1967. Sud-Aviation, now Aérospatiale, was developing the SA-330 Puma and the SA-341 Gazelle, while Westland was developing the WG-13 Lynx. Since the three helicopters originated as national projects, the marketing has been handled more or less as with national projects. Several civilian and military versions have been developed. Puma and Gazelle helicopters have sold well in the Third World, with over 600 orders by 1983.

The Gazelle military versions SA-342K and SA-342L have been sold at least to Iraq, Kuwait, Lebanon and Egypt. The first locally assembled SA-342 Gazelle rolled out of the Egyptian plant in late 1983.

The large export market for these helicopters can probably to a large extent be explained by the growing interest in using helicopters in air-to-ground roles. Many Puma and Gazelle customers have also ordered Milan and HOT anti-tank missiles. The British Lynx, on the other hand, has sold primarily in the naval version and on a much smaller scale.

Euromissile

In 1972 Euromissile was set up in France as an economic common interest group by Aérospatiale and MBB. Euromissile is responsible for the management and the marketing of the HOT and Milan anti-tank and Roland anti-aircraft missile systems. Euromissile is free to sell the missiles to countries for which a French export licence can be approved. The French government has committed itself only to inform the West German government. France can export the Milan in spite of West German objections, as has reportedly happened with exports to Syria.[15]

According to Euromissile, about 375 000 missiles[16] are said to have been ordered by 30 or more nations.[17] An agreement for licensed production in India was signed in 1982, and negotiations are under way with several countries for future licensed production in addition to further sales by Euromissile.

The Milan is said to have benefited from a priority that Euromissile placed on the Milan at the expense of the HOT. The HOT missile is nevertheless reported to be in service with 13 armies and deployed in 9 countries outside NATO. A forecast estimates a production volume of 12 000 HOT missiles per year to 1986.[18]

The Roland has been sold to at least six Third World countries, but the Third World share is lower than that for the other missiles. This is at least partly explained by the fact that the Roland is a more sophisticated missile and because there are more surface-to-air missiles in direct competition with the Roland than there are anti-tank missiles in competition with the HOT and Milan missiles.

III. Conclusions

These case studies do not indicate that co-operation in western Europe has so far created a regional market that reduces the economic rationale for continued arms trade with other nations. One explanation might be that multinational projects are not yet efficient enough and that there are therefore still economic savings to be gained by finding new forms of co-operation. Until then, third country sales will continue to be an important means to reduce economic losses, especially in times of recession.

Another more plausible explanation is that, even if west European co-operation is organized in the theoretically most efficient way, a regional west European market will still not be large enough to reduce the economic rationale for third country exports. For a producer working in a competitive world market, it is not so much a question of whether a regional market is too small or not—any reduction of the global market is bad for business. From this it follows that even if the market included all of western Europe plus the United States and Canada, there would still be prospects of even larger sales if the rest of the world were included. If 'the rest of the world' is to be excluded, it has to be by political decision, and not on the basis of economic calculations.

In fact, although based on different types of organization, multinational projects in one way or another stimulate arms exports, the existence or growth of domestic arms industries in several countries, or both.

In most cases international companies such as Euromissile function as clearing-houses for export sales and tend to play down competition between the partners in export markets. The same principle is used in the field howitzer FH-70 programme, establishing a central sales office as a focal point for marketing and sales.[19]

Apart from organizations like Euromissile, with equal shares between the partners and a centralized marketing office, there are other principles that support—or at least do not in themselves restrict—continued third country sales. For example, it is the industry developing the weapon, or in some cases the government ordering a weapon, which is the owner of the product or the technology. Further, in a main contractor–subcontractor relationship, it is normally the main contractor which is responsible for marketing the weapon. In such a relationship, exports can be the responsibility of the partner with the least restrictive export policy. This is most common in bilateral projects, such as the Alpha Jet.

In west European multinational research and development projects, the commercial benefits are shared among the partners, making trade an interest of them all. This differs markedly from licence agreements in which the licenser rather than the manufacturer controls and generally also benefits from trade. In west European licensed production of US weapon systems, the United States has been in control of third country sales. European governments and industries have therefore since the 1970s shown reluctance to accept extensive dual production of US weapon systems. The trend is instead towards joint research and development projects. "Cooperation can be possible only if we [west European countries] are able to keep our political independence, such as our control over our own third-party sales", says Henri Conze, member of the French Delégation Général pour l'Armement. "We as allies are fighting the same battle, but sometimes there are discrepancies in exactly how we believe it should be fought."[20]

One aspect of increased west European research and development co-operation is that the producers may offer licensed manufacture of their joint weapons in third countries. The Jaguar aircraft and Milan missiles are manufactured in India, the Alpha Jet in Egypt, and Puma helicopters in Brazil and Indonesia. The spread of manufacturing centres complicates future control of the trade in arms and military technology. First, when a manufacturing country has acquired the necessary skills, the licenser has lost control of the manufacture of the weapon. The manufacturing countries can in principle continue to manufacture the weapon after the licenser has stopped producing it. Second, there is a growing international trade in weapons among Third World countries. The establishment of manufacturing centres in the Third World therefore increases the probability that such weapons, or variations of such weapons, will spread to other Third World countries.

In short, with increased co-production and licensed manufacturing in third countries, the prospects for conventional arms control will diminish. As long as national west European arms exports are not restricted, multinational projects can, and probably will, be organized in ways that do not restrict third country sales. One may in fact doubt the will of producers and even governments to help realize the suggestions of the Fergusson Report to further develop dual production programmes while at the same time limiting competitive arms sales outside the Alliance.[21] The remark by the Economic and Monetary Committee of the European Parliament—that multinational weapon projects may lead to increased third country sales—seems nearer to the truth.

IV. Prospects for the future

Government considerations in participating and in selecting domestic industries include the preservation or creation of specific production or management skills as well as local or regional employment. An international project might be more likely to continue than a national project, since a decision by one partner to withdraw when joint development has begun and there are no alternative national projects has far-reaching implications for the other partner(s). New expectations and demands for follow-on projects will continue to be created in order to preserve the national benefits already gained.

Perhaps the most clear-cut example of follow-on planning is Euromissile. Euromissile was from the beginning given the task of designing, developing and manufacturing future tactical guided missiles. The implementation has taken different roads.

First, a company called the EuroMissile Dynamics Group (EMDG) was established in 1980 by Aérospatiale, MBB and BAe to design, develop and manufacture third-generation anti-tank guided weapons (ATGW-3, also called ATEM, anti-tank euromissile). In 1983, EMDG received a contract to begin project definitions of a medium-range, man-portable, laser beam-guided missile to replace the Milan, and a long-range, fire-and-forget, infra-red passive homing missile to be mounted on helicopters and special vehicles. This missile is to replace the HOT and Swingfire missiles. The EMDG has given prime responsibility for developing the medium-range missile to Aérospatiale, which is also developing a short-range anti-tank weapon known as ACCP (anti-char courte portée).[22] MBB has primary responsibility for developing the helicopter-launched version of the long-range missile, and BAe for the ground-launched version.[23] In addition, each company has a specific area of technological responsibility (BAe, infra-red seeker; MBB, warheads; Aérospatiale, optronics).

Second, another parallel organization was established in 1976 to develop second-generation anti-ship missiles. The ASEM (Anti-Ship Euromissile) economic interest group was established by MBB, Aérospatiale and the Hawker-Siddeley Dynamics (HSD) to produce a long-range anti-ship supersonic missile (ASSM), then envisaged by several NATO navies.[24] The British government later pulled out of the programme, and what is left today is the co-ordinated development between France and FR Germany. Hope has been expressed, however, that when west European anti-ship missiles are no longer competing on the international market, Britain will join the programme.[25]

Although the acquisition of follow-on weapon systems does not automatically lead to third country sales, it normally does for at least two reasons. First, there already exists a third country market with older generations of these weapons, where governments more often than not are as eager to get the best on the market as the producers are to sell. Second, if the weapons have been tested in war and proved to be efficient, more customers are likely to show interest in the follow-on systems. The demand for French and British missiles after the Falkland/Malvinas conflict indicates broad markets also for follow-on missiles.

In the case of missile production by Euromissile and its 'sister' organizations, all three, although separate companies, function as a 'family' with Euromissile as the 'head of the family'. EMDG, what remains of ASEM and Euromissile are located in the same building outside Paris, and all the administrative work is done by Euromissile.[26]

In projects involving more than two partners a future solution seems to be an organization like Euromissile, where the managing organization is in charge of sales. The responsibilities might, however, be difficult to arrange if a particular weapon is to be produced in several different national versions. In the Heli-Europe and Tornado programmes the national project shares are not evenly distributed, and in the EMDG the responsibilities are distributed in accordance with different versions of the missiles. In programmes like these it might not always be possible to allocate third country sales revenues in fair shares. Certain partners might have to be compensated for loss of export profits,[27] although this may not always work, as indicated by the Jaguar project.

While important in west European projects, compensation might be even more relevant in transatlantic projects. The proposition that partnership with the United States may result in foreclosure of certain markets is, according to a RAND study, probably true but does not therefore necessarily mean a net loss in total sales by the European nation(s). Under certain types of multinational arrangement, the United States could make new markets available. Examples that have been mentioned are a share of the United States home market ('buy European'); a share of the US foreign markets (for instance, like a European share of the F-16 projected future markets); or agreements to refrain from competing for some markets (for instance, that the United States concede Taiwanese, Swedish or other markets to west European suppliers).[28]

This means that the United States must bargain with west European suppliers about world market shares. To do this, the United States would have to be prepared to reduce its own production. Any such arrangement would require careful planning by all governments involved.[29] This is, however, contrary to the present trend where governments are giving their industries more freedom in arranging co-operative arrangements and production than before. If such military producer cartels are to be formed, where does the Soviet Union, the second largest arms supplier, fit in? If the attempt by the Carter Administration to restrict the international trade in conventional weapons in co-operation with the Soviet Union, Great Britain and France is an indication of the prospects for such arrangements, the conclusion can only be negative. This implies that the "essential condition for governing the world trade in arms", according to the Fergusson Report, has few, if any, chances of being realized.[30]

The prospects for international arms control as an automatic result of increased co-operation in weapon acquisition are grim indeed. Instead of solving economic and political difficulties, multinational projects make the relationships increasingly political, while the economic incentive to export is retained. In fact, the projects studied here give no reason to believe that the main producers or their governments are likely to suggest restrictions in third country sales. Governments co-operate to arm rather than to disarm. Multinational sales policies are based on national export policies, and as long as there are nations with more liberal policies than those of other countries, multinational projects can be organized in ways that do not decrease the prospects of third country sales. What is necessary in order to change this state of affairs is a change in the political attitude towards the national benefits from the international arms trade. It will take brave decisions with a view far beyond considerations of national industrial profitability, employment and technological dependencies. As long as governments, as well as other interested parties, have not overcome their local, regional or nationalistic attitudes, prospects for conventional arms control will not improve.

Notes and references

[1] For a further discussion of definitions and the relationships between international arms projects and the arms trade, see Hagelin, B., 'International weapons acquisition: a threat to armament control?' *Bulletin of Peace Proposals*, No. 2, 1978.

[2] This aspect is not treated in Edmonds, M. (ed.), *International Arms Procurement: New Directions* (Pergamon Press, New York, 1981). In Hartley, K., *NATO Arms Co-operation: A Study in Economics and Politics* (George Allen & Unwin, London, 1983) exports are only treated as one of several 'performance indicators' for joint aircraft projects.

[3] One important aspect of co-production within NATO is the different perspectives individual member countries have. The United States is in a special position due to the strength of its arms industry and also because of its interest in directing the flow of military technology to Third World countries. There has been much discussion of this among the members throughout NATO history, but especially since the mid-1970s. The Carter Administration proposed to improve transatlantic arms co-operation while at the same time attempting to reduce the international arms trade. Three ways to improve transatlantic co-operation were instituted: Memoranda of Understanding on the removal of trade barriers and promotion of reciprocal procurement between the United States and individual west European nations; dual (licensed) manufacture by interested states of weapon systems developed by other countries; and the adoption of the family of weapons concept, whereby military requirements would be split up among the Alliance members to minimize duplication of research and development and to maximize the standardization of equipment. Since then the Reagan Administration has added one more to this 'triad', namely transatlantic industrial teaming.

[4] *European Defense Cooperation*, hearing before the Subcommittee on Research and Development on Manpower and Personnel of the Committee on Armed Services, US Senate, 31 March 1976 (US Government Printing Office, Washington, D.C., 1976), p. 17.

[5] *European Defense Cooperation*, (note 4), p. 4.

[6] *Definition of Armaments Requirements and Procurement in Western Europe*, WEU Document 821, Report submitted on behalf of the Committee on Defence Questions and Armaments, by Mr Meintz, Rapporteur, 6 November 1979, pp. 156–59.

[7] Report drawn up on behalf of the Political Affairs Committee on Arms Procurement Within a Common Industrial Policy and Arms Sales, European Parliament Working Document No. 1-455/83, 27 June 1983, p. 8 (*The Fergusson Report*).

[8] See *Aviation Week & Space Technology*, 28 November 1983, p. 132.

[9] *Standardization in NATO: Improving the Effectiveness and Economy of Mutual Defense Efforts*, GAO PSAD-78-2, US Government Accounting Office, 19 January 1978, p. 28.

[10] *No Easy Choice: NATO Collaboration and the US Arms Export Control Issue*, GAO ID-81-18, US Government Accounting Office, 19 January 1981. A reluctance on the part of west European states to co-operate with the United States has been documented in several other studies; see,

for instance, *Two-Way Street: US–Europe Arms Procurement, The Klepsch Report* (Brassey's Publishers Ltd, London, 1979); Hagen, S. H., *Twisting Arms: Political, Military and Economic Aspects of Arms Co-operation in the Atlantic Alliance*, National Security Series No. 3, 1980 (Centre for International Relations, Queen's University, Kingston, Ontario, Canada, 1980); *Department of Defense Appropriations Bill 1980, Report of the Committee on Appropriations together with additional views*, House of Representatives Report 96-450 (US Government Printing Office, Washington, D.C., 20 September 1979); Gessert, R. A., 'US arms export policy and weapons cooperation', *NATO's Fifteen Nations*, December 1977–January 1978; Rich, M. *et al.*, *Multinational Coproduction of Military Aerospace Systems*, RAND Report R-2861-AF, October 1981; and *Issues Concerning the Transfer of US Defense Manufacturing Technology*, Report prepared for the Committee on International Relations, House of Representatives, by the Congressional Research Service, Library of Congress, 30 June 1977.

[11] *Two-Way Street* (note 10), p. 75.

[12] See, for instance, the discussion by Bray, F. T. J. and Moodie, M., *Defense Technology and the Atlantic Alliance: Competition or Collaboration?* Foreign Policy Report (Institute for Foreign Policy Analysis, Inc., Cambridge, Mass., 1977), p. 15.

[13] *Defense Market Survey, Panavia Tornado*, (DMS, Greenwich, Conn., 1983). According to the 1982 guidelines, arms exports are permitted if the government can provide convincing arguments that exports are necessary to FR Germany's vital international and security interests; see SIPRI, *World Armaments and Disarmament, SIPRI Yearbook 1983* (Taylor & Francis, London, 1983), pp. 275–77.

[14] *SIPRI Yearbook 1983* (note 13), p. 278.

[15] *Defense Market Survey, Milan* (DMS, Greenwich, Conn., 1981).

[16] See the interview with Marcel Mover, President of Euromissile, in *Defense and Armaments*, No. 17, March 1983, p. 58.

[17] *Aviation Week & Space Technology*, 24 October 1983, p. 22.

[18] *Defense Market Survey, HOT* (DMS, Greenwich, Conn., 1981).

[19] *Transatlantic Cooperation in Developing Weapon Systems for NATO: A European Perspective*, GAO PSAD-79-26, US General Accounting Office, 21 March 1979, p. 23.

[20] *Aviation Week & Space Technology*, 30 May 1983, p. 114.

[21] *The Fergusson Report* (note 7), pp. 6–8.

[22] *Flight International*, 12 November 1983, p. 1302.

[23] *Aviation Week & Space Technology*, 15 August 1983, p. 22.

[24] *Interavia Airletter*, 1 December 1976.

[25] *Defense & Foreign Affairs*, No. 3, 1980, p. 6.

[26] *Military Technology*, June/July 1980, p. 94.

[27] *A European Armaments Policy*, Western European Union Document No. 786, 31 October 1978, p. 17.

[28] Rich, M. *et al.* (note 10), pp. 76–78.

[29] Franko, L. G., 'Restraining arms exports to the third world: will Europe agree?' *Survival*, January/February 1979, p. 25.

[30] *The Fergusson Report* (note 7), p. 27.

6. Statistics on military research and development expenditure

MARY ACLAND-HOOD

Superscript numbers refer to the list of notes and references at the end of the chapter.

I. Introduction

Much of today's very large military expenditure pays for new and modernized weapons rather than for greater numbers of existing weapons. These qualitative changes are even more likely than quantitative increases to cause uncertainty and insecurity and to stimulate more changes in response. The qualitative arms race is fuelled by military research and development (R&D): even static or declining levels of military R&D create long-lasting pressures to increase military spending provided that some technological change has been produced. It is clear that for this reason alone military R&D is more significant than its relatively small share of the resources used for all military expenditure would indicate. Moreover, while world military R&D is only about one-tenth of total world military expenditure, it uses a much greater proportion of the world's research resources—probably about a quarter of all research and development expenditure[1] and almost as high a proportion of all the scientists and engineers engaged in research.

The lack of hard information about many countries, including two of the big spenders (the USSR and China), makes it impossible to be precise about total world R&D expenditure. However, it seems likely that the total in 1983 was around $60 billion in current money terms. In volume terms there was probably not much difference in total spending between the 1960s and the late 1970s—with possibly some small decline in between—but it seems likely that the volume of spending may have risen by around one-fifth since 1980.

The distribution of world military R&D is and has been highly concentrated—much more so than total military expenditure. While the USA and the USSR together account for roughly half of all military expenditure, their share of world military R&D expenditure was estimated to be around four-fifths in the 1960s,[2] and although it probably fell to about three-quarters at the end of the 1970s, it seems to be back to about four-fifths now. However, the concentration was not much diminished by this estimated fall: throughout the period 1960–83, 90 per cent or more of the total was accounted for by the six largest spenders, who are, in addition to the USA and the USSR, the UK, France, China and the Federal Republic of Germany. Data for the USA, the UK, France and FR Germany are given in tables 6.1–6.6. Estimates for the USSR vary wildly,[3] and a range of values which fall within one-third and two-fifths of the world total has been assumed. China's spending is assumed to fall somewhere between FR Germany's and France's: nearer the former in the 1960s and nearer the latter more recently.

II. Trends and pattern of spending in 19 countries from 1961

The 19 countries included in tables 6.1–6.6 are those for which reasonably reliable data are readily available. They account for over one-half of total military R&D expenditure and, although they exclude the USSR (one of the top two spenders) and China (one of the top six), they cover all the groups into which the significant military R&D spenders fall. Among other countries excluded are some which are almost certainly significant military R&D spenders (Czechoslovakia, Argentina, the German Democratic Republic and Israel) and others which probably are (South Africa, Pakistan and Brazil), but the total military R&D expenditure of all these excluded countries was unlikely to have been much more than $1 billion in 1980.

Table 6.1 shows fiscal year military R&D expenditures in national currencies at current prices for the 19 countries. These are the basis for the other tables.

Table 6.2 shows military R&D expenditures adjusted to calendar years and converted to constant 1980 US dollars so that volume trends can be identified, comparisons made and total expenditure estimates in volume terms made for this group of countries. Because the figures are at constant 1980 prices the recent figures are smaller than the current price estimates which form these countries' share of the tentative world total (see page 165). The high degree of concentration of military R&D in a small number of countries is clearly shown, and the countries fall into distinct groups, with infrequent moves between them. The USA—in the absence of figures for the USSR—is in a class of its own, spending $15–22 billion, much more than all the other countries put together and at the very least four times as much as the next largest. The United Kingdom and France form the next group, spending between $1 billion and $3.5 billion each annually, followed by the FR Germany with $0.4–1 billion and Sweden with $0.2–0.4 billion. US spending, which was at a historically high level in the 1960s, fell in the 1970s but rose from 1980 to become some 10 per cent higher in 1983 than it was in the 1960s, with further large real increases planned. In the UK, spending fell in the late 1960s and early 1970s after a rise in the early 1960s and began to rise again from the mid-1970s, levelling off in the 1980s at about one-fifth higher than in the early 1960s. French expenditure rose until the late 1960s, dipped, and rose again to half as much again as at the beginning of the period. West German expenditure followed yet another pattern, more than doubling from the early 1960s to the 1970s and finishing twice as high as in the early 1960s.

No clear universal pattern emerges but, because of the large initial differences between them, there was little change in the relative positions of the more significant spenders in spite of the different trends.

The next two tables deal with military R&D spending as a share of R&D in general. Table 6.3 shows how much of all government R&D spending is for military R&D. Here, too, there are big differences in share and in movement. The high military R&D spenders are, on the whole, also those with a large military share in government R&D—Japan is an exception. The USA and the UK spent on average roughly half of their government R&D money on military R&D, but in the UK the share fell from 60 per cent in the early 1960s to fluctuate between 45.1 and 51.8 per cent, while in the USA the share reflected the pattern shown by the volume of military R&D spending: falling and then rising above the early 1960s level with the rise expected to continue. France's share was around one-third throughout, and in FR Germany and Sweden the share fell.

The share of military R&D in government R&D can vary between countries because of differences in the government share in total national R&D expenditure. Table 6.4 shows how much of gross domestic expenditure (government and non-government) on R&D is for military R&D: it gives an indication of the military burden on the national scientific effort. If the countries are ranked in order of size of share, a comparison of tables 6.3 and 6.4 shows no dramatic changes in order, but the UK has a smaller share of gross domestic expenditure on R&D than the USA, reflecting a smaller share of government in total expenditure; and the US share, although rising, has not yet reached its 1963–65 level.

Table 6.5 shows the R&D share in total military expenditure. The rank order of countries is similar to that in the other tables (not unexpectedly, given, the greater concentration of military R&D expenditure than of military expenditure in general) and, again, there are considerable differences between countries. Table 6.6 shows the share of military R&D in gross domestic product: here too the rank orders are similar and there are large differences. Both these tables show the US share lower in the middle years and then rising but not yet as high as in the early 1960s.

The main points illustrated by the tables are: (*a*) that a lot of money is being spent on military R&D, concentrated heavily in a few countries;

Table 6.1. Military R&D in 19 countries, current prices, 1961–83 fiscal years,[a] national currencies

Country	Currency	Fiscal year[a] begins	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Australia	*mn dollars*	1 Jul	..	..	..	..	..	..	..	..	..	..
Belgium	*mn francs*	1 Jan	..	..	..	..	85	98	84	87	95	97
Canada	*mn dollars*	1 Apr	45	46	47	55	77	65	67	66	61	64
Denmark	*mn kroner*	Pre-1978, 1 Apr 1978–, 1 Jan	..	..	..	..	..	..	..	..	..	..
Finland	*mn markkaa*	1 Jan	..	..	..	..	..	..	..	..	..	6
France	*mn francs*	1 Jan	1 310	1 519	1 720	1 970	2 739	3 030	3 082	2 792	2 752	2 800
FR Germany	*mn marks*	1 Jan	381	410	546	647	739	803	1 024	982	1 070	1 151
Greece	*mn drachmas*	1 Jan	..	..	..	..	..	..	..	..	..	..
India	*mn rupees*	1 Apr		51	71	82	95	114	115	125	143	187
Italy	*bn lire*	1 Jan	..	..	3.8	4.9	7.6	8.5	9.0	9.0	8.8	11.3
Japan	*bn yen*	1 Apr	3.2	3.0	2.6	3.4	4.5	5.7	6.4	4.9	6.5	..
Netherlands	*mn guilders*	1 Jan	10	10	16	22	23	30	36	45	53	49
New Zealand[f]	*mn dollars*	1 Apr	..	..	..	..	..	..	..	..	..	[g]
Norway	*mn kroner*	1 Apr	11	12	14	18	23	18	22	24	27	32
Spain	*mn pesetas*	1 Apr	..	..	49	46	76	124	208	262	330	118
Sweden	*mn kronor*	1 Jul	281	322	371	432	464	529	573	549	411	..
Switzerland	*mn francs*	1 Jan	..	..	..	..	..	..	..	..	42	54
UK	*mn pounds*	1 Apr	249	243	241	262	262	260	241	237	242	258
USA	*mn dollars*	Pre-1975/76, 1 Jul 1976/77–, 1 Jan	7 339	7 383	7 273[b]	8 000	7 179	7 200	8 134	8 593	8 356[b]	7 981

Sources: See page 172.

Table 6.2. Military R&D in 19 countries, constant prices, 1961–83 calendar years, US $ million, 1980 prices and exchange-rates

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Australia	..	..	..	..	..	..	..	..	..	..	..
Belgium	..	..	..	..	7.0	7.7	6.5	6.6	6.9	6.8	7.4
Canada	..	108	108	122	160	148	138	133	119	117	..
Denmark	..	..	..	..	..	..	..	..	..	..	..
Finland	..	..	..	..	..	..	..	..	..	4.7	4.8
France	1 127	1 243	1 339	1 489	2 013	2 173	2 151	1 861	1 732	1 661	1 630
FR Germany	435	454	588	683	753	790	992	935	999	1 040	1 013
Greece	..	..	..	..	..	..	..	..	..	..	..
India	..	..	30	32	34	37	34	35	39	47	(59)
Italy	..	..	21	25	38	41	42	41	39	48	52
Japan	..	49	40	46	57	70	78	62	69	..	..
Netherlands	16	15	23	30	30	37	43	51	56	50	59
New Zealand[f]	..	..	..	..	..	..	..	..	..	..	1.9
Norway	7	8	9	11	13	10	11	13	14	14	..
Spain	..	..	4.3	3.8	5.5	8·4	13.3	16.0	19.7	6.6	..
Sweden	..	239	267	299	318	332	352	352	293	..	..
Switzerland	..	..	..	..	..	..	..	..	42	52	65
UK	..	2 827	2 734	2 812	2 756	2 636	2 424	2 237	2 141	2 132	2 240
USA	20 278	19 968	20 528	20 185	18 821	19 462	20 650	20 082	18 356	17 081	17 323

Sources: See page 172.

Notes for tables 6.1 and 6.2:

[a] Fiscal years are entered under the calendar year in which they begin with the exception of the USA, for which they are entere under the calendar year in which they end. This ensures that the fiscal years are entered under the calendar year in which the great part of them falls.

[b] Not comparable with previous years.

[c] Excludes unscheduled new programmes.

[d] Revised upwards: not comparable with previous years.

[e] Defence Research and Development Organization only.

[f] Expenditures of the Ministry of Defence, which are included in R&D objectives other than defence.

[g] Less than New Zealand $500 000.

[h] Fiscal years.

1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
..	..	..	..	..	80	..	89	..	..	..	..	..	..
111	126	..	105	114	117	68	50[b]	77	58	64	87*	(99[b])*	..
..	..	..	..	60	71	79	82	86	98	109	(131)*	(158)*	..
..	..	..	..	5	7	8	8	4	5	5	6*	6[c]*	6[c]*
7	7	8	10	12	14	15	17	19	20	24	29	32*	..
2 900	3 050	..	4 650	5 050	5 600	6 100	7 500	9 350	11 350	14 900[d]	17 800*	(18 103)*	..
1 179	1 019	1 352	1 411	1 405	1 491	1 596	1 732	1 848	1 730	1 565	1 675*	(1 803)*	..
..	..	..	..	..	..	53	82	95	194	221	..	..	..
(244)	(299)	343[b,e]	..	522[e]	581[b]	588	837	..	..	..	..	..	..
12.9	14.4	17.1	18.3	15.2	26.3	31.9	36.7	32.8	41.7	168.1[b]	168.1*	(216.7)*	..
..	..	..	..	17.1	18.9	22.0	24.2	26.7	29.1	(32.0)	..	..	..
62	63	65	60	68	74	74	84	91	98[b]*	98*	104[b]*	107*	110*
1	1	1	1	1	1	2	2	2	(3)	..	..	..	..
..	..	..	..	..	..	92	96	96	102	162	220	296*	..
..	..	..	..	..	773	285	409	432	261	..	..	..	..
..	..	..	..	780	..	1 143	1 097	992	942	1 055	1 482*	..	..
72	82	68	70	66	91	84	85	..	..	..	..	..	..
303	352	407	500	668	756	872	1 029	1 308	1 628	1 688	1 842*	1 916*	..
8 110	8 902	9 002	9 016	9 679	10 430	11 864	12 583[b]	13 594	15 075	17 841	22 102	24 906*	31 787*

1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
..	..	..	..	129[h]		120[h]	..	..	..	..	..
8.0	..	5.5	5.3	4.9	2.7	1.9	2.8	2.0	2.0	2.6*	(2.7)[b]*
..	..	..	..	82	86	84	80	81	81	(86)*	(98)[c]*
..	..	..	..	1.8	1.8	1.8	0.8	0.8	0.8	0.8*	0.8*
5.0	5.1	5.1	5.3	5.4	5.2	5.4	5.6	5.4	5.7	6.3	6.5*
1 615	..	2 019	1 962	1 984	1 977	2 235	2 517	2 686	3 109[d]	3 322*	(3 091)*
829	1 029	1 003	943	959	991	1 047	1 072	952	813	827*	(863)*
..	..	..	..	..	2.1	2.8	2.8	4.5	4.2	..	..
(70)	..	..	..	(98)	91	117	..	..	..	..	..
55	59	53	38	56	58	60	46	49	167[b]*	143*	(160)*
..	..	..	..	102	109	117	124	126	(131)	..	..
56	53	45	46	46	43	47	49	49*	46*	46*	46*
2.0	2.4	1.9	2.2	3.1	2.5	3.0	2.8	(2.8)	..	..	..
..	..	..	..	..	23	23	22	21	29	35*	44*
..	..	..	..	21.5	6.5	7.6	7.0	3.6	..	..	..
..	..	..	..	..	..	323	281	229	211	246*	..
70	53	50	44	60	55	55	..	..	..	..	..
2 429	2 572	2 696	2 848	2 862	2 840	3 079	3 393	3 598	3 475	3 450*	3 472*
17 622	16 714	15 631	15 397	15 785	16 364	16 207	15 850	15 767	17 125	19 473	22 041*

Conventions for tables 6.1–6.6

.. Information not available or not applicable.
* Provisional figures.
( ) SIPRI estimates.

Table 6.3. Percentage share of military R&D in total government R&D for 19 countries

	Fiscal years[a]								
	1961–65	1966–70	1971–75	1976–79	1980	1981	1982	1983	1984
	Averages of available years								
Australia	. .	. .	. .	12.6[d]	. .	. .	. .	. .	. .
Belgium	2.1[e]	1.3	0.8[b]	0.4	0.3	0.3	0.4	(0.4)*	. .
Canada	21.3	13.5	7.1[e]	6.7	5.3	5.1	(5.3)*	(5.7)*	. .
Denmark	. .	. .	0.5[e]	0.5	0.3	0.3	0.3*	0.2*	0.3*
Finland	. .	3.2[e]	2.5	2.2	1.9	1.9	2.0	2.0*	. .
France	39.8	32.4	29.5[b]	32.6	36.5	36.5	37.7*	(33.0)*	. .
FR Germany	20.2	19.4	12.0	11.9	10.1	8.8	8.7*	(9.4)*	. .
Greece	. .	. .	. .	3.7[c]	6.3	7.2	. .	. .	. .
India	15.3[e]	16.6[a]	21.2[e]	18.8[c]	. .	. .	. .	. .	. .
Italy	6.5[c]	4.9	4.6	4.1	2.7	6.5	5.6*	(6.1)*	. .
Japan	2.8	2.5[b]	2.2[e]	2.3	2.3	(2.4)	. .	. .	. .
Netherlands	4.3	5.0	4.0	3.0	2.9*	2.8*	3.0*	3.1*	3.1*
New Zealand	. .	1.4[e]	1.5	1.7	(1.6)	. .	. .	. .	. .
Norway	7.5	5.9	. .	5.1[c]	4.6	6.5	7.7	9.6*	. .
Spain	3.5[c]	6.6	. .	3.5	1.4	. .	. .	. .	. .
Sweden	49.9	39.4[b]	25.2[e]	21.7[c]	15.6	16.0	19.2*	. .	. .
Switzerland	. .	19.5[d]	18.5	17.9[c]	. .	. .	. .	. .	. .
UK	60.0	45.1	46.2	51.6	51.8	49.6	50.2*	50.0*	. .
USA	61.3	51.3	52.5	48.6	47.6	49.1	60.8	64.1	69.4*

Sources: See page 172.

Table 6.4. Percentage share of military R&D in gross domestic expenditure on R&D (government and non-government) for 19 countries

	Fiscal years[a]								
	1963–65	1966–70	1971–75	1976–79	1980	1981	1982	1983	1984
	Averages of available years								
Australia	. .	. .	. .	9.4[e]	. .	. .	. .	. .	. .
Belgium	1.0[e]	0.7[d]	0.5[d]	0.2[d]	. .	. .	. .	. .	. .
Canada	10.6	7.2	. .	3.6	2.8	2.6	(2.6)*	(2.8)*	. .
Denmark	. .	. .	. .	0.1[e]	. .	. .	. .	. .	. .
Finland	. .	. .	1.6[c]	1.2[d]	. .	1.0	. .	. .	. .
France	26.2	22.5	18.4[b]	19.6	22.2	24.4*	. .	. .	. .
FR Germany	10.8	10.3	6.9	6.2[c]	. .	. .	. .	. .	. .
Greece	. .	. .	. .	3.6[e]	. .	5.2	. .	. .	. .
India	13.9[e]	13.4[e]	. .	15.1[c]	. .	. .	. .	. .	. .
Italy	2.6[d]	2.4[b]	2.1	1.9[c]	1.4	. .	. .	. .	. .
Japan	0.9	0.9[b]	0.7[e]	0.6	0.6	(0.5)	. .	. .	. .
Netherlands	1.9[e]	2.3	2.0	1.6	1.5*	1.5*	1.5*	1.5*	1.5*
New Zealand	. .	. .	1.2[c]	1.4	. .	. .	. .	. .	. .
Norway	4.6[e]	3.9[b]	. .	3.5[d]	2.8	3.8	. .	. .	. .
Spain	2.7[e]	5.1[c]	. .	3.3[e]	. .	. .	. .	. .	. .
Sweden	34.2[e]	27.3[d]	15.2[e]	14.2[d]	. .	. .	. .	. .	. .
Switzerland	. .	2.4[d]	2.6	2.6[d]	. .	. .	. .	. .	. .
UK	34.5[e]	25.6[b]	28.9[d]	29.3[e]	. .	28.0*	. .	. .	. .
USA	40.6[e]	31.2[b]	27.7[b]	25.4	23.4	24.1	27.3*	28.1*	32.1*

Sources: See page 172.

Notes for tables 6.3 and 6.4:

[a] See table 6.1 for definitions.

[b] 4 years' data.

[c] 3 years' data.

[d] 2 years' data.

[e] 1 year's data.

Table 6.5. Percentage share of military R&D in military expenditure for 19 countries

	Calendar years							
	1961–65	1966–70	1971–75	1976–79	1980	1981	1982	1983
	Averages of available years							
Australia	..	..	..	3.43[c]	..	..	..	..
Belgium	0.32[d]	0.29	0.22[a]	0.09	0.05	0.05	0.07*	(0.07)*
Canada	3.12[a]	3.40	..	1.82	1.73	1.69	(1.64)*	(1.80)*
Denmark	..	..	..	0.10	0.05	0.05	0.05*	..
Finland	..	1.01[d]	0.87	0.82	0.70	0.72	0.75	0.78*
France	7.95	9.75	8.77[a]	8.88	10.16	11.49	12.03*	(11.02)*
FR Germany	3.01	4.78	4.02	3.97	3.57	3.00	3.09*	(3.16)*
Greece	..	..	..	0.10[b]	0.20	0.15	..	..
India	0.99[b]	1.28	(1.67)[c]	2.44[b]	..	..	..	..
Italy	0.48[b]	0.66	0.64	0.66	0.51	1.70*	1.37*	(1.47)*
Japan	1.31[a]	1.44[a]	..	1.28	1.29	(1.31)	..	..
Netherlands	0.67	1.26	1.17	0.90	0.93*	0.87*	0.87*	0.87*
New Zealand	..	..	0.59	0.79	(0.69)	..	..	..
Norway	1.02	1.04	..	1.42	1.23	1.71	2.01*	2.45*
Spain	0.27[b]	0.58	..	0.30	0.91	..	..	..
Sweden	9.22[a]	10.05[a]	..	7.54[c]	5.71	5.25	6.22*	..
Switzerland	..	2.45[c]	2.82	2.74[b]	..	..	..	..
UK	12.93[a]	10.79	11.12	12.77	13.45	13.78	13.02*	11.79*
USA	14.54	10.80	11.27	11.77	10.95	11.13	11.61	11.82*

Sources: See page 172.

Table 6.6. Percentage share of military R&D in gross domestic product for 19 countries

	Calendar years							
	1961–65	1966–70	1971–75	1976–79	1980	1981	1982	1983
	Averages of available years							
Australia	..	..	..	0.093[c]	..	..	..	..
Belgium	0.010[d]	0.009	0.006[a]	0.003	0.002	0.002	0.002*	..
Canada	0.109[a]	0.089	..	0.034	0.031	0.030	(0.034)*	..
Denmark	..	..	..	0.002	0.001	0.001	0.001*	..
Finland	..	0.013[d]	0.012	0.012	0.011	0.011	0.012	(0.012)*
France	0.451	0.454	0.339[a]	0.348	0.410	0.480	0.501*	(0.469)*
FR Germany	0.137	0.181	0.142	0.134	0.117	0.101	0.105*	(0.108)*
Greece	..	..	..	0.006[b]	0.011	0.011	..	..
India	0.036[b]	0.040	(0.057)[c]	0.074[b]	..	..	..	..
Italy	0.016	0.019	0.017	0.016	0.012	0.042*	0.036*	(0.040)*
Japan	0.012[a]	0.012[a]	..	0.012	0.012	(0.012)	..	..
Netherlands	0.029	0.046	0.039	0.029	0.029*	0.028*	0.028*	..
New Zealand	..	..	0.010	0.012	(0.012)	..	..	..
Norway	0.033	0.036	..	0.044[b]	0.036	0.049	0.060*	(0.075)*
Spain	0.005[b]	0.010	..	0.005	0.002	..	..	..
Sweden	0.378[a]	0.381[a]	..	0.251[c]	0.185	0.175	0.204*	..
Switzerland	..	0.055[a]	0.058	0.059[b]	..	..	..	..
UK	0.790[a]	0.572	0.551	0.604	0.684	0.676	0.667*	(0.655)*
USA	1.254	0.951	0.712	0.617	0.610	0.651	0.754	(0.824)*

Sources: See page 172.

Notes for tables 6.5 and 6.6:

[a] 4 years' data.
[b] 3 years' data.
[c] 2 years' data.
[d] 1 year's data.

(*b*) that while the share of national income being used for it is not enormous, it is significant; and (*c*) that big spenders also use very big shares of their government and total R&D resources on the military. In the absence of proof that the best way to achieve civil technological development is to spend money on something else, this seems likely to be a heavy drain on their scarce scientific and technological resources.

Notes and references

[1] Norman, C., *The God That Limps: Science and Technology in the Eighties*, Worldwatch Institute (W. W. Nation & Co., New York, 1981), p. 72.
[2] SIPRI, *Resources Devoted to Military Research and Development* (Almqvist & Wiksell, Stockholm, 1972), p. 10.

Sources for tables 6.1–6.6

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An Analysis of Federal R&D Funding by Function, FYs 1969–79, National Science Foundation Report 78–320, Appendix C.
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Bowles, J. R., 1983, 'Research and Development: preliminary estimates of expenditure in the United Kingdom in 1981', *Economic Trends* (Central Statistical Office, HMSO, London), p. 116.
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'Statistical Trends in Norway', *Financial Times*, 7 March 1983.
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Appendix 6A

Sources and methods for the military R&D data

The data are intended to give an indication of the level and pattern of and trends in resources used for military R&D for the countries for which reasonably reliable data for a number of years are available. There are therefore some very important omissions from the tables, notably the USSR, which is one of the two overwhelmingly biggest spenders, and China, which is one of the six largest. (The background to the estimates included in the tentative world total given on page 165 will be described in a SIPRI book on military research and development to be published in 1985: some indications of approaches to estimating USSR resource use were given in the *SIPRI Yearbook 1983* chapter on military R&D.[1])

The amounts spent on military R&D can indicate how much of a burden this use of resources is on economies, but do not lead directly to measures of its output—that is, of its results—although they are an important determinant of them. One reason is that there are considerable differences between countries in attitudes to technological change and in methods of implementing it, which lead to differences in the kind of results and probably to the output per unit of input.

One very important source for the military R&D figures is the Organization for Economic Co-operation and Development (OECD) Directorate for Science, Technology and Industry. The figures are, as far as possible, government funding for the objective 'defence' and defined according to the OECD *Frascati Manual*.[2]

Tables 6.1, 6.3 and 6.4 are on the basis of the fiscal years for which the data were originally reported. The fiscal years are defined in table 6.1.

Tables 6.2, 6.5 and 6.6 are on a calendar year basis and are intended to be as comparable as possible to the equivalent military expenditure tables in chapter 3 of this Yearbook. In table 6.6, the percentage shares in GDP are therefore not always identical to those given by the OECD. The military R&D figures were adjusted where necessary to calendar years, assuming an even spread of expenditure through each year. In table 6.2 consumer price indices were used as deflators as they are available over the period covered and for the countries included, and their use results in reasonable indications of trends in resources absorbed. Tables 6.5 and 6.6 are calculated from calendar year, current national currency figures.

The military expenditure series for the past 10 years are given in chapter 3 of this Yearbook, and they and the price indices, exchange-rates and GDP series are described in appendix 3B.

Notes and references

[1] SIPRI, *World Armaments and Disarmament, SIPRI Yearbook 1983* (Taylor & Francis, London, 1983), pp. 228–40.
[2] 'The socio-economic objectives of government R&D funding', *The Measurement of Scientific and Technical Activities: Proposed Standard Practice for Surveys of Research and Experimental Development—Frascati Manual 1980* (OECD, Paris), 1981, chapter 8.

7. The trade in major conventional weapons

THOMAS OHLSON and MICHAEL BRZOSKA

Superscript numbers refer to the list of notes and references at the end of the chapter.

I. Introduction

Critics of the international trade in weapons often argue that instead of buying peace and security, arms transfers aggravate economic and social insecurity in the Third World by draining precious foreign exchange, natural resources and human skills from basic needs. The arms trade statistics for the period 1979–83 seem to indicate that this view has made some impact in recent years. The annual values for the past five years show a flattening out—and even some decline—since 1980. However, compared with the previous five-year period, the total volume of transfers of major conventional weapons, measured in constant US dollars, is still about 30 per cent greater.

The new trend is not, however, the result of international detente or drastic revisions in national security policies. The explanation is instead to be found in the serious economic problems currently experienced in the world, particularly in the Third World. Such problems as deep debt or declining oil revenues are the main reasons for the current decrease in the demand for conventional weapons. One of the main trends in the arms trade since World War II is the gradual shift from near-monopoly to increasing competition in arms supply. The first phase, during the 1950s and most of the 1960s, can be described as hegemonic and oligopolistic. The second phase is the commercial oligopolistic period of the 1970s, while the present 'polypolistic' phase is characterized by a growing number of suppliers of weapons of all kinds, and a shift towards a buyer's market. From 1970, economic determinants of arms supply have gained impetus relative to political determinants, and Third World arms producers and newcomers from the west European arms export periphery, such as Spain, have entered the market.

As shown in section III, these developments—in combination with the present world-wide economic crisis—have increased competition among the suppliers. A growing number of arms producers try to sustain an indigenous arms industry while at the same time they face cut-backs in domestic procurement for budgetary reasons, and exports are seen as a solution.

Some of the reasons for, and consequences of, these new developments in the arms trade are described in section V. Section VI reviews some implications for arms transfer control. There is also a discussion in section IV of arms resupply in the Iraq–Iran war.

II. The flow of arms: general trends

Over the period 1979–83 the volume of major weapons delivered has ceased to grow. (All tables and figures in this chapter are based on the SIPRI values of major weapons *actually delivered* in the given year or years; for a description of the valuation method used, see appendix 7D.) The slow decline after 1980 is statistically valid, even making allowance for further upward revisions as more transfers are identified. The main reason for this decline is budget constraints following from the economic recession.

Of special interest in the arms trade statistics are the positions of the Soviet Union and the United States in the rank order of suppliers. As usual, there is no simple answer to the question of who is the largest arms supplier in the world. Some of the points to be made from comparing Soviet and US arms transfers are the following:

1. The aggregate figures for the five-year period 1979–83 show that the Soviet Union and the United States account for just over a third each of *total* arms exports: 37 per cent for the USSR and 35 per cent for the USA. The Soviet Union is the largest supplier to the Third World, while the United States leads in supply to the industrialized countries.
2. The annual values and shares for the past five years (table 7.1, figure 7.1) show that the United States has been in the lead in total arms exports since 1981, and that its exports to the Third World are increasing. The Soviet lead in the five-year totals is accounted for by that country's large export figures for 1979. The explanation for the general upward trend in US arms exports is the expansive arms export policy pursued by the Reagan Administration.
3. A large share of the total arms exports of both countries is directed to the Third World: 69 per cent for the USSR and 50 per cent for the USA. The USA, however, has about twice as many recipients in the Third World and it has granted about five times as many production licences. This shows that countries that receive weapons from the Soviet Union are getting them in very large numbers. Syria is currently the obvious case in point. The USA's smaller proportion going to the Third World is explained by the large number of weapons produced under US licence by west European and Japanese arms manufacturers.

Table 7.1. The largest major-weapon exporting countries: the values and respective shares for 1979–83

Figures are SIPRI trend indicator values, as expressed in US $ million, at constant (1975) prices; shares in percentages. Figures may not add up to totals due to rounding.

Country	1979	1980	1981	1982	1983	1979–83	Per cent of total exports to Third World, 1979–83
USSR	6 921	6 486	4 962	4 736	4 070	27 174	
	46.1	*42.4*	*33.8*	*32.7*	*30.3*	*37.2*	*69.1*
USA	3 901	5 512	5 519	5 704	5 264	25 900	
	26.0	*36.0*	*37.6*	*39.3*	*39.1*	*35.5*	*50.3*
France	1 633	1 194	1 292	1 227	1 192	6 539	
	10.9	*7.8*	*8.8*	*8.5*	*8.9*	*9.0*	*79.3*
UK	446	515	601	743	527	2 831	
	3.0	*3.4*	*4.1*	*5.1*	*3.9*	*3.9*	*77.3*
Italy	483	377	526	579	458	2 424	
	3.2	*2.5*	*3.6*	*4.0*	*3.4*	*3.3*	*93.3*
FR Germany	468	295	403	284	750	2 201	
	3.1	*1.9*	*2.7*	*2.0*	*5.6*	*3.0*	*55.4*
Third World	349	271	396	438	332	1 785	
	2.3	*1.8*	*2.7*	*3.0*	*2.5*	*2.4*	*97.3*
Others	810	660	989	792	856	4 106	
	5.4	*4.3*	*6.7*	*5.5*	*6.4*	*5.6*	*65.4*
Total	**15 011**	**15 310**	**14 688**	**14 503**	**13 449**	**72 960**	

Figure 7.1. The Soviet and US shares of world exports of major weapons: total exports and exports to the Third World, 1979–83

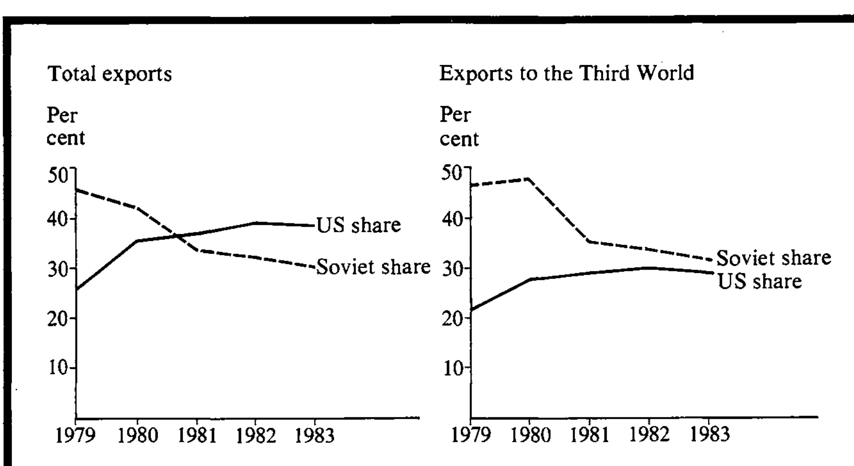
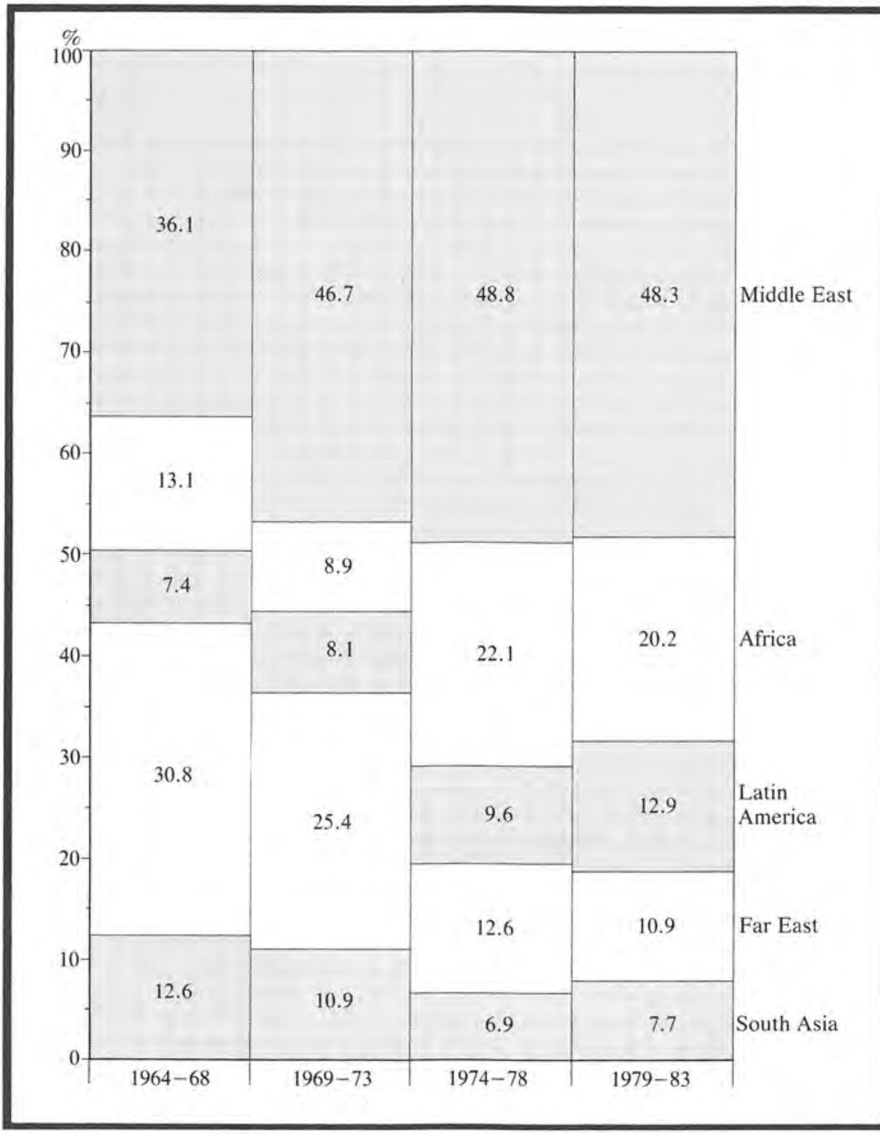


Figure 7.2. Percentage shares of imports of major weapons by the Third World: by region, 1964–83

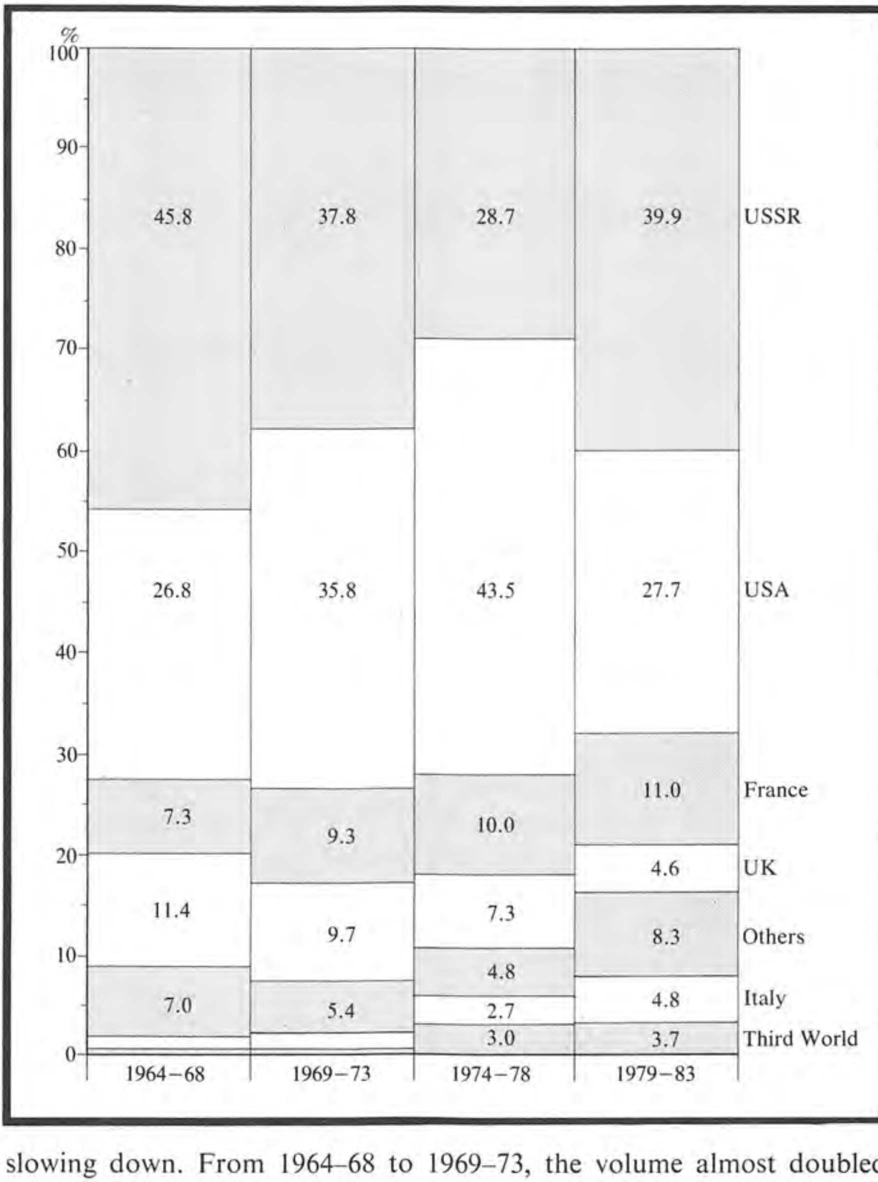


4. The long-term trends in arms exports to the Third World are shown in figure 7.3. The Soviet Union has—in terms of consecutive five-year totals and except for the period 1974–78—been the largest arms exporter to the Third World for the past 20 years (see also appendix 7A).

Several other notable facts show up in the statistics.

1. About 65 per cent of the total arms flow during 1979–83 consists of imports by the Third World. The rate of growth of this share, however, is

Figure 7.3. Percentage shares of exports of major weapons to the Third World regions listed in figure 7.2: by supplier, 1964–83



slowing down. From 1964–68 to 1969–73, the volume almost doubled; and it more than doubled in the next period, 1974–78. But from then to the most recent period, 1979–83, the increase was only 20 per cent.

2. The Middle East still accounts for almost 50 per cent of all Third World arms imports. The Latin American share is rising, while African arms imports are decreasing slightly (figure 7.2).

3. The five highest-ranking Third World arms importing countries—Syria, Libya, Iraq, Egypt and Saudi Arabia—alone account for about

Table 7.2. Rank order of the 20 largest Third World major-weapon importing countries, 1979–83

Percentages are based on SIPRI trend indicator values, as expressed in US $ million, at constant (1975) prices.

Importing country	Percentage of total Third World imports	Importing country	Percentage of total Third World imports
1. Syria	*11.8*	11. Algeria	*2.2*
2. Libya	*9.2*	12. Morocco	*2.2*
3. Iraq	*8.9*	13. Viet Nam	*2.0*
4. Egypt	*7.7*	14. Korea, South	*1.8*
5. Saudi Arabia	*7.0*	15. Peru	*1.8*
6. India	*5.5*	16. Taiwan	*1.8*
7. Israel	*4.7*	17. Indonesia	*1.7*
8. Cuba	*2.8*	18. Jordan	*1.5*
9. Argentina	*2.8*	19. Pakistan	*1.3*
10. Yemen, South	*2.2*	20. Kuwait	*1.2*
		Others	*19.9*
		Total	*100.0*
		Total value	**47 097**

45 per cent of all Third World arms imports (table 7.2).

4. FR Germany increased its arms exports drastically in 1983, mostly due to warship deliveries to Latin America. Approximately 18 per cent of West German arms exports during 1979–83 was accounted for by weapons produced under licence from FR Germany—no other supplier exceeds 10 per cent.

5. The Third World countries taken together are slowly increasing their share of total arms exports, and they now account for 3.7 per cent of Third World imports.

6. Spain has increased its arms exports considerably over the past five years. Previously negligible as an arms exporter, Spain accounted for 3.8 per cent of arms exports to the Third World in 1983 (see chapter 4).

III. The suppliers

The Soviet Union

Soviet arms exports are the most important, if not the only powerful, instrument of Soviet policy in the Third World. But the issues of how and why the arms trade is used are hotly debated issues. Those issues can only be inferred from known facts because of the dearth of information from the Soviet Union. Furthermore, there is disagreement about what facts are known.

US information on Soviet arms trade

In the report on Soviet arms exports in *SIPRI Yearbook 1983* it was claimed that Soviet arms exports are guided by a mixture of policy aims, among which the commercial has become more prominent.[1]

In the United States, many subscribe to what might be labelled 'the master plan' view. In the words of a writer in the *Armed Forces Journal International*:

> Unlike the West, the USSR does not export major amounts of arms to a wide range of buyers. The USSR heavily concentrates its exports and advisory efforts on a few key countries. While the end result often seems to further Third World extremism or to allow Third World nations to exploit the divisions between East and West, it is clear that the USSR is trying to create client states that will either serve Soviet interests or serve the purpose of exacerbating regional conflicts and rivalries which will damage the West.[2]

If indeed this has been the aim of Soviet policy in the Third World, the results have been poor. In some cases, the buyers have even behaved contrary to Soviet interests; in others, Soviet interests have shifted. To take four examples—the first four countries in the Third World with which the Soviet Union had 20-year treaties: Egypt (treaty signed in 1971) turned to the USA as its main supplier; India (1971) diversified its arms supplies in the late 1970s and is a strong proponent of non-alignment; Iraq (1972) did not receive weapons in the first months of its war with Iran and now is only reluctantly supplied; and Somalia (1972) turned to the West when the Soviet Union did not support its war efforts against Ethiopia. On the other hand, Soviet relations with Afghanistan, Angola, the Congo, Ethiopia, Mozambique, South Yemen, Syria and Viet Nam—countries with which 20-year treaties of friendship were signed between 1976 and 1981—are better, though not entirely smooth.

This view of an aggressive Soviet arms export policy is supported by figures the US government presents. In general, two types of figure are given: numbers of weapon systems and US dollar values for exports to individual countries or regions. In both types of data the Soviet Union emerges as the foremost supplier to the Third World.

These data have drawbacks. The prices put by the USA on Soviet weapon systems are not published. They seem to be derived from estimates of the 'use value' of weapon systems. The absolute numbers of weapon systems are not a very good measure: they do not take account of the diverse quality, age, level of sophistication, and so on of the weapons transferred.

There is also a problem with the reliability of these figures. An example is given in table 7.3.

Data from various US government sources are compared in columns 1 and 2, as well as column 6 (which is constructed from columns 4 and 5)

Table 7.3. US estimates of Soviet deliveries of major weapons, 1977–82

Weapon	1977–82 (1)	1977–81 (2)	1982? (3)= (1)−(2)	1978–82 (4)	1977 (5)	1977–82? (6)= (4)+(5)	1977–81 (7)=(2)	1982? (8)= (6)−(7)	5-year average 1978–82 (9)= (4)÷5
Tanks/SPGs	7 065	7 050	15	6 530	1 430	7 960	7 050	910	1 306
APCs and ACs	8 660	8 640	20	8 070	1 855	9 925	8 640	1 285	1 614
Artillery (100-mm and over)	9 590	8 450	1 140	7 800	2 590	10 390	8 450	1 940	1 560
Major surface combatants	32	32	0	32	4	36	32	4	6
Minor surface combatants	126	128	−2	127	16	143	128	15	25
Submarines	6	6	0	7	0	7	6	1	1
Supersonic combat aircraft	2 235	2 230	5	2 150	440	2 590	2 230	360	430
Subsonic combat aircraft	290	290	0	216	100	316	290	26	43
Helicopters	910	915	−5	1 030	70	1 100	915	185	206
Other military aircraft	345	345	0	340	45	385	345	40	68
Surface-to-air missiles	11 680	11 670	10	6 530	6 015	12 545	11 670	875	1 306

Sources:
Column 1: US Department of Defense, *Soviet Military Power*, 2nd ed. (US Government Printing Office, Washington, D.C., 1983), p. 13.
Column 2: Statement of Lt. General A. Williams, Director, Defense Intelligence Agency, before the Subcommittee on International Trade, Finance and Security Economics of the Joint Economic Committee, US Congress, Washington, D.C., June 29, 1982, p. 20.
Column 4: Statement of Major General Schuyler Bissell, Deputy Director, Defense Intelligence Agency, before the Subcommittee on International Trade, Finance and Security Economics of the Joint Economic Committee, US Congress, Washington, D.C., June 28, 1983, p. 15.
Column 5: US Department of State, *Conventional Arms Transfers to the Third World, 1972–81*, Special Report No. 102, August 1982, p. 13.

and column 7 (identical to column 2). Both resulting columns 3 and 8 should give figures for 1982. There are large discrepancies between these two columns, column 3 showing up as especially unreliable. The numbers in columns 3 and 8 are in general below the figures for the 5-year average 1978–82. The exception is artillery pieces with calibres of 100 mm or more.

There may be several explanations. One is that the numbers in the sources cited cannot and are not intended to be taken precisely. A second explanation is that the estimates for Soviet deliveries in 1977–82 have recently been revised downwards. This would be contrary to usual practice, since more transfers are normally identified over time. A third explanation is that the Soviet deliveries indeed declined in 1982, although it is improbable that they declined to the extent suggested by column 3 of table 7.3.

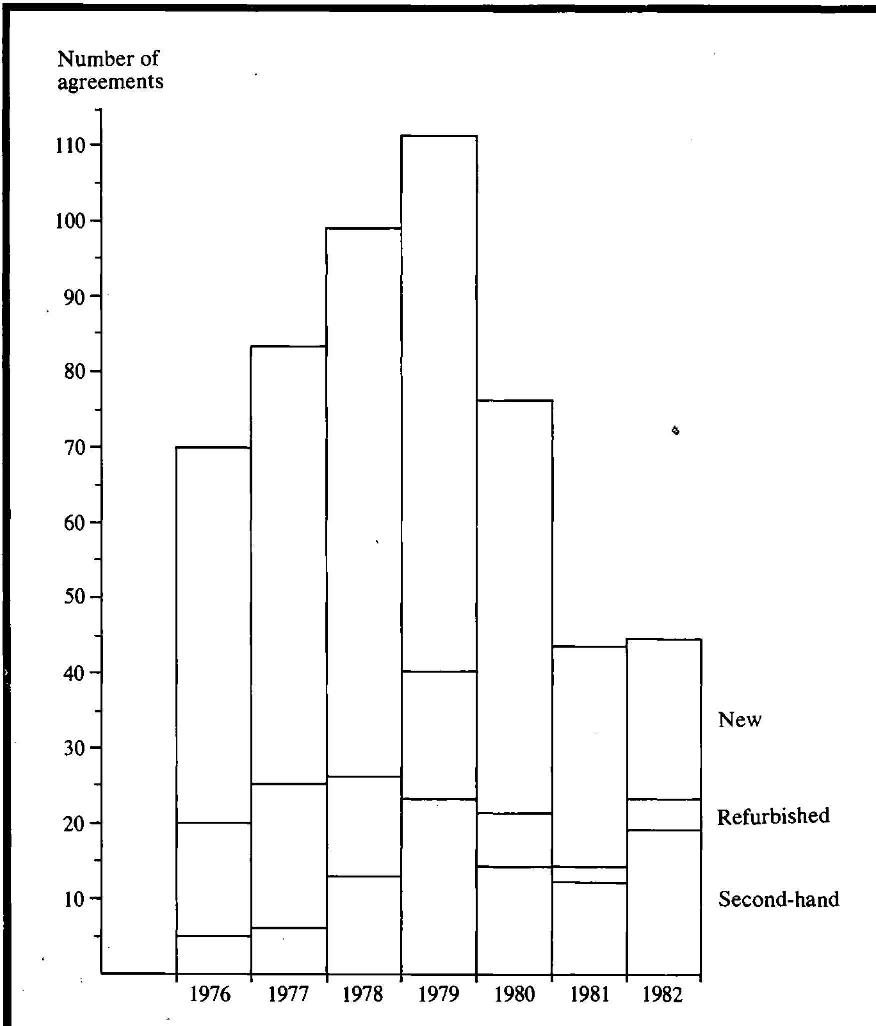
Soviet arms export policy

The SIPRI estimates of Soviet arms exports indicate a slight downward trend since 1980, both for total exports and for exports to Third World regions, albeit from a very high level (see tables 7.1 and 7A.1). Since 1979 there has also been a reduction in the number of new arms transfer agreements (see figure 7.4).[3] This is in line with the delivery data since there is a time lag between order and delivery dates. Figure 7.4 also shows another development: the number of agreements covering the transfer of new weapons has diminished while the number of orders for second-hand weapons has remained stable. Soviet deliveries do not always consist of new equipment; substantial numbers of ships, aircraft and armoured vehicles supplied are old. This of course adds to the problems of interpreting US data on numbers delivered; both old and new equipment are added together.

Both US and SIPRI statistics indicate certain changes in Soviet arms export policy after 1979. Indications come not only from numbers for orders and deliveries but also from cases of countries that were traditional Soviet clients but which the Soviet Union became reluctant to supply. The Soviet Union has shown some restraint in the Iraq–Iran war. Angola and Mozambique are not able to defend their borders or even large parts of their territories against South African raids. Libya's attempt to influence events in Chad was not wholeheartedly supported by Soviet deliveries (though this probably was not necessary given the very large amounts of Soviet weapons already in Libyan hands).

It is unclear why Soviet arms exports declined during 1980–83. One general reason is the economic crisis in most recipient countries. The Soviet Union also has economic problems that might have contributed to a less generous attitude towards military assistance through subsidized arms supplies. One observer of Soviet arms export policy has noted:

Figure 7.4. Soviet arms trade agreements: the distribution of new, refurbished and second-hand weapons, 1976–82



"It has also grown clear in recent years that Moscow's resolute arms aid policy has resulted in unsuspected follow-up costs." He goes on to conclude: "So it is hardly surprising that the Soviet leaders have decided to stop for breath for a while to consolidate what has already been achieved."[4]

Several political circumstances also enter into the assessment. The invasion of Afghanistan gave the Soviet Union a militaristic image throughout the Third World. The Soviet Union may also be afraid of direct clashes with a more aggressive USA. Finally, the USSR might have thought in terms of 'linkage' between restraint on their side in the Third

World and success in negotiations on arms control. If this were true, then changes in Soviet arms transfer policy could have been expected once it seemed likely that the Geneva negotiations would fail.

There are signs that the Soviet attitude has begun to change again. Shipments to Libya have resumed. Syria has received the SS-21 surface-to-surface missile, a powerful weapon even with a conventional warhead. The Soviet Union has also upgraded Syrian air defence and ground forces equipment. The Syrian losses in 1982 in the Lebanon war have been more than made good by the delivery of the SA-5 missile, T-72 tank and SS-21 missile. It is also reported that between 5 000 and 7 000 Soviet military advisers were sent to Syria to man many of these modern weapon systems.

Another case in point is India. In 1983 the Soviet Union succeeded in obtaining Indian consent to a major offer of Soviet tanks, aircraft and production technology (see section IV).

The United States

US arms transfer policy has been extensively described in previous SIPRI Yearbooks.[5] The policy declares that arms transfers are a key instrument of foreign policy: potential arms sales are judged by their contribution to US security. Compared to 1981, public concern about arms sales has decreased: other issues were predominant during 1983. Hence, applications of the arms transfer policy, in the form of deliveries and new contracts, quietly proceeded.

Deliveries of F-16 aircraft to Pakistan and Venezuela started during the year, and several new contracts were signed: FR Germany and the Netherlands decided to acquire the Patriot SAM system, Israel is receiving an additional 75 F-16s, Thailand ordered fighter aircraft, helicopters and missile-armed corvettes, Saudi Arabia and Lebanon ordered large quantities of main battle tanks and other armoured vehicles, and South Korea will receive additional batches of Improved Hawk SAMs.

Regarding the Taiwan–China issue (discussed in *SIPRI Yearbook 1983*),[6] in 1983 the United States delivered 66 refurbished F-104G Starfighter aircraft and offered Taiwan $530 million worth of missiles, armoured vehicles, tank conversion kits and spare parts. China's reaction to these agreements was surprisingly mild: Chinese Prime Minister Zhao Ziyang said in early January 1984 that China would not demand a halt to US arms transfers to Taiwan, even though he considered the recent US–Taiwanese agreements a violation of the 1982 US–Chinese communiqué which requires the United States to reduce the quantity and quality of weapons sold to Taiwan.[7] These deliveries are the main obstacle to improved relations between the USA and China, but China seems willing to put this issue aside. This should, in part, be seen in the light of the agreements made during Defense Secretary Weinberger's visit to China in September 1983, covering the transfer of US military and dual-use technology to China. US technology is vital to China's industrial modernization programme.

Another notable development is increasing US willingness to supply sophisticated surveillance and battle management aircraft. These aircraft represent a significant addition to the military capabilities of the recipient, as demonstrated by the Israeli E-2C Hawkeyes used in 1982 in the Lebanon war. The Hawkeyes have also been ordered by Egypt and Singapore, and other Third World countries are currently negotiating for purchases. Five E-3A Sentry AWACS aircraft were sold to Saudi Arabia in 1981. E-3As have also been deployed by the USA to survey wars, for example in Sudan (the Chad civil war with Libyan involvement) and in Saudi Arabia (the Iraq–Iran war). Some of the information gained was in both cases shared with the host country.

Consequently, arms transfers remain a key foreign policy instrument. However, others—notably military aid and the direct use of US military force—are becoming increasingly important. Military aid[8] is granted to countries considered of vital strategic or political importance to the USA, and which lack the funds to pay for what they want. The FY 1984 Foreign Military Sales (FMS) request was for $5.4 billion, of which $1 billion in forgiven credits to Egypt and Israel. This compares to total FMS financing of $2.8 billion for 1981 and $4.0 billion for 1982. Israel and Egypt will account for approximately 50 per cent of total US military assistance during 1983–84.[9] One specific reason for granting military aid is to obtain base rights in exchange—for example, in Kenya, Morocco, Oman, the Philippines and Somalia. Another reason is to support countries with a hostile Soviet-armed neighbour—for example Chad, Egypt and Sudan.

In 1983 the United States used military force in Grenada and Lebanon. The threat of similar actions is felt in Central America (see chapter 14). US advisers were present in Chad during the summer of 1983. This new attitude was underlined by Secretary Weinberger in February 1983: "Our plans and programs must, therefore, focus on strengthening our ability to respond effectively, with military force if necessary, in several strategically important areas, and in circumstances ranging from small-scale incidents to major military operations".[10]

France

French arms exports were analysed in *SIPRI Yearbook 1983*.[11] It was argued that sales of arms and military technology are critical for the French economy and that the export dependency of the French arms industry is steadily increasing. The percentage of arms sales in relation to French defence procurement and arms exports taken together increased from 14.8 per cent in 1970 to 38.1 per cent in 1980 and to 42.5 per cent in 1982.[12] For many of the key companies, such as SNIAS–Aérospatiale, Dassault–Bréguet and Thomson–CSF, it is well above 50 per cent. France now relies more than ever on arms exports in order to sustain employment and output, lower the price of equipment for its own forces, reduce the budget deficit and help to pay for large oil imports.

During its three years in power the Socialist government has not—in spite of election rhetoric—taken any steps to reduce arms exports. On the contrary, it has found it necessary to try to expand them. The political justification for this economic pragmatism is the view that arms clients should have the possibility of choosing suppliers who do not demand political or other commitments in exchange for arms sales, as the United States and the Soviet Union do. The only countries currently embargoed from French arms sales are Chile and South Africa. Other countries to which France is currently reluctant to supply weapons are Iran, Libya and Nicaragua.

The value of French arms export contracts, as reported and measured by the French government in current francs, amounted to 33.8 billion francs in 1981. This figure rose to 41.6 billion francs in 1982, largely due to the sale of Mirage 2000 fighters to Egypt and India and large orders for a variety of weapons from Iraq. The estimated figure for 1983 is about 32 billion francs,[13] with sales of the Mirage 2000 to Peru and the United Arab Emirates, and Kuwaiti orders for AS-332 Super Puma helicopters armed with AM-39 Exocet anti-ship missiles and for a sophisticated radar air defence system. Egypt added several follow-on contracts to its earlier orders for Mirage and Alpha Jet aircraft, and continued its purchases of French arms production technology—in December a production licence for the Super Puma helicopter was acquired.

The drop in order value in 1983 has seriously worried the French government and the almost exclusively state-owned arms industry. Marc Cauchie, director of export sales for the French government's General Armaments Agency, described the decreasing global demand for weapons as a "worldwide crisis".[14]

The French government is therefore looking for new and improved ways to promote arms exports: offices will be set up to handle arms sales to specific regions or countries; naval equipment—now accounting for approximately 10 per cent of French arms exports—will be subject to special marketing efforts; a diversification of recipients will be sought—currently the vast majority of arms sales are to the Middle East; and the French arms industry will be urged to seek long-term commitments through technology transfer programmes rather than outright weapon sales.

The magnitude of the arms trade in the future will largely depend on global economic developments. France seems to be in a favourable position relative to its competitor suppliers for a number of reasons. First, it has, and will continue to have, most of its arms clients in the Middle East. Saudi Arabia, Iraq, Egypt and the smaller Gulf states are among its principal customers. It can be assumed that the fall in oil revenues will not reduce their defence spending drastically. Feelings of insecurity, now fuelled also by the Iraq–Iran war and the Syrian–Israeli confrontation in Lebanon, will keep demand high. Second, the French arms industry offers a wide range of equipment, both sophisticated high-technology weapons and cheaper and more rugged weapons for poorer clients. Third, with troops in Chad and Lebanon, and large quantities of weapons on the Iraqi side against Iran, and in the recent Falklands/Malvinas conflict, France is currently very active on the international scene. This results in a long list of battle-proven weapons, and it contributes to France's reputation as a reliable arms supplier. Fourth, among the industrialized arms-producing countries, France is undoubtedly among those most ready to furnish its clients with arms production technology. Finally, many Third World countries opt for reduced dependence on the two major powers and instead try to seek other sources for their weapons.

A case in point is the Saudi decision in January 1984 to place an order with France worth 35–40 billion francs.[15] This contract covers the development and delivery of ground radars and Shahine missile batteries for a low-level air defence and is the largest weapon contract from a foreign buyer ever received by France. It alone surpasses the total order value for French arms during 1983. The contract can be seen as a follow-on to the so-called Sawari deal from 1980, which covered naval equipment, and it is an example of the attempts of the recipients to acquire weapons from several suppliers. This French air defence system will operate jointly with the AWACS aircraft and their related ground radar stations. The latter equipment, which will provide high-altitude reconnaissance, is part of the so-called AWACS deal between the USA and Saudi Arabia, finalized in 1981.

The United Kingdom

After a low point in 1980, British arms producers were able to increase their arms exports to the Third World in 1981 and 1982 (see table 7A.1). Deliveries dropped again in 1983, but this seems to be due to the timing of the fulfilment of orders and not a result of decreasing demand for British arms. 1983 was a very successful year for the British industry, with many substantial orders for Jaguar and Hawk aircraft, Sea King helicopters, Chieftain and Vickers Mk-3 tanks, missiles and ships. British arms exports will most probably rise substantially in the future. The official figures already show this trend: they more than doubled between 1979 and 1982.[16]

Britain had for some time after World War II been the second largest major weapon exporter until it was surpassed by the Soviet Union in 1955 and by France in 1975. Since then, the level of British sales has been equalled by Italian exports of major weapons.

There were basically four reasons for this loss of importance: (*a*) the general reduction in Britain's importance in world politics, including decolonization; (*b*) the shrinking of Britain's military industrial base due partly to cuts in the growth of military expenditures; (*c*) a concentration on products for the British armed forces, with little R&D for export products; and (*d*) restrictions on arms transfers, especially in the explosive growth phase of the arms market in the 1970s, when for instance an embargo was invoked against arms sales to Chile, a traditional British customer. The situation has changed under the Conservative government. Almost immediately after coming to power it adopted a new approach, outlined in Prime Minister Thatcher's speech at the opening of the Farnborough Air Show in 1980. Today the Minister of State for Defence Procurement, Geoffrey Pattie, described as the "supersalesman"[17] of British arms, sees his brief as encompassing defence sales as well as procurement. Within the government an enlarged Defence Sales Organization (DSO) helps to channel requests from foreign governments to companies, to advertise British products in magazines, exhibitions and the annual British Defence Equipment Catalogue, and to acquire export permits. The primary body to deal with export licencing is the Defence Secretariat 13 in the British Ministry of Defence (MoD). It has two basic interests: to safeguard sensitive technology and to promote exports.[18] A complicated weighting system of both products and countries has been introduced to ensure that the first aim is reached, so that attention can be devoted to the second.[19] Of the approximately 6 000–7 000 licence applications received per year, fewer than 3 per cent are formally refused, while it was previously as much as 7 per cent.

The type of weapons offered has also changed. First, the British arms industry has regained a strong technological position. It has a lead among European companies in military electronics, as well as in fields of special metallurgy, aircraft and aircraft engine design and production. A number of weapon systems have even been sold to the United States, a very protected market, among them Rapier missiles and Hawk trainer aircraft.

Second, and more important for Third World buyers, weapons are now more tailored to the demands of potential customers. Minister Pattie has said that one of his jobs is persuading the armed services to think in terms of foreign sales.[20] There are stripped-down versions of some weapon systems, such as the Hawk and Jaguar aircraft, and products exclusively for export, such as the Vickers Mk–3 MBT.

Finally, a most convincing argument in relevant circles is that British arms are 'battle-proven'. The Falklands/Malvinas campaign has been a powerful sales promoter; even before that, increased British military activity had an effect. One of the best British customers is Oman which has bought Jaguar aircraft, ships, missiles and now also the Chieftain tank. The UK actively supported Oman in the guerrilla war of the 1970s.

The policy of increased arms exports is not without costs. The loss of British lives, partly due to the use of British-built arms by Argentina in the Falklands/Malvinas war, was much discussed. The British government put pressure on other governments not to sell arms to Argentina; at the same time it honoured contracts of British sub-contractors for parts of exactly the same systems, for instance electronics for the French-built Exocet missile and engines for the German-built Meko frigate.[21]

On political grounds, the cases of Chile, Indonesia and South Africa are relevant. A second County Class missile destroyer will be supplied to Chile and possibly also Jaguar aircraft, in spite of internal opposition in Chile and opposition also from the United States.[22] Indonesia received Hawk ground attack aircraft, although it was pointed out that they might be used for attacks against opponent forces in East Timor.[23] Fixed radars were exported to South Africa. The government denied that this was a violation of the UN arms embargo. Outside observers suggested that the radars will have a military role. In a handbook on weapon systems, the Marconi S247 radar is only described vaguely,since "information relating to these radars is still largely subject to security restriction".[24]

Finally, the extent of the economic contribution of British arms exports is doubtful. At least in the past, the heavy financial burden of military research and development (see chapter 6) was not reduced through arms exports.[25] It is not proven that military R&D, which is increasingly geared towards arms exports, yields much civilian spin-off. Even in the electronics industry, where one might assume that such spin-off is important, it is in fact very limited.[26]

In conclusion, however, it is basically the economic motive that is driving Britain's 'supersalesman' and others in the arms industry to increase their promotion efforts. About 3 per cent of British exports in 1983 were arms exports. It is supplemented, in the UK as well as in other countries, by an interest in keeping a broad industrial arms production base. In Britain this will probably lead to increased pressure to export in the near future, when the decision to buy Trident submarines eats into the procurement budget for conventional weapons, thereby reducing home orders for these weapon systems.

Italy

Italian arms producers feel the general contraction of the arms market perhaps more than other suppliers of weapons. Italian arms production is heavily dependent on exports, which go predominantly to the Third World (see table 7.1). The rapid growth of Italian arms exports seems to have come to a halt. There have been only a few new orders in 1983, among them MB-339A jet trainers by Nigeria, S-211 aircraft by Singapore, Aspide anti-aircraft missiles by Egypt and Thailand, and ship orders by Nigeria and Venezuela—none of the size of the Iraqi order for Lupo and Wadi Class ships in 1980.

This presents a serious problem for the arms industry. A large production capacity was built up in the 1970s and early 1980s. The figure for employment in the military industry (excluding sub-contractors) has more than doubled in this period and now stands at over 80 000.[27] The growth rate was higher than for any other sector of Italian manufacturing in the 1970s.[28] Export dependence of the arms industry has increased to over 70 per cent, from 40 per cent in the early 1970s.[29] Arms exports are an important foreign exchange earner, accounting for about 8 per cent of all exports of engineering goods in 1982.[30]

Weapon transfers are also an important source of R&D funds for the Italian arms industry. Compared to other NATO countries, the amount of military R&D funds provided by the government is very small. But company money, in many cases coming from the investment funds of the state-owned holdings owning most major arms-producing companies, has been provided instead. These quasi-private R&D expenditures mainly have to be recovered through exports.

Data on the economic aspects of Italian arms production and exports are tentative, as the Italian government is reluctant to disclose information. The data it does release tend to overstate the importance of arms exports. For instance, in the Italian White Book on Defence of 1977 (the only one published so far) a figure of 2 300 million lire is given for "business conducted" in 1975 in the section on arms exports.[31] Independent estimates put actual Italian arms exports for that year at around one-sixth of that sum.[32]

Several proposals for more openness and stricter control of arms sales have recently been put forward in the National Assembly. So far, the majority of legislators seems to be content with present export policy, often described as a 'non-policy'. It is based on a ministerial decree, which has not been disclosed to the members of the Assembly.[33]

The drop in orders is not a consequence of any change in the Italian government's approach to arms transfer control. The Iraq–Iran war has been "a god-send for the Italian defense industry".[34] Italian companies have supplied Iraq with a large array of small arms and ammunition and Iran with ordnance as well. So other explanations must be sought. One factor is the phase of the production cycle in which many Italian arms companies currently find themselves. New products are in the development stage, such as the joint Aeritalia/Aermacchi/Embraer (Brazil) project for a new light attack aircraft called AMX and Agusta's A-129 Mangusta attack helicopter. Another point relates to the dependence on foreign technology that has characterized Italian arms production in the past. US companies granted a large number of licences for the production of aeroplanes, jet engines, armoured vehicles and components to Italian companies. FR Germany granted a licence to produce the Leopard 1 tank and its derivatives. Italian companies now regard the capability to produce weapons designed indigenously as technologically preferable. With increased competition, it is no longer easy for Italian arms companies to obtain licences for weapons that they want to export. The potential licencers are also interested in export earnings.

The move towards 'italianization' of production was in part a reaction to past experiences. The United States has on several occasions tried to pressure the Italian government not to allow the sale of arms, for instance in the cases of G-222 transport aircraft to Libya, CH-47C Boeing helicopters to Iran and Lupo Class frigates to Iraq. The instrument used was a veto on parts produced in the USA. The West German government also intervened when Oto Melara tried to export a licence-produced version of the Leopard 1, called the 'Lion'. The Italian manufacturers circumvented these pressures in most cases, for instance, when they installed Rolls Royce instead of General Electric engines on the G-222, or when they redesigned the Lion to the very similar looking OF-40. Still, prospective buyers could not rely on Italian suppliers as they did in the past. The result of the move towards 'italianization' has also been that potential customers are no longer certain that they will get proven, reliable technology; and the original designers of 'first-rank' technology are themselves willing to supply.

At the other end of the spectrum, concerning the 'cheap and rugged' weapon systems, Italian arms producers are feeling increased competition from the Third World and countries of the European arms export periphery. Countries like Brazil have taken Italy's place as a newcomer, but with proven designs. Arms producers in the UK, France and other countries are also trying to produce simplified versions of their more expensive products. The specific position of Italian arms production between the core and the periphery of world-wide arms production currently does not seem to attract the commercial success that the industry needs.

FR Germany

West German arms export policy, described at some length in *SIPRI Yearbook 1983*, has continued to be the focal point of political party and general public interest.[35] Discussions have focused on two issues: (*a*) the 'guidelines' on export policy for war materials and weapon-related materials; and (*b*) the sale of arms to Saudi Arabia.

Several politicians from the ruling coalition have tried to persuade the conservative/liberal (CDU/FDP) government to change the 1982 guidelines devised by the social democratic/liberal coalition government. These critics want to give a more political role to arms exports. They share this view with the arms industry, which has been asking for a relaxation of export regulations since the early 1970s. But there are currently no signs that the government intends to change the guidelines. Strong forces within the CDU as well as the FDP are working against expanding arms exports to the Third World. The Minister of State in the Foreign Office, Alois Mertes, a proponent of a restrictive policy, wrote that all West German governments have seen arms exports in the light of securing peace. This has always been done "through restricting arms exports and active pressure for a fair and controlled reduction of world-wide arms exports".[36]

However, West German arms exports have risen steadily throughout the 1970s and early 1980s (see table 7A.2). One reason is that the guidelines do not regulate all weapon transfers. Thus Iraq could receive Bo-105 helicopters (assembled in Spain) and tank transporters, while Iran could order the TAM, a German-designed tank built in Argentina but powered by an engine delivered from FR Germany.

The guidelines also state that West German participation in arms co-production projects is more important than export control. This, in fact, has been the policy since 1971. In the SIPRI arms trade statistics, exports are counted as the exports of the final country from which the weapon is exported. If exports are valued according to the project share of the countries participating in co-production, the arms export values of FR Germany increase (see table 7.4). Most of the weapons for which FR Germany is a co-production partner are not exported directly from FR Germany. Compared with the UK or France, FR Germany still has more restrictive export regulations; but they do not apply to most co-produced weapon systems (see chapter 5). In 1983, new co-production agreements were signed: for the PAH-2 anti-tank helicopter programme in conjunction with France and the programme to build a fighter aircraft together with France, Italy, Spain and the UK.

The political issues surrounding arms transfer decisions were discussed intensely in connection with the possible sale of armoured vehicles to Saudi Arabia. The Saudi government has for more than a decade expressed

Table 7.4. West German exports of major weapons: with and without sales of co-produced items, 1979–83

Figures are in US $ million, at constant (1975) prices.

	1979	1980	1981	1982	1983
To all regions					
Direct exports only	468	295	403	284	750
Co-produced items only[a]	51	58	59	39	47
Export including co-production	519	353	462	323	797
To Third World regions					
Direct exports only	229	137	262	122	470
Co-produced items only[a]	22	40	51	32	40
Export including co-production	251	177	313	154	510

[a] Co-produced items are valued according to the West German project share.

interest in buying West German tanks. Chancellor Kohl told the Saudi government during his visit in October 1983 that FR Germany would not supply the Leopard 2 tank but was prepared to discuss the sale of other arms. This was a reference to the Roland and Gepard AAVs as well as the Marder MICV, which the government has classified as defensive weapons. The sale to Saudi Arabia would be a change in West German arms export policy, as FR Germany has so far not directly supplied these vehicles to armed forces in the Third World. Requests from several countries have been turned down. Negotiations for armoured vehicles for Saudi Arabia have led to strong pressure from the Israeli government. A trade-off with Israel (one suggestion has been to supply the Israeli armed forces with the Rheinmetall 120-mm smooth-bore gun) might seem tempting to the West German government but seems not to have been negotiated when Chancellor Kohl visited Israel in January 1984. The Israeli government instead repeated its strong opposition to the Saudi sale, stressing Germany's historical obligations. Kohl stated upon his return that the decision would be made in Bonn, taking Israeli, Saudi and West German interests into account.

In 1983 the West German arms industry finalized three large export contracts with industrialized countries: the sale of six Type 210 submarines (with options on two more) to Norway, four Meko 200 frigates to Turkey and 420 Leopard 2 tanks to Switzerland. These deals are important as the production of Leopard 2s, Tornado MRCAs and Bremen Class frigates—the major projects for the West German armed forces—is slowly being scaled down. The real test of whether the new government will maintain or give up the few restrictions that are still in effect has yet to come. Pressure from the arms industry will build up as capacity utilization decreases.[37]

IV. Some recipient perspectives

The Iraq–Iran war and the arms trade

The Iraq–Iran war, now in its fourth year, has developed into a military and diplomatic stalemate: a war of attrition in which neither adversary appears to have the military strength to defeat the other or the will to negotiate a peaceful settlement of the conflict. Recent developments, however, have increased the likelihood of a technological and/or geo-

Figure 7.5. The Persian/Arabian Gulf region

graphical escalation of the conflict—thus making the war a global concern. Arms resupplies continue to reach the adversaries in sufficient quantities for the war to continue.

The factors underlying the Iraqi decision to invade Iran in September 1980 were manifold. Among a complex web of historical, ideological and legal aspects, the issue claimed by Iraq to be most important concerned the border between the two countries along the Shatt-al-Arab River, and some nearby territories. This river is a vital strategic and economic artery for both countries: it provides Iran with its only waterway access to the oil ports of Khorramshahr and Abadan, and it is Iraq's main lifeline to the sea (see figure 7.5). Behind these Iraqi claims there was a broader aim: to destabilize and overthrow the fundamentalist Islamic government in Iran and to take the place of Iran as the predominant military power in the Gulf area. This would also mute the growing domestic unrest in Iraq, which is caused in part by Iran's Islamic revolution.

The Iraqi invasion was obviously based on a misperception of Iran's military capability and will to defend itself. The Iraqi leadership envisaged a quick victory against an enemy weakened by internal turmoil, purges of the officer corps, and arms resupply and maintenance problems. This turned out not to be true. Instead, the protracted and bloody war, with more than 300 000 soldiers and civilians killed, has put severe strains on the economies of the two countries. Both countries have spent a large proportion of their national income on weapons, ammunition and spare parts. Iraq is in the worse situation: it has used up its financial reserves, civilian development programmes have been abandoned, and the country has been forced to drastically reduce its oil exports. Due to war damage and pipeline cut-offs, Iraq was in late 1983 able to export only about one-fifth of the amount of oil exported before the war. Iran's economy is in a better state. It exported in 1983 about three times as much oil per day as Iraq. The Gulf war has become an economic war in which both sides try to disrupt the main source of revenue of the other—the flow of oil.

Although they undoubtedly view Iran as a potentially more dangerous state than Iraq, the reactions of the Gulf states have been cautious—at least in terms of public commitment. None of them, including Saudi Arabia, has the capability to defend itself, should any of them become actively involved in the war. On the other hand, these countries share several common security concerns, for example, the fear of domestic unrest caused by a spreading Islamic revolution, the fear of the hegemonic aspirations of Iraq and Iran, and fear of intervention by the major powers. The formation of the Gulf Cooperation Council (GCC)[38] in 1981 provided a formula to reconcile these security needs. The Gulf states, primarily Saudi Arabia and Kuwait, have provided well over US $20 billion[39] to sustain Iraq's war effort and to prevent an Iraqi defeat—money that protects them from both Iran and Iraq. The political leaderships in the GCC countries are seemingly content with having the two regional powers fighting each other rather than expanding their influence into the smaller states of the Gulf.

The United States and the Soviet Union have both declared their neutrality in the war, they both envisage unpredictable advantages—or losses—from the war, and they have both, directly or indirectly, supplied both belligerents with weapons during the course of the war (see table 7.5). Although a resumption of diplomatic relations with Iraq is expected during 1984, the United States has, by the end of 1983, no diplomatic relations with—and little leverage over—either party. The Soviet Union has diplomatic relations with both Iraq and Iran, a friendship treaty with Iraq and Syria, and strong military ties with Libya. Libya and Syria are also among the main weapon suppliers to Iran. The USSR is thus in a complex situation, with Iraq, Iran and their allies making their claims on support a test of Soviet credibility.

There are several points to be made regarding US and Soviet positions in the Iraq–Iran war. On the one hand, the fact that the war continues reflects their limited abilities to stop the war through diplomacy. On the other hand, they do not perceive the war, in its present and still limited form, as a serious threat to their interests in the area. On the contrary, the Soviet Union is directly supplying Iraq, and it is in the interest of both major powers that their allies deliver weapons to both Iraq and Iran. After the war, Iraq and Iran will have to rebuild their civilian and military structures. The continued limited war thus creates the conditions for Iraq's and Iran's future reliance on the major powers. The nature of this reliance, however, remains highly obscure. The USA and the USSR do not, therefore, wish to limit their future options by committing themselves too deeply at the present stage.

Arms resupply during the war

The weapon flows to Iraq and Iran are illustrated in table 7.5.[40] Only confirmed deliveries of major weapons, or other forms of support, have been included. Arms resupply during war in general is more complex, covert and difficult to verify than in peace-time; the table undoubtedly under-estimates the complexity of the real situation.

The number of arms suppliers increased dramatically after the outbreak of the war: in the case of Iraq, from 3 to 18; and for Iran, from 5 to 17. Second, the supply patterns have changed. Third, unlikely groupings of countries emerge as suppliers, or supporters, of the same party. Iran, for example, has received weapons from such politically disparate countries as Israel, Libya, North and South Korea, South Africa, Syria and Taiwan. Furthermore, both countries rely to a significant extent on private arms

Table 7.5. Arms resupply and other support to Iraq and Iran, 1980–83

	Iraq			Iran		
Country[a]	Major weapons before war	Major weapons during war	Other support during war	Major weapons before war	Major weapons during war	Other support during war
USA		×[b]		×	×[c]	×[c]
USSR	×	×	×	×	×[d]	×[d]
China		×			×	
Belgium			×[e]			
France	×	×	×	×	×[f]	
FR Germany		×[g]	×[g]			
Greece					×[e]	×[e]
Italy		×	×	×	×	
Portugal			×[e]			
Spain		×	×			
United Kingdom			×[e]	×		×[e]
Czechoslovakia		×	×			
German DR		×	×		×	
Hungary		×				
Poland		×	×			
Yugoslavia		×				
Austria		×[h]				
Switzerland		×			×	
Egypt		×	×[e,i]			
Israel					×	×
Jordan		×	×[e,i]			
Kuwait			×[j]			
Saudi Arabia			×[j]			
Syria					×	×
United Arab Emirates			×[j]			
Yemen, South						×
Pakistan			×			
Korea, North		×	×		×	×
Korea, South					×[k]	×
Philippines			×[j]			
Taiwan						×
Viet Nam						×
Algeria					×	×
Libya					×	×
Morocco			×			
Ethiopia			×[e]			
South Africa					×	
Sudan			×[i]			
Argentina					×	×[e,i]
Brazil	×	×	×		×[l]	

[a] Sometimes without official sanction or knowledge.
[b] 60 Hughes helicopters; Learjet 35A reconnaissance aircraft; Hercules transports.
[c] Not officially sanctioned; private dealers and individual companies; often via Israel.
[d] Via Libya, North Korea, Syria and WTO countries.
[e] Small arms, ammunition, or spares.
[f] Last three of 12 Kaman Class FACs ordered 1974.

dealers and circuitous delivery routes via third countries for their supply of small arms, spare parts and munitions.

Iraq has for several years tried to extend the sources of its weapons and move away from dependence on the Soviet Union. The main Western benefactor of this policy is France, although the USSR is still by far the largest single arms supplier. France has sold to Iraq approximately $5 billion[41] worth of arms since the start of the war, mostly on credit terms but also in exchange for oil. During 1982–83, Iraq accounted for 40 per cent of total French arms exports.[42] In 1983, France leased to Iraq five Super Etendard fighters armed with Exocet anti-ship missiles. This shows France's fear of an Iraqi defeat; it also increases Iraq's capacity to attack oil tankers and other targets in the Gulf. Other French deliveries include Mirage fighters, missile-armed helicopters and Roland surface-to-air missiles. Egypt, Italy and Spain are also among the main suppliers of arms to Iraq. Egypt has retransferred weapons from a multitude of original suppliers. Egypt's arms exports to Iraq during 1982 reportedly totalled $1 billion.[43]

Iran's main suppliers of major weapons are Libya, Syria and North Korea. It is reported that 40 per cent of Iran's arms imports during 1982, or $800 million, came from North Korea.[44] Support has also been given by Israel, South Africa and Taiwan, often referred to as pariahs in the international system. With foreign assistance, Iran is also in the process of enhancing its significant, indigenous capacity to produce weapons and munitions. Otherwise, Iran is heavily dependent on the private, international market for supplies. The most absurd example is probably the case of the private arms dealer who purchased captured Iranian equipment —M-47 tanks, howitzers and mortars—from Iraq, and then resold it to Iran.[45]

Effect on regional arms procurement

Many of the current procurement programmes of the GCC countries were initiated before the war started, fuelled by other regional developments, for example the Iranian revolution and emerging Shi'ite fundamentalist movements in the largely Sunni Muslim-dominated GCC states, Iraq's growth as a major regional power and the Soviet invasion of Afghanistan. The present threats arising from the Iraq–Iran war have resulted in further military acquisition programmes in the neighbouring

[g] Bo-105 helicopters direct and from Spain; Roland-2 SAMs from Euromissile; tank transporters.
[h] GHN-45 155-mm howitzers via Jordan.
[i] Training, military advisers or troops.
[j] Financial support.
[k] US-made AAMs for F-4 Phantom fighters.
[l] Armoured vehicles via Libya.

oil-producing Arab states. Since late 1980, all of the six GCC members have purchased major warships or missile-armed fast attack craft, sophisticated jet fighters, helicopters, main battle tanks or other modern armoured vehicles, and a wide range of anti-air, anti-ship and anti-tank missiles.

The main threat currently seen by the GCC states is an Iraqi attack on tankers passing through the Gulf, and the likely ensuing Iranian attempts to mine, or otherwise block, the Straits of Hormuz. In effect, all security threats in the area are threats to the oil flow. This makes them not only a regional but also a global concern. From the outset of the war, the United States and the Soviet Union have striven to keep the conflict from spreading beyond Iraq and Iran. The USA has pledged to protect free shipping through the Gulf.[46] US policy in the region is focused on protecting Western access to Gulf oil by supporting friendly regimes and building up US military installations in the Gulf.

Foreign intervention is unwanted, and the Gulf states are trying to prevent such a development, primarily through substantial arms imports. Another effort is the possible setting up of a joint GCC rapid deployment force: extensive manoeuvres have already taken place under the GCC umbrella. Another method is more co-ordinated arms procurement, as exemplified by the recent Saudi Arabian decision to acquire a complete low-level air defence radar network from France, including improved Shahine/Crotale surface-to-air missiles; and the simultaneous Kuwaiti order for a similar French air defence radar system.

Conclusions

The main conclusions to be drawn from the facts concerning the arms trade in the Iraq–Iran war are the following:

1. The weapon flows are in many ways different from those before the war. There is a dramatic increase in the number of suppliers, the patterns of supply are different from those before the war, and there are supplier groupings and interests which are not easily explained along standard political lines.

2. The procurement methods of wartime supply are different. Secret trade routes and arms merchants play a more significant role than in peace-time. The private, international arms market is booming. Many governments also profit markedly from the war.

3. The United States and the Soviet Union are maintaining a low profile—support is primarily given indirectly to both parties, often through their allies.

4. Except possibly for France, very few of the states involved in the arms resupply show signs of wanting to see an end to the war.

5. A massive rearmament process is likely to emerge in Iraq and Iran once the war ends, particularly in the field of high-technology weaponry. This will affect arms procurement policies throughout the region.

6. The prospects for arms trade restraint in the area seem bleak. The flows of arms resupply illustrate the fierce competition between supplier states. There are many semi-official and private suppliers willing to furnish the belligerent states of this conflict with weapons and other forms of support.

India and Pakistan

One of the exceptions to the general decline in arms transfers in the early 1980s is in the trade with India.

In 1983 India reportedly ordered Sea King helicopters and Sea Eagle missiles from the UK, RBS-70 missiles from Sweden, and BMP-1 MICVs, T-74 tanks, and MiG-29 and MiG-25 Foxhound aircraft from the Soviet Union. It also negotiated for the transfer of artillery weapons from the USA, although no deal was signed since the US government was unwilling to deliver the technology for licensed production. India then discussed the purchase of 155-mm artillery pieces with several west European countries.

More significant than such direct transfers are the licensing agreements which India concluded in 1983: for the Soviet MiG-27 (production of 200 is planned), the West German Do-228 transport aircraft and the follow-on production of Jaguar aircraft. The MiG-29 and the T-74 may also be licence-produced in India. The production plans of the Indian arms industry already include future licensed production or assembly of Milan anti-tank missiles, Type 209 submarines and Mirage 2000 aircraft. In addition, other projects are being pursued with foreign assistance, such as the Light Combat Aircraft for which West German, British and French companies have made proposals, and the MBT-80 Chetak tank, powered by a West German engine. Some of these projects might be cancelled, but there will be an increase in the capacity of the arms industry, which is among the largest in the world, employing about 250 000 people.[47]

As a consequence of increased arms production and increased pressure to export, a new arms export policy was adopted by India in 1983. The aim is to promote the export of small arms, military vehicles, electronics and helicopters, but not such weapon systems as tanks or fighter aircraft. In 1983 eight Chetak helicopters were sent to the USSR. If this Indian-produced derivative of the French Alouette helicopter performs well in competition with Soviet-built military helicopters, a large order may follow.

India's procurement and production plans are often viewed in the light of development issues. India is still among the 20 poorest nations in the world: more than half of the population lives below the subsistence minimum as defined by international development aid organizations. However, its industrial sector is rather large, larger for instance than Belgium's. The regular Indian response to this type of criticism is three-fold: first, that, compared with the industrialized countries, India is relatively unarmed; second, that the economic burden for India is below the Third World average if military expenditure is measured as a share of gross national product; and, finally, that India has threats to its security which it must counter. The biggest such threat is seen in Pakistani military force.

The Pakistani armed forces were in 1983 not able to order as many weapons as they wished to have, owing to financial problems. New orders include US-built G-134 Mohawk surveillance aircraft. Deliveries of F-16 aircraft from the United States and Q-5 Fantan-A aircraft as well as tanks from China substantially increased Pakistani military power.

There are at least four interrelated reasons for this continuing armament process on the Indian subcontinent. One is the availability of finance to the Indian government. Owing to its inward-looking development policy, India has not been as hard-hit by the world recession as other countries. A second point is the superpower interests in the region, especially after the Soviet invasion of Afghanistan. This was one factor in the rapprochment between Pakistan and the USA, including a commitment of $3 200 million of aid (financing the supply of helicopters, artillery and armoured vehicles) as well as the transfer of 40 F-16 fighter aircraft. Third, there are signs that India is more interested in becoming a major regional power. Finally, an important factor seems to be the Pakistan–India clash, involving the two countries in an action–reaction pattern of arms procurement.

An example is the acquisition of front-line fighter aircraft by the two countries. Until the late 1970s, there was a clear and simple pattern: wars led to the acquisition of new aircraft models in order to replace lost aircraft. The pattern was changed dramatically when India started to introduce the MiG-21bis, the Jaguar, the MiG-23 and the MiG-25. Pakistan acquired the F-16, at present the most modern aircraft in the region, which in turn was used by the Indian armed forces as a reason to order even more modern models (table 7.6). The recent Indian orders of Soviet aircraft are at least partly due to the Soviet invasion of Afghanistan, as this was the decisive factor motivating the US government to offer F-16 aircraft to Pakistan.

Whether or not the Indian and Pakistani perceptions of threat are real, they in any case strengthen the case for those in both countries interested in acquiring modern weapon systems, possibly far beyond what could be justified in the light of the security needs of both countries. It also clears the field for foreign arms salesmen eager to sell their products. They are, of course, currently more attracted to the economically better-off India.

In 1983 *HMS Invincible*, called by the *Times* the "most glamorous of the Falkland war veterans",[48] visited India on its tour around the world to show British arms. Less spectacular but more successful were the Soviet

Table 7.6. India and Pakistan: fighter aircraft introduced since 1963

India Designation (supplier)	Year	Pakistan Designation (supplier)
MiG-21 (USSR)	1963	
	1964	
	1965[a]	
	1966	F-6 (PR China)
	1967	
Su-7 (USSR)	1968	Mirage III (France)
	1969	
	1970	
	1971[a]	
MiG-21MF (USSR/India)	1972	Mirage V (France)
	1973	
	1974	
	1975	
	1976	
MiG-21bis (USSR)	1977	
	1978	
Jaguar (UK/France)	1979	
MiG-23 (USSR)	1980	
MiG-25 (USSR)	1981	
	1982	F-16 (USA)
	1983	Q-5 Fantan-A (PR China)
	After 1983	
MiG-27 (USSR/India)		
MiG-29 (USSR)?		
MiG-25 Foxhound (USSR)?		
Mirage 2000 (France)		

[a] Wars in 1965 and 1971.

efforts to sell in the past two years. The Soviet share in Indian arms procurement has dropped sharply since the late 1970s. Their interest in the Indian market does not seem to be different from that of other sellers, namely a basically commercial one. The balance of trade between India and the Soviet Union is increasingly in favour of India. Due to the secrecy both countries attach to arms deals, it is not known to what extent the Indian diversification of arms suppliers has added to this. But certainly the Soviet Union is very interested in a closer tie with Indian arms procurement again.

V. The determinants of supply and demand

Any attempts to restrain the international trade in conventional weapons will have to be based on, among other things, an insight into the factors that propel the trade in arms. Consequently, it is important to list these factors.

Supply factors

The incentives to export weapons are multiple. They can be grouped into two basic categories: political and economic factors. They are at work on different levels: the international, the national and the sub-national (industrial) levels.

Starting at the global or international level, the political factors are determined by the world-wide East–West conflict. One instrument in this hegemonic struggle is arms transfers. Obviously, the factors on the international level are primarily applicable to the major powers, the USA and the USSR. But other suppliers, such as France or Sweden, can use global rationales by pointing out that their weapons come free of political, military or economic strings. In the hegemonic conflict arms transfers are intimately intertwined with attempts to exert political leverage. Arms sales are seen as a means to establish or maintain influence in a region or a country, or to prevent other countries from becoming influential. Buying a modern weapon system is normally a long-term commitment from both parties: with the direct acquisition follows supply of spare parts, technical assistance, maintenance, training and education throughout the lifespan of the weapon. Economically, the aim is to ensure the stability of civilian markets and the inflow of necessary raw materials.

From a national point of view, there are such factors as the influence on the military elites of the recipients; burden sharing; standardization; and access to transit rights, facilities and spares. Furthermore, the longer production runs resulting from arms exports are claimed to be beneficial for a number of reasons: they lower national arms procurement expenditures through lower unit prices and help recoup some of the R&D costs; they ensure a stable employment level; and they provide an industrial capacity to increase production for national defence, should such need arise. In times of pressures to economize on domestic procurement expenditures, such arguments become very powerful. Also, arms exports generate insight into military R&D and production in other countries. Finally, there is the suggestion that arms exports, at least in the short term, help to improve the balance of payments, and that arms transfers open doors for civilian exports; conversely, restrictions on arms exports, it is argued, will cause other hidden losses to the economy.

On the sub-national or industrial level, the pressures to export arms are of a purely economic nature. First of all, in the West there are often specific, structural differences between the defence industry and the ideal free market enterprise. For example, *prices of weapons do not normally* *fall with reduced demand*; instead they tend to rise. Added demand from abroad holds the price rises down and the firm remains competitive. Another difference is that *supply does not always adjust to demand* because of the need for excess capacity in case of war. Arms exports help to finance this excess capacity. Second, arms exports are a highly profitable business for the arms industries: even if the weapons are sold on favourable credit terms for the recipient, the export earnings are normally guaranteed by the supplier's government. Third, in many defence industries arms exports account for a substantial part of total turnover, and with relatively large barriers to entry and exit this comprises yet another strong and built-in pressure to export. A substantial number of companies entered the arms business in the 1970s when demand boomed and they found it difficult to move back to civilian production in times of general slack in civilian markets.

Despite this, economic constraints in the recipient countries have so far caused a slow-down of the international arms trade in the 1980s. This has led arms manufacturers to intensify their marketing effort, illustrated for instance by the increasing number of arms fairs and exhibitions (see table 7.7). There is also a tendency for arms industries to dissociate themselves from their respective governments. From an arms control perspective there is an important point to be made: the various determinants listed above are not always pulling in the same direction. There is an inherent tendency towards a collision of interests between the political and economic determinants. This has most often occurred in countries with restrictive arms export policies—such as Sweden and FR Germany—taking the form of a clash between the government and the industry; but it also happened in the USA when President Carter's policy aimed at restraining US arms exports.

Demand factors

The pressures to import arms can be identified on levels similar to those for the pressures to export. On a regional or sub-regional level, there is the almost automatic pressure arising from circular arms procurement patterns, as exemplified by the case of India and Pakistan (see section IV). The key phrase is 'enhancement of national security'. It is a very ill-defined proposition, used to legitimize both the preparation to counter-attack and the acquisition of large weapon arsenals for internal repression.

Other factors on the national level are prestige reasons, and the proposition that the import of modern weapons and weapon technology is beneficial from the point of view of industrialization and development. There are also actors at the sub-national level—the military elite is the most important one: often it has vested interests and exerts a major influence

Table 7.7. Major international exhibitions of military equipment

First year	Name	Location (country)	Frequency[a]	Type of exhibit[b]	Organizer[c]	Exhibitors[d]
1983	Natsedes	China	?	N	E/S	I
1983	Expol	France	?	P	E	I
1982	World Defense Expo	USA	1	C	E	I
1981	Cairo Military Exhibition	Egypt	3	V	E	I
1980	Asian Aerospace	Singapore	3	A	E	I
1980	Defendory	Greece	2	V	E/S	I
1980	Feria Internacional del Aire	Chile	2	A	S	I
1979	Defence Components Exhibition	UK	2	C	E/S	N
1978	International Naval Technology Expo	Netherlands	2	N	E	I
1976	British Army Equipment Exhibition	UK	2	G	S	N
1976	Electronics for National Security[e]	Belgium	2	EC	E	I
1976	Mostra Navale	Italy	2	N	S	N
1971	Royal Naval Equipment Exhibition	UK	2	N	S	N
1968	Satory	France	2	G	S	N
1968	Bourget Navale	France	2	N	S	N
1946	US Armed Forces Communications and Electronics Association	USA	1	EC	S	I
1945	Association of the US Army	USA	1	G	S	I
1932	Farnborough International Air Show	UK	2	A	S	I
1909	Salon Aérospatiale du Bourget	France	2	A	S	I

[a] Number of exhibitions per year.
[b] Exhibition of A = Aircraft (civil/military)
P = Internal security/Police equipment
C = Components
V = Various types
G = Ground forces equipment
N = Naval equipment
EC = Electronics/Communication equipment
[c] Organizer is either S: State/national organization or E: Exhibition company.
[d] Exhibitors are either N: National or I: International.
[e] Former name and location: Military Defense Electronics Exposition/International Defense Electronics Exposition, FR Germany.

on arms procurement decisions. Inter-service rivalry is a related factor which often leads to excessive arms imports.

The obvious restraining factor on the demand side is cost. When measured against the national security needs of a country plagued by economic problems, the cost of modern and sophisticated weapon systems may be deemed too high, particularly if the weapons do not seem appropriate for the relevant conflict scenarios.

VI. Arms transfer control

International efforts to limit the global arms trade have come to a virtual halt. None of the various suggestions and initiatives of the past decade has led to any action.

Major initiatives of the 1970s were the unilateral restrictions adopted by the Carter Administration in 1977 and the bilateral Conventional Arms Transfer Talks by US and Soviet delegations in 1977 and 1978. Important suggestions came forward within the UN: one was the revival of the idea of publishing international arms trade and possibly also arms production statistics; another was the final document of the first Special Session on Disarmament in 1978, which called for consultations between the major arms suppliers and recipients on the subject of arms transfers. The Brandt Commission—a body of international development experts—proposed a tax on arms transfers. On the side of the recipient countries, there is the 1974 Declaration of Ayacucho by which eight South American countries agreed to try to create a situation in which a ban on the procurement of sophisticated offensive weapons would occur.

The need for control of the trade in conventional weapons has become even more urgent now than in the past. Some of the basic rationales for arms transfer limitations are now more relevant.

1. The transfer of arms is often a political act, and with the present tensions between the USA and the USSR there is a danger that a conflict between their respective arms clients could escalate into a major power confrontation.

2. The arms market is today a buyer's market due to the global over-capacity of arms production, and the proliferation of arms production capabilities. Hence, the world becomes less stable than before, conflicts become more frequent, and the disposition to solve them peacefully decreases.

3. The imports of arms and military technology in general are an economic burden for all countries, but especially for those with limited foreign exchange earnings. The current extreme indebtedness of many countries in the Third World is aggravated by arms imports.

Prospects for the future

New attempts at control of arms transfers will have to be based on experience gained from the failures. Control has to lie in the interests of the participating parties. There are various proposals for action, such as: supplier versus recipient control; unilateral, bilateral, regional/global multilateral measures; quantitative or qualitative restrictions, and so on. Among the proposals, most attention should be given to those that: (*a*) combine diverging interests; (*b*) help to change or re-evaluate interests; or (*c*) provide countervailing interests.

For those suppliers that use arms exports as a foreign policy instrument, the danger of horizontal escalation is such a countervailing interest. It has led to tacit self-restraint in the past—in the field of nuclear technology, but also in the field of conventional armaments. In North and South Korea, for example, the Soviet Union refrained from supplying mobile air defence systems while the USA did not supply any advanced aircraft until 1981, when the Reagan Administration decided to sell F-16 aircraft to South Korea.[49] Currently, the perception of such a common interest does not seem to be very strong despite the recent conflicts, and the experiences learned from them, in the Middle East.

The economic determinants of arms exports, now so prominent for a large and growing number of suppliers, are at least partly outweighed by the so-called opportunity costs of arms; resources can only be used once, either for arms or civilian use. Furthermore, the long-term development potential—and thus the prospects for world trade in general—grow if civilian goods rather than arms are traded. As the economic benefits now accrue differently than they would if more civilian goods were exchanged, a compensation scheme would have to be devised. If this were achieved, a multilateral limitation involving suppliers with economic motives could be in the interest of all of them.

In the light of the detrimental effects of arms exports, this would seem to be an attractive development for all parties involved, especially the recipient countries. However, a very serious objection to such arms transfer limitations is raised by a number of recipient states. They are afraid that their security interests are not fully appreciated. This claim is based on the assumption that security can be bought through arms—a crucial and highly controversial assumption. The Brandt Commission, for instance, stated: "More arms do not make mankind safer, just poorer".[50] It seems vital for Third World countries—and, indeed, for all countries—to re-examine the issues of militarization and security needs in the light of the costs and consequences. One important aspect here is that Third World conflicts—real or perceived—are regionally based, even if they are often enmeshed in and fuelled by the competition between the major powers. Therefore, there is much room for initiatives toward arms limitations from the recipient's side. This should be paralleled by continued similar efforts on the part of the supplying countries.

One important confidence-building measure for any such discussion is open reporting on trade in and production of conventional arms. Secrecy promotes suspicion. More openness would also stimulate public debate of arms transfers, both in supplier and recipient states. Public debate, in turn, stimulates reconsideration and re-evaluation of the interests and determinants of the arms trade and the ways to control it.

Finally, any action to reduce the overcapacity in arms production will reduce the economic pressures to export arms—pressures which are an important determinant of the current level of the arms trade, independent of the security needs of the recipients or suppliers. There is increasing activity by trade unionists working in the arms industry to move away from arms production for exports.[51] The arguments in favour of planning conversion from arms production to civilian production, put forward by the UN expert committee on disarmament and development,[52] are further strengthened when seen in connection with arms exports.

Notes and references

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[35] SIPRI (note 1), pp. 275–80.
[36] *Rheinischer Merkur/Christ und Welt*, 20 May 1983.
[37] H. Wulf, 'Kein Geld mehr zu verpulvern', *Die Zeit*, 18 November 1983.
[38] The GCC members are Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates. The GCC was originally intended to co-ordinate the economic, cultural, scientific, educational and health activities of the participating states. Defence co-operation, on internal security matters and against external threats, received increasing emphasis during 1982–83.
[39] *Asiaweek*, 4 November 1983, p. 24.
[40] The term 'major weapons' conforms with SIPRI's general practice of covering deliveries of aircraft, armoured vehicles including heavy artillery missiles and warships. 'Other support, includes deliveries of small arms, ammunition and spare parts, provision of financial aid, transit rights, military advisers or troops, and training. Excluded are deliveries of civilian ships and aircraft, so-called dual technology and industrial assistance.
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Appendix 7A

Aggregate tables of the value of the trade in major weapons with the Third World, 1964–83

Table 7A.1. Values of imports of major weapons by the Third World: by region, 1964–83[a]

Figures are SIPRI trend indicator values, as expressed in US $ million, at constant (1975) prices. A = yearly figures, B^b = five-year moving averages.

Region code	Region[c]		1964	1965	1966	1967	1968	1969	1970	1971
8	Middle East	A	388	441	440	1 063	1 258	1 212	1 462	1 758
		B	447	545	718	883	1 087	1 351	1 353	1 544
12	North Africa	A	40	81	122	135	83	87	121	123
		B	63	82	92	102	110	110	116	129
10	Far East (excl. Viet Nam)[d]	A	392	340	497	199	266	586	271	419
		B	379	348	339	378	364	348	341	348
15	South America	A	51	110	138	128	208	158	148	222
		B	96	100	127	148	156	173	209	238
9	South Asia	A	79	213	391	271	297	312	300	499
		B	219	235	250	297	314	336	363	362
13	Sub-Saharan Africa (excl. S. Africa)	A	68	95	93	81	55	71	121	134
		B	70	77	78	79	84	92	94	113
14	Central America	A	34	18	21	16	8	10	6	47
		B	93	37	19	15	12	17	21	31
	South Africa	A	51	186	92	78	45	46	77	69
		B	100	112	90	89	68	63	52	51
11	Oceania	A	–	–	–	–	–	–	–	–
		B	–	–	–	–	–	–	–	–
	Total (excl. Viet Nam)	**A**	**1 104**	**1 485**	**1 794**	**1 971**	**2 220**	**2 482**	**2 506**	**3 272**
		B	**1 468**	**1 536**	**1 715**	**1 990**	**2 195**	**2 490**	**2 551**	**2 816**
	Viet Nam	A	91	74	237	494	473	298	433	435
		B	107	190	274	315	387	427	568	490
	Total[e]	**A**	**1 195**	**1 559**	**2 031**	**2 465**	**2 693**	**2 780**	**2 939**	**3 707**
		B	**1 574**	**1 726**	**1 989**	**2 305**	**2 582**	**2 917**	**3 118**	**3 305**

[a] The values include licensed production of major weapons in Third World countries (see appendix 7D). For the values for the period 1950–56, see *SIPRI Yearbook 1976*, pp. 250–51; and for 1957–63, *SIPRI Yearbook 1978*, pp. 254–55.

[b] Five-year moving averages are calculated from the year arms imports began, as a more stable measure of the trend in arms imports than the often erratic year-to-year figures.

[c] The regions are listed in rank order according to their five-year average values in the column for 1981. The region code numbers in the first column correspond to those used in the arms trade registers (appendices 7B and 7C).

[d] Viet Nam is included in the figures for the Far East after 1975, the year the Viet Nam War ended.

[e] Items may not add up to totals due to rounding.

– Nil.

.. Not applicable.

Source: SIPRI computer-stored data base.

1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
076	2 211	2 836	3 527	3 613	5 190	4 018	3 512	5 112	4 168	5 056	4 906
869	2 282	2 653	3 475	3 837	3 972	4 289	4 400	4 373	4 551	..	..
167	145	228	761	929	948	1 337	2 281	1 568	1 092	1 018	576
157	285	444	602	841	1 251	1 413	1 445	1 459	1 307	..	..
162	302	249	640	1 035	653	2 367	1 964	1 046	802	529	792
281	354	478	579	989	1 332	1 413	1 366	1 342	1 027	..	..
310	352	446	630	710	826	713	798	787	824	678	1 027
296	392	490	593	665	735	767	790	760	823	..	..
409	289	373	177	414	663	1 077	541	633	892	891	697
374	349	332	383	541	574	666	761	807	731	..	..
89	152	386	232	432	1 148	1 269	299	795	721	437	407
176	199	258	470	693	676	789	846	704	532	..	..
35	56	87	137	58	60	110	80	631	431	473	313
46	72	75	80	90	89	188	262	345	386	..	..
25	37	274	179	118	211	253	120	88	20	35	35
96	117	127	164	207	176	158	138	103	60	..	..
–	–	–	–	3	–	3	3	1	3	4	12
–	–	–	–	–	2	2	2	3	5	..	..
273	**3 545**	**4 878**	**6 284**	**7 312**	**9 699**	**11 147**	**9 599**	**10 660**	**8 954**	**9 120**	**8 764**
295	**4 050**	**4 858**	**6 344**	**7 864**	**8 807**	**9 685**	**10 010**	**9 896**	**9 420**	..	..
200	82	185	20								
467	384	–	–								
473	**3 627**	**5 064**	**6 304**	**7 312**	**9 699**	**11 147**	**9 599**	**10 660**	**8 954**	**9 120**	**8 764**
762	**4 435**	**5 156**	**6 401**	**7 905**	**8 810**	**9 685**	**10 010**	**9 896**	**9 420**	..	..

Table 7A.2. Values of exports of major weapons to regions listed in table 7A.1: by supplier, 1964–83[a]

Figures are SIPRI trend indicator values, as expressed in US $ million, at constant (1975) prices.
A = yearly figures, B = five-year moving averages.

Country[b]		1964	1965	1966	1967	1968	1969	1970	1971
USSR[c]	A	375	544	970	1 545	1 116	834	1 136	1 515
	B	669	773	910	1 002	1 120	1 229	1 615	1 249
USA[c]	A	372	540	514	481	754	1 244	1 258	1 179
	B	462	484	533	707	850	983	1 120	1 182
France[c]	A	137	96	140	68	288	172	203	276
	B	138	127	146	153	174	201	258	308
Italy	A	20	7	1	20	67	53	43	41
	B	10	14	23	30	37	49	51	49
UK	A	179	265	193	203	294	348	185	393
	B	188	203	227	261	245	285	318	322
FR Germany	A	26	13	83	4	11	17	1	25
	B	27	28	27	26	23	12	18	17
China[c]	A	51	9	47	17	5	10	22	106
	B	21	25	26	18	20	32	60	65
Netherlands	A	11	22	1	–	5	25	10	34
	B	7	7	8	11	8	15	20	27
Sweden	A	–	–	2	–	–	*	–	–
	B	–	–	–	–	–	1	1	2
Canada[c]	A	11	18	12	11	48	19	37	55
	B	11	13	20	22	25	34	40	31
Czechoslovakia	A	9	4	8	11	39	22	31	14
	B	9	10	14	17	22	23	24	16
Switzerland	A	–	1	1	1	1	–	2	2
	B	1	1	1	1	1	1	1	2
Japan[c]	A	1	6	11	30	49	2	*	*
	B	9	10	19	20	18	16	10	–
Third World	A	3	4	25	15	9	20	8	15
	B	9	10	11	15	15	13	14	16
Other industrialized, West	A	*	30	23	58	7	11	3	46
	B	11	22	24	26	20	25	16	18
Other industrialized, East	A	–	*	–	2	–	2	–	5
	B	2	–	–	1	1	2	1	1
Total[d]	A	**1 195**	**1 559**	**2 031**	**2 465**	**2 693**	**2 780**	**2 939**	**3 707**
	B	**1 574**	**1 727**	**1 989**	**2 305**	**2 581**	**2 917**	**3 118**	**3 305**

[a] The values include licences sold to Third World countries for production of major weapons (see appendix 7D). For the values for the period 1950–56, see *SIPRI Yearbook 1976*, pp. 252–53; and for 1957–63, *SIPRI Yearbook 1978*, pp. 256–57.
[b] The countries are listed in rank order according to their five-year average values in the column for 1981.
[c] Including exports to Viet Nam.
[d] Items may not add up to totals due to rounding.
* < $0.5 million.
– Nil.
.. Not applicable.

Source: SIPRI computer-stored data base.

1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1 225	1 537	1 930	2 160	1 554	2 156	3 526	4 565	5 157	3 171	3 043	2 848
1 469	1 673	1 681	1 867	2 265	2 792	3 392	3 715	3 892	3 756	..	..
1 166	1 061	1 404	2 343	3 892	4 826	4 727	2 036	3 072	2 613	2 758	2 557
1 214	1 431	1 973	2 705	3 438	3 565	3 711	3 455	3 041	2 607	..	..
351	538	449	593	553	1 282	1 070	1 161	931	1 053	1 023	1 017
363	441	497	683	789	932	999	1 099	1 048	1 037	..	..
52	56	139	72	159	348	341	423	326	499	556	458
66	72	96	155	212	269	319	387	429	452	..	..
369	316	579	647	587	536	553	383	374	476	589	366
368	461	500	533	580	541	487	464	475	438	..	..
37	3	116	138	131	60	41	229	137	262	122	470
36	64	85	90	97	120	120	146	158	244	..	..
158	27	104	63	57	66	154	26	55	134	113	163
83	92	82	63	89	73	72	87	96	98	..	..
27	39	33	42	29	72	64	169	108	57	44	15
29	35	34	43	48	75	88	94	88	79	..	..
5	1	6	21	21	5	16	69	103	34	23	23
7	6	11	11	14	26	43	45	49	50	..	..
39	6	1	6	34	29	116	28	17	42	90	21
28	21	17	15	37	43	45	46	59	40	..	..
14	1	15	6	6	–	18	45	45	22	7	19
15	10	8	6	9	15	23	26	27	28	..	..
2	2	*	1	8	5	6	22	15	29	31	32
2	1	3	3	4	8	11	15	21	26	..	..
–	–	3	–	3	–	14	21	–	–	–	–
1	1	1	1	4	8	8	7	7	4	..	..
18	20	276	185	202	134	382	338	271	390	420	317
67	103	140	163	236	248	265	303	360	347	..	..
11	19	11	13	46	162	113	51	24	93	302	438
18	20	20	50	69	77	79	89	117	182	..	..
–	–	–	2	30	18	6	32	27	78	*	20
1	1	6	10	11	18	23	32	29	31	..	..
3 473	**3 627**	**5 064**	**6 304**	**7 312**	**9 699**	**11 147**	**9 599**	**10 660**	**8 954**	**9 120**	**8 764**
3 762	**4 435**	**5 156**	**6 401**	**7 905**	**8 810**	**9 685**	**10 010**	**9 896**	**9 420**	..	..

Appendix 7B

Register of the trade in major conventional weapons with industrialized and Third World countries, 1983

This appendix lists major weapons on order or under delivery during 1983. (Note: Statistics in chapter 7 are for actual deliveries only.) The sources and methods for the data collection, and the conventions, abbreviations and acronyms used, are explained in appendix 7D. The entries are made alphabetically, by recipient, supplier and weapon designation.

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
I. Industrialized countries								
11 Australia	Canada	2	B-707-320C	Transport	1983	1983	2	
	France	18	AS-350 Ecureuil	Hel	1982	(1983)	(4)	For delivery 1983-84; 12 for
						(1984)	(12)	AF, 6 for Navy
		6	AS-350 Ecureuil	Hel	(1983)			In addition to 18 ordered 1982
		. .	Milan	ATM	(1983)			Unspecified number of missiles and 10 launchers ordered; follow-on orders expected; total cost: $6 mn
		(550)	R-550 Magic	AAM	1981	(1983)	(275)	Replacing obsolete Sidewinders on
						(1984)	(275)	Mirage fighters
	UK	. .	Rapier	Landmob SAM	1975	1978	(50)	Final assembly in Australia from 1983
						1979	(50)	
						1980	(50)	
						1981	(50)	
						1982	(50)	
						1983	(50)	
		2	SH-3D Sea King	Hel	1980	1983	2	
	USA	(30)	AGM-84A Harpoon	AShM	1982			Arming 10 P-3C Orions on order
		. .	AIM-9L	AAM	1983			Arming F/A-18 Hornets
		4	F-111	Fighter/bomber	1980	1983	4	An additional 4 may be ordered as attrition aircraft
		75	F/A-18 Hornet	Fighter/strike	1981			For delivery from 1984; 57 fighters and 18 two-seat trainers
		1	FFG-7 Class	Frigate	1977	1983	1	Third ship ordered Nov 1977
		1	FFG-7 Class	Frigate	1980	(1984)	(1)	In addition to 3 in service; ordered Apr 1980; licence production of 2 to follow
		2	KC-135	Tanker/transport	1982			For in-flight refuelling of RAAF F-111s and F/A-18 Hornets

		36	M-198 155mm	TH	1980	1983	(18)	
						(1984)	(18)	
		10	P-3C Orion	ASW/mar patrol	1982			Update-2 version; in addition to 20 P-3B/Cs in service; will probably replace the 10 P-3Bs; for delivery 1984-86
		(64)	RGM-84A Harpoon	ShShM	1976	1980	(16)	Arming 4 FFG-7 Class frigates
						1981	(16)	
						1983	(16)	
						(1984)	(16)	
		(96)	RIM-66A/SM-1	ShAM/ShShM	1976	1980	(24)	Arming 4 FFG-7 Class frigates
						1981	(24)	
						1983	(24)	
						(1984)	(24)	
7 Austria	France	24	Mirage-50	Fighter/MRCA	(1984)			Decided in principle
	Switzerland	6	PC-7	Trainer	1983			Replacing SAAB Safir; option on 6 more
	USA	24	M-109-A2 155mm	SPH	1982			US Letter of Offer Mar 1982
4 Belgium	Brazil	5	EMB-121 Xingu	Transport	(1982)			
	France	(1020)	Milan	ATM	1979	1980	(200)	
						1981	(200)	
						1982	(200)	
						1983	(200)	
	USA	(1224)	AIM-7E Sparrow	AAM	1977	1979	(60)	Arming F-16 fighters
						1980	(120)	
						1981	(216)	
						1982	(216)	
						1983	216	
		200	AIM-9L	AAM	1982			Will probably be purchased from European consortium which assembles the NATO Sidewinder
		124	M-109-A2 155mm	SPH	1983			For delivery 1984-85
		. .	SH-3D Sea King	Hel	(1983)			Unconfirmed
5 Bulgaria	USSR	. .	T-72	MBT	(1978)	(1980)	(50)	
						(1981)	(50)	
						(1982)	(50)	
						(1983)	(50)	
4 Canada	Brazil	. .	EMB-312 Tucano	Trainer	(1983)			Unspecified number reportedly ordered in connection with Brazilian order for DHC-5Ds
	UK	. .	Blowpipe	Port SAM	1981	(1982)	(50)	
						(1983)	(50)	

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
	USA	86	AIM-7F Sparrow	AAM	1980	(1982)	(12)	Arming F/A-18s; more to follow
						(1983)	(38)	
		182	AIM-9L	AAM	1980	(1982)	(24)	Arming F/A-18s; more to follow
						(1983)	(76)	
		138	F/A-18 Hornet	Fighter/strike	1980	1982	2	Order incl 113 single-seat fighters and 25 two-seat operational trainers; delivery schedule: 1982-88; Canadian designation: CF-18; total cost: $2 900 mn
						1983	(19)	
		26	M-109-A2 155mm	SPH	1983			
3 China	France	50	AS-365N	Hel	1980	1982	(1)	Ordered Jul 1980; second batch to be assembled locally; for offshore oil operations; may carry HOT ATMs
						1983	(10)	
7 Cyprus	Brazil	20	EE-9 Cascavel	AC	1982			
5 Czechoslovakia	Poland	22	An-2 Colt	Lightplane	1980			
	USSR	. .	AA-8 Aphid	AAM	1977	1978	(50)	Arming MiG-23s
						1979	(50)	
						1980	(50)	
						1981	(50)	
						1982	(50)	
						1983	(50)	
		. .	AT-4 Spigot	ATM	1979	(1980)	(480)	
						(1981)	(480)	
						(1982)	(480)	
						(1983)	(480)	
		. .	AT-6 Spiral	ATM	(1979)	(1980)	(24)	Seen on Mi-24 Hind-D helicopters; 2 missiles/helicopter
						(1981)	(24)	
						(1982)	(24)	
						(1983)	(24)	
		. .	M-1973 152mm	SPG	(1980)	(1981)	(10)	
						(1982)	(10)	
						(1983)	(10)	
		. .	M-1974 122mm	SPH	1979	(1980)	(50)	
						(1981)	(50)	

						(1982)	(50)	
						(1983)	(50)	
		. .	Mi-24 Hind-D	Hel	(1979)	1980	(12)	In service
						1981	(12)	
						1982	(12)	
						1983	(12)	
		. .	MiG-23	Fighter	(1977)	1979	(30)	Incl interceptor, ground attack and trainer versions
						1980	(30)	
						1981	(30)	
						1982	(30)	
						1983	(20)	
		. .	SA-9 Gaskin	Landmob SAM	1979	(1980)	(200)	
						(1981)	(200)	
						(1982)	(200)	
						(1983)	(200)	
		(40)	Su-20 Fitter-C	Fighter/ground attack	(1981)	(1982)	(20)	
						(1983)	(20)	
4 Denmark	USA	200	AIM-9L	AAM	1983	(1983)	(100)	Arming F-16s
		840	BGM-71A TOW	ATM	1980	(1982)	(420)	Order incl 62 launchers
						(1983)	(420)	
		46	F-16A	Fighter/strike	1977	1980	13	
						1981	13	
						1982	13	
						1983	7	
		12	F-16B	Fighter/trainer	1977	1980	3	
						1981	3	
						1982	3	
						1983	3	
		(72)	MIM-23B Hawk	Landmob SAM	1981	(1982)	(36)	2 btys with 12 launchers each
						(1983)	(36)	
		33	RGM-84A Harpoon	ShShM	(1983)			US Letter of Offer Jul 1983; arming Niels Juel Class frigates
7 Finland	Netherlands	1	F-27 Mk-600	Transport	1982	1983	1	2 additional F-27s purchased from Finnish airline Karair
	Sweden	(60)	Bv-206	APC	1980			Total cost: $3.75 mn
		(20)	J-35 Draken	Fighter/strike	(1983)			In addition to 20 in service; from Swedish AF inventory
		8	RBS-15	ShAM/ShShM	1983			Ordered Mar 1983; first export order; value: SEK300 mn

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
	UK	50	Hawk	Adv trainer/strike	1977	1980	2	4 to be delivered complete from the UK,
						1981	(5)	the rest scheduled for local assembly
						1982	(12)	during 1981-85; Mk-51
						1983	(12)	
	USA	. .	BGM-71A TOW	ATM	(1983)			Unconfirmed; improved version reportedly ordered
		2	Model 500D	Hel	1982	1983	2	Replacing 2 Model 300Cs
		4	PA-31 Chieftain	Lightplane	1982	1983	4	Option on 2 more
		2	PA-31 Chieftain	Lightplane	1983			
4 France	Australia	1	C-130A Hercules	Transport	(1983)	1983	1	
	Brazil	41	EMB-121 Xingu	Transport	1981	1981	8	25 for AF, 16 for Navy
						1982	19	
						1983	14	
	Canada	2	DHC-6	Transport	1982	1982	(1)	
						(1983)	(1)	
5 German DR	USSR	. .	AT-4 Spigot	ATM	1978	(1979)	(240)	
						(1980)	(240)	
						(1981)	(240)	
						(1982)	(240)	
						(1983)	(240)	
		. .	BTR-70	APC	(1982)	(1983)	(50)	Replacing BTR-60; also designated SPW-70
		. .	M-1973 152mm	SPG	(1978)	(1979)	(12)	
						(1980)	(12)	
						(1981)	(12)	
						(1982)	(12)	
						(1983)	(12)	
		. .	M-1974 122mm	SPH	(1979)	(1980)	(20)	
						(1981)	(20)	
						(1982)	(20)	
						(1983)	(20)	
		. .	MiG-23	Fighter	(1978)	1979	(12)	
						1980	(12)	
						1981	(12)	
						1982	(12)	
						1983	(12)	
		(216)	SA-N-5	ShAM	1981	1981	(120)	Arming Parchim Class corvettes
						1982	(72)	
						1983	(24)	

		..	Su-20 Fitter-C	Fighter/ground attack	(1978)	1979	(10)	
						1980	(10)	
						1981	(10)	
						1982	(10)	
						1983	(10)	
		..	T-72	MBT	(1978)	1979	(50)	
						1980	(100)	
						1981	(100)	
						1982	(100)	
						1983	(100)	
		..	T-74	MBT	(1981)	1982	(15)	
						1983	(15)	
4 Germany, FR	France	40	MM-38 Exocet	ShShM	(1981)	(1982)	(4)	Arming 10 S-143A Class FACs under construction in FR Germany
						(1983)	(20)	
						(1984)	(16)	
	Israel	4	Westwind 1123	Transport	1980	1982	(2)	Ordered May 1980
						(1983)	(2)	
	UK	12	Lynx	Hel	1979	(1982)	(4)	For 6 Bremen Class frigates
						(1983)	(4)	
						(1984)	(4)	
	USA	500	AGM-65B	ASM	1981			Arming F-4Fs; will probably also be ordered for Tornado MRCA
		(1792)	MIM-104 Patriot	Landmob SAM	(1983)			12 units + 2 for training; additional 12 provided by USA; all units to be manned by West German personnel for 10 years; total value: $3 000 mn
		(144)	RGM-84A Harpoon	ShShM	1978	(1982)	(48)	Arming 6 Bremen Class frigates
						(1983)	(48)	
						(1984)	(48)	
		144	Seasparrow	ShAM/ShShM	(1978)	1982	(48)	Arming Bremen Class frigates
						1983	(48)	
						1984	(48)	
4 Greece	Austria	(32)	Cuirassier	LT/TD	(1980)	1982	(16)	
						1983	(16)	
	Canada	(1)	CL-215	Amphibian	(1983)	1983	(1)	
	France	(40)	Mirage-2000	Fighter/strike	(1984)			Decision pending
	Germany, FR	27	F-104G	Fighter	1982	1983	(13)	
						1984	(14)	
		4	Leopard ARV	ARV	1981			
		106	Leopard-1-A4	MBT	1981	1983	(15)	For delivery from 1983; Greece may order an additional 113 Leopards

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
		. .	Milan	ATM	1982	(1983)	(150)	MAP package incl 27 F-104Gs
						(1984)	(150)	
	Italy	(30)	G-222	Transport	(1984)			Negotiating; competing with F-27 and HS-748
	Jordan	13	F-5A	Fighter	1983	(1984)	(13)	
		2	F-5B	Fighter/trainer	1983	(1984)	(2)	
	Netherlands	10	F-104G	Fighter	(1982)	(1983)	(10)	
	USA	200	AGM-65B	ASM	1980	(1982)	(100)	
						(1983)	(100)	
		280	AIM-7M Sparrow	AAM/SAM	1982			Incl in sale of Skyguard SAM system
		300	AIM-9L	AAM	1980	(1981)	(100)	DoD notified Congress Jul 1980; arming A-7 Corsairs
						(1982)	(100)	
						(1983)	(100)	
		1487	BGM-71A TOW	ATM	(1981)	(1983)	(200)	Total cost incl 50 launchers: $19 mn
		(64)	BGM-71A TOW	ATM	(1983)			Arming 8 Model 209 AH-1S helicopters
		48	M-109-A2 155mm	SPH	1981			
		51	M-113-A2	APC	1983			
		58	M-198 155mm	TH	1982			
		(110)	M-60-A3	MBT	1983			Total cost: $186 mn
		8	Model 209 AH-1S	Hel	(1980)			Ordered Sep 1980; armed with TOW ATMs; US Letter of Offer 1983; total cost: $66 mn
5 Hungary	USSR	. .	T-72	MBT	1980	1982	(30)	Ordered Apr 1980
						1983	(30)	
7 Ireland	France	5	AS-365	Hel	1983	1983	(3)	
4 Italy	France	(3252)	Milan	ATM	1981	1982	(1000)	Italy plans to procure 37 750 missiles; the remainder will be produced under licence by OTO-Melara over a 10-year period; order incl 1 850 launchers of which 250 will be purchased directly from Euromissile
						(1983)	(1000)	
	USA	2311	BGM-71A TOW	ATM	1981	(1982)	(200)	First sale of improved version; order incl 632 practice missiles
						1983	(1000)	
		450	FIM-92A Stinger	Port SAM	(1983)			Total cost incl 150 launchers: $51 mn
		(72)	RIM-24 Tartar	ShAM	(1981)	(1983)	(72)	DoD notified Congress; 2 systems arming Audace Class destroyers

		35	RIM-67A/SM-1	ShAM/ShShM	1981	(1983)	(35)	Replacing Terrier on 1 helicopter cruiser, 2 Andrea Doria Class cruisers and augmenting Tartar on Audace- and Impavido Class destroyers
10 Japan	UK	(176)	FH-70 155mm	TH	(1983)			Possibly for licence production
	USA	. .	AGM-84A Harpoon	AShM	(1980)	(1982)	(10)	Arming P-3C Orions
						(1983)	(20)	
		164	AIM-9L	AAM	1981	(1983)	(82)	Arming F-4 and F-15 fighters; licence production to follow
						(1984)	(82)	
		. .	BGM-71A TOW	ATM	1983			9 systems reportedly ordered; licence production may follow
		4	C-130H Hercules	Transport	1982			Total requirement: 18
		15	CH-47D Chinook	Hel	(1983)			
		4	E-2C Hawkeye	AEW	1979	1982	2	
						1983	2	
		4	E-2C Hawkeye	AEW	1981			For delivery in 1984; in addition to 4 delivered 1982-83
		100	FIM-92A Stinger	Port SAM	1982			
		16	King Air C-90	Trainer	(1979)	1980	2	
						1981	(4)	
						1982	3	
						1983	2	
		(19)	M-110-A2 203mm	SPH	(1982)			Unconfirmed
		87	M-113-A2	APC	1980			Ordered Jan 1980; unconfirmed
		(24)	RGM-84A Harpoon	ShShM	(1979)	(1981)	(8)	Arming Yubari- and Ishikari Class frigates
						(1983)	(8)	
						(1984)	(8)	
		(96)	RGM-84A Harpoon	ShShM	(1981)	1982	(8)	Arming Hatsuyuki- and last of Tachikaze Class destroyers
						1983	(16)	
						1984	(24)	
		1	SH-60B Seahawk	Hel	1983			Selected to replace SH-3B helicopters
4 Netherlands	Germany, FR	445	Leopard-2	MBT	1979	1981	4	Contract signed Jun 1979; chosen instead of US M-1 Abrams; offsets to Dutch industry at 59% of purchase value, may reach 100%; to replace 369 Centurions and 130 AMX-13s
						1982	(50)	
						1983	(60)	
	USA	(38)	AGM-84A Harpoon	AShM	(1978)	(1981)	(1)	
						(1982)	(3)	
						(1983)	(17)	
						(1984)	(17)	

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
		840	AIM-9L	AAM	1977	(1979)	(40)	Arming 102 F-16 fighters
						(1980)	(160)	
						(1981)	(200)	
						(1982)	(200)	
						(1983)	(200)	
		900	AIM-9L	AAM	1983			Total cost: $78 mn
		(2086)	BGM-71A TOW	ATM	1981	(1982)	(1043)	
						(1983)	(1043)	
		57	F-16A	Fighter/strike	(1983)			Bringing total F-16 procurement to 211 aircraft
		646	FIM-92A Stinger	Port SAM	1982	(1983)	(100)	
		160	MIM-104 Patriot	Landmob SAM	1983			Contract signed Dec 1983; total cost: $300 mn incl 20 launchers and 4 AN/ MPQ 533 radar sets
		13	P-3C Orion	ASW/mar patrol	1978	1981	1	
						1982	3	
						1983	(5)	
						(1984)	(4)	
		(240)	RGM-84A Harpoon	ShShM	1975	1978	(24)	Arming Kortenaer Class frigates
						1979	(24)	
						1980	(48)	
						1981	(48)	
						1982	(24)	
						1983	(72)	
		(48)	RIM-24 Tartar	ShAM	(1983)	(1984)	(24)	Arming 2 additional Kortenaer Class frigates
		(320)	Seasparrow	ShAM/ShShM	(1974)	(1978)	(32)	Arming Kortenaer Class frigates
						(1979)	(32)	
						(1980)	(64)	
						(1981)	(64)	
						(1982)	(32)	
						(1983)	(96)	
11 New Zealand	UK	2	Leander Class	Frigate	1981	1982	1	
						1983	1	
		26	FV-101 Scorpion	LT	1980	(1982)	(13)	
						(1983)	(13)	
		4	Wasp	Hel	1982	1983	4	

4 Norway	Germany, FR	6	Type 210	Submarine	1983			Contract signed Sep 1983; for delivery from 1989; offsets incl delivery of 12 fire control systems for West German submarines
	Sweden	. .	Bv-206	APC	(1981)	1982	(51)	Order may ultimately comprise 3 000 APCs
						(1983)	(200)	
		3	MFI-15 Safari	Lightplane	(1983)	1983	3	
		. .	RBS-70	Port SAM	1982	(1983)	(100)	Third order
		. .	RBS-70	Port SAM	1983			Fourth order
	USA	432	AIM-9L	AAM	1977	(1982)	(60)	NATO co-production programme; production started Dec 1980 at Raufoss; also production of rocket engine for NATO Sidewinder; formal contract signed Mar 1981
						(1983)	(100)	
		60	F-16A	Fighter/strike	1977	1980	(6)	Delivered from Fokker licence production plant in the Netherlands
						1981	(16)	
						1982	(15)	
						1983	(15)	
						1984	(8)	
		12	F-16B	Fighter/trainer	1977	1980	(2)	Delivered from Fokker licence production plant in the Netherlands
						1981	(3)	
						1982	(3)	
						1983	(2)	
						1984	(2)	
		24	F-16C	Fighter/strike	1983			Ordered as attrition aircraft; for delivery early 1990s
		5	M-88-A1	ARV	1981			
		(324)	MIM-23B Hawk	Landmob SAM	1983			Leasing agreement; ordered number unconfirmed; 6 btys with 6 launch units/bty
4 Portugal	Brazil	5	EMB-111	Mar patrol	(1983)			Negotiating
	France	18	MM-38 Exocet	ShShM	(1983)			Arming 3 Kortenaer Class frigates
	Italy	12	A-109 Hirundo	Hel	(1984)			Delayed due to funding problems
	Netherlands	1	Kortenaer Class	Frigate	1983			On order; to be delivered prior to licence production of 2
	USA	30	A-7P Corsair-2	Fighter	1983			For delivery 1984-85
5 Romania	France	4	AS-365N	Hel	(1980)			

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
4 Spain	France	12	AS-332	Hel	1982	1983	(6)	For SAR duties
	Germany, FR	(124)	Bo-105CB	Hel	1979	1980	(10)	Assembled in Spain; 60-68 for Spain,
						1981	(20)	the rest for Iraq; 85-90 produced by
						1982	(30)	end-1983
						1983	(30)	
	USA	. .	AIM-7F Sparrow	AAM	(1983)			Arming F/A-18A Hornet fighters
		12	AV-8B Harrier	Fighter	1983			For delivery from 1986; total value: $378 mn; offset value: $130 mn
		72	F/A-18 Hornet	Fighter/strike	1983			For delivery from 1986; total cost: $2 600 mn
		11	LVTP-7A1	Amph ASSV	(1983)			Total cost incl spares and support equipment: $16 mn
		1760	Chaparral	Landmob SAM	1981			
		4	P-3A Orion	ASW/mar patrol	1983			US Letter of Offer Sep 1983; total cost: $64 mn incl overhaul of 2 in service, spares and training
		(48)	RGM-84A Harpoon	ShShM	(1977)			Arming 3 FFG-7 Class frigates
		(24)	RGM-84A Harpoon	ShShM	1983	(1983)	(12)	Arming Lazaga Class FACs
						(1984)	(12)	
		(72)	RIM-67C/SM-2	ShAM/ShShM	1982			Arming 3 new FFG-7 Class destroyers now under construction
		10	SH-60B Seahawk	Hel	1983			Ordered May 1983; total cost: $275 mn
7 Sweden	UK	. .	Sky Flash	AAM	1981	(1983)	(50)	Additional quantity for JA-37 Viggen; total cost: approx. $26.5 mn
	USA	. .	AIM-9L	AAM	1982			US DoD agreed to sell May 1982; delay due to funding problems; to arm JA-37 Viggen; Sweden already has earlier AIM-9J version
		2000	BGM-71A TOW	ATM	1980	1981	(500)	DoD notified Congress Oct 1980; total
						1982	(500)	cost incl 100 practice missiles and
						1983	(500)	associated equipment: $16 mn
		. .	MIM-23B Hawk	Landmob SAM	(1978)			Status of deal uncertain
		10	Model 300C	Hel	1982	1983	10	Swedish designation: HKP-5B
7 Switzerland	France	2	Mirage-3D	Trainer	1980	(1983)	(2)	To replace 2 trainers lost in recent years; also designated Mirage-3BS/80
	Germany, FR	(420)	Leopard-2	MBT	1983			Initial order for 210; 175 to be produced under licence; 15-year re-equipment programme

	USA	500	AGM-65A	ASM	1981			Arming F-5Es
		3	UH-60A	Hel	(1983)			Formal agreement to be signed 1984
4 Turkey	Belgium	. .	T-33A	Trainer	(1980)	1980	(3)	
						1981	(3)	
						1982	(3)	
						1983	(3)	
	Germany, FR	1	Dogan Class	FAC	1979	(1983)	(1)	In addition to 4 in service; armed with Harpoon ShShMs; also designated Type 57
		50	F-104G	Fighter	1983	1983	(25)	
						(1984)	(25)	
		2	Koeln Class	Frigate	(1982)	1983	2	NATO aid
		77	Leopard-1-A3	MBT	1980	1981	(20)	Follow-on order expected
						1982	(27)	
						1983	(30)	
		4	Meko-200 Type	Frigate	1983			2 to be built in FR Germany and 2 in Turkey; will probably be armed with 2x4 Harpoon ShShMs and Aspide ShAMs using 1x8 Seasparrow launcher; partly MAP
		(2500)	Milan	ATM	1981	1981	480	
						(1982)	(480)	
						(1983)	(500)	
		2	Rhein Class	Support ship	(1975)	1977	1	Depot ship
						1983	1	
	Netherlands	23	F-104G	Fighter	1983			Ordered Oct 1983
	Norway	(8)	F-5A	Fighter	1983	1983	(8)	
	UK	(144)	Rapier Improved	Landmob SAM	1983			Total value incl 36 launch units and 18 Blindfire radars: $225 mn; for delivery 1984-85
		. .	Sea Skua	AShM	(1983)			Unspecified number ordered Oct 1983; arming AB-212 helicopters
	USA	750	AIM-9P	AAM	1982			AIM-9P-3 version
		. .	BGM-71A TOW	ATM	(1979)			Unspecified number on order; unconfirmed
		(48)	BGM-71A TOW	ATM	(1983)			Arming 6 Model 209 helicopters
		1	Dixie Class	Destroyer tender	1982	1983	1	On lease; to support Gearing Class
		160	F-16C	Fighter/strike	1983			Incl a number of two-seat trainers; for delivery over 10 years from 1986; first 40 direct from USA; 120 to be locally assembled
		. .	FIM-92A Stinger	Port SAM	(1983)			To be followed by NATO Stinger
		25	Model 205 UH-1H	Hel	1982			Total cost incl spares and support equipment: $36 mn; for delivery 1984-85

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
		6	Model 209 AH-1S	Hel	(1983)			Total cost incl TOW ATMs: $50 mn
		30	Model 300C	Hel	(1982)	1983	30	
		8	RGM-84A Harpoon	ShShM	1980	(1983)	(8)	Arming fifth Dogan Class FAC
4 UK	Brazil	3	EMB-312 Tucano	Trainer	1982			
	France	(228)	MM-38 Exocet	ShShM	(1971)	1972	(12)	Arming modernized Leander Class
						1973	(12)	
						1974	(12)	
						1975	(24)	
						1976	(24)	
						1977	(36)	
						1979	(12)	
						1980	(36)	
						1982	(24)	
						1983	(36)	
		(48)	MM-38 Exocet	ShShM	(1981)	1983	(12)	Arming 4 Broadsword Class destroyers
						1984	(12)	
	USA	60	AV-8B Harrier	Fighter	1981			Selected after competition with Harrier Mk-5; final agreement between BAc and McDonnell-Douglas covers 336 Harriers for US Marines and 60 for RAF; first delivery 1984
		8	CH-47D Chinook	Hel	1982			For delivery 1984; first 3 to replace losses in Falkland/Malvinas conflict
		15	F-4 Phantom	Fighter	1982	(1984)	(15)	Ex-US Navy; probably version J
1 USA	Canada	969	Piranha	APC	1982	1983	(50)	USA selected GM of Canada to produce Swiss-designed Piranha for US Marines; first delivery October 1983
	Sweden	(300)	Bv-206	APC	(1982)	1983	(150)	Ordered number also reported as 268
						1984	(150)	
	UK	12	Hawk	Adv trainer/strike	(1982)	(1984)	(6)	On loan from the UK; separate from VTX-programme involving co-production of 320 Hawk aircraft
		3	Lyness Class	Support ship	1980	(1981)	1	Negotiating purchase of third ship for delivery 1984; total cost of first 2 ships: $37 mn; negotiations for third ship, 'Stromness', halted due to Falkland/Malvinas conflict
						1982	1	

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		(200)	Rapier	Landmob SAM	1981	(1983)	(32)	Offset for Trident SLBM; for defence of US air bases in the UK; delivery to start in 1983; 32 launch units with 4 missiles/launcher; second order for approx. 70 missiles in 1982
2 USSR	Czechoslovakia	. .	L-39 Albatross	Trainer	1972	1978	(20)	Replacing L-29 Delfin
						1979	(20)	
						1980	(20)	
						1981	(20)	
						1982	(20)	
						1983	(20)	
	India	8	SA-316B Chetak	Hel	(1983)	(1984)	(8)	Ordered for evaluation in Siberia; additional orders expected
6 Yugoslavia	Norway	. .	Penguin-2	ShShM	(1984)			Negotiating
	USA	(40)	AGM-65B	ASM	1982	1983	(12)	Arming Orao fighters
	USSR	. .	AT-3 Sagger	ATM	(1978)	1980	(60)	Arming Gazelle helicopters
						1981	(60)	
						1982	(60)	
						1983	(60)	
		. .	SA-7 Grail	Port SAM	(1978)	1980	(60)	Arming Gazelle helicopters
						1981	(60)	
						1982	(60)	
						1983	(60)	
		. .	T-74	MBT	(1982)	(1983)	(12)	

II. Third World countries

12 Algeria	Brazil	. .	EE-9 Cascavel	AC	(1983)			Negotiating sale valued at $400 mn
	France	55	M-3	APC	1982	(1983)	(55)	
	UK	2		Support ship	1981	1983	1	Similar to ships ordered by Oman; order incl 2 PCs; total value: $124 mn
						1984	1	
		2	Kebir Class	PC	1981	1982	1	Delivered prior to licence production of 4 additional PCs in Algeria
						1983	1	
	USA	6	C-130H Hercules	Transport	1982	1983	6	Order incl 2 C-130H-30 Super Hercules; in addition to 6 in military service

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
		2	C-130H-30	Transport	1982	1983	2	Order incl 6 C-130Hs
	USSR	2	Foxtrot Class	Submarine	(1982)			
		4	Nanuchka Class	Corvette	(1979)	1980	1	
						1981	1	
						1982	1	
						1983	1	
		(24)	SA-N-4	ShAM	(1979)	1980	(6)	Arming 4 Nanuchka Class corvettes
						1981	(6)	
						1982	(6)	
						1983	(6)	
		(48)	SSN-2 Styx	ShShM	(1979)	1980	(12)	Arming 4 Nanuchka Class corvettes
						1981	(12)	
						1982	(12)	
						1983	(12)	
13 Angola	France	(37)	SA-360 Dauphin	Hel	(1983)	(1983)	(17)	Unconfirmed lease agreement
						(1984)	(20)	
	Portugal	2	SA-316B	Hel	1983	1983	2	
	Romania	6	SA-316B	Hel	(1982)	1983	6	
	Switzerland	12	PC-7	Trainer	1982	1983	(6)	
						(1984)	(6).	
	USA	3	T-41A	Lightplane	(1982)	(1983)	3	
	USSR	1	An-26 Curl	Transport	(1982)	1983	1	
		. .	T-62	MBT	(1980)	(1981)	(10)	Unconfirmed; reportedly delivered; incl small number of T-72s
						(1982)	(10)	
						(1983)	(10)	
15 Argentina	Austria	27	Cuirassier	LT/TD	1982			Negotiations reportedly resumed after Falkland/Malvinas conflict; status of deal uncertain
	Brazil	12	EMB-326 Xavante	Trainer/COIN	1982	1983	12	Total cost: $60 mn
	Bulgaria	. .	SA-7 Grail	Port SAM	1983	1983	(50)	Unspecified number ordered for use with marine infantry
	France	(20)	AM-39 Exocet	AShM	1979	1982	(10)	Arming 14 Super Etendard fighters
						1983	(10)	
		(24)	AS-332	Hel	1983	(1984)	(15)	
		36	ERC-90 Lynx	AC	1979	(1982)	(18)	Ordered Oct 1979; for border defence against Chile
						(1983)	(18)	
		60	ERC-90S Sagaie	AC	1981	(1983)	(20)	

		1000	HOT	ATM	1980	1980	(200)	Current status uncertain
						(1981)	(200)	
						(1982)	(200)	
						(1983)	(200)	
		(96)	MM-40 Exocet	ShShM/SShM	(1980)	1983	48	Arming 4 Meko-360 destroyers
						(1984)	(48)	
		(24)	MM-40 Exocet	ShShM/SShM	1980	(1983)	(8)	Arming 6 Meko-140 frigates
		(90)	R-550 Magic	AAM	(1980)	(1981)	(30)	Arming Super Etendard and other fighters
						(1982)	(30)	
						(1983)	(30)	
		(72)	Roland-1	Landmob SAM	1981	1982	(24)	
						(1983)	(48)	
		14	Super Etendard	Fighter/strike	1979	1982	10	Armed with Exocet AShMs
						1983	4	
		..	Super Etendard	Fighter/strike	1982			Unconfirmed; in addition to 14 in service
		(30)	Super-530	AAM	(1980)	(1981)	(10)	Arming Super Etendard and other fighters
						(1982)	(10)	
						(1983)	(10)	
	Germany, FR	4	Meko-360 Type	Destroyer	1978	1983	2	Ordered Dec 1978
						(1984)	(2)	
		1		Survey ship	1981			Ordered Dec 1981
		2	Type 1700	Submarine	1977	(1983)	1	To be delivered prior to licence production of 4; first ship, 'Santa Cruz', commissioned 1983
	Israel	(24)	A-4E Skyhawk	Fighter/bomber	(1982)	1982	(12)	Unconfirmed
						1983	(12)	
		(22)	Mirage-3C	Fighter	1982	1982	(11)	Conflicting information; possibly con-
						1983	(11)	fused with 28 IAI Nesher fighters
		(28)	Nesher	Fighter	1982	1982	(8)	Unconfirmed
						1983	(20)	
	Italy	(96)	Aspide	AAM/SAM/ShAM	(1979)	1983	48	Arming 4 Meko-360 destroyers; 16 reserve missiles per 8-cell launcher
						(1984)	(48)	
	Spain	5	Halcon Class	PC	1979	1982	1	Displacement: 900t; helicopter platform
						1983	4	
	USA	4	L-100-20	Transport	1983	1983	1	
		6	L-188 Electra	Transport	(1982)	1983	6	Total cost: $10.2 mn
		1	Model 212	Hel	(1982)	1983	1	
8 Bahrain	France	(24)	MM-38 Exocet	ShShM	1979	1983	(12)	Arming 2 TNC-45 FACs
						1984	(12)	

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
	Germany, FR	2	TNC-45	FAC	1979	1983	1	
						1984	1	
	USA	60	AIM-9P	AAM	(1983)			
		2000	BGM-71A TOW	ATM	(1982)	(1983)	(1000)	
						(1984)	(1000)	
		(12)	F-4 Phantom	Fighter	(1983)			Unconfirmed
		4	F-5E Tiger-2	Fighter	(1983)			
		2	F-5F Tiger-2	Trainer	(1983)			Total cost incl 4 F-5Es and 60 AIM-9P AAMs: $180 mn; US Letter of Offer reportedly rejected by Bahrain
9 Bangladesh	China	(4)	Hainan Class	FAC	(1981)	1982	1	Status of last 3 ordered unclear
14 Belize	UK	2	BN-2A Defender	Transport	1982	1983	2	For maritime patrol
13 Benin	USSR	. .	MiG-23	Fighter	(1984)			Acc to unconfirmed reports, a squadron of MiG-23s will be delivered in 1984
15 Bolivia	Belgium	52	F-104A	Fighter	(1982)			May be cancelled due to funding problems
	France	(12)	Mirage-5	Fighter	(1983)	(1983)	(12)	12 Mirage-3/5s reportedly delivered; unconfirmed
15 Brazil	Australia	12	A-4G Skyhawk	Fighter/bomber	(1983)			Version unconfirmed; for aircraft carrier 'Minais Gerais'
	Canada	(12)	DHC-5D Buffalo	Transport	(1983)			Reportedly ordered
	France	2	Mirage-3D	Trainer	1982	1984	2	Replacing lost aircraft
		(48)	MM-40 Exocet	ShShM/SShM	1982			Arming 4 corvettes under construction
	Germany, FR	1	Type 209	Submarine	1982			Order incl 1 submarine to be built under licence; also designated Type 1400
	Italy	6	SH-3D Sea King	Hel	(1982)	1983	6	
	USA	16	LVTP-7A1	Amph ASSV	1983			For Brazilian Marines
10 Brunei	UK	. .	Rapier	Landmob SAM	1979	1983	(64)	1 bty ordered; incl Blindfire radar; total cost: $82 mn
13 Burundi	France	6	AML-60	AC	1982	(1983)	(6)	
		12	AML/D-90 Lynx	Recce AC	1982	(1983)	(12)	Partly financed by France; deal incl AML-60 and M3 vehicles
		9	M-3	APC	1982	(1983)	(9)	

		2	SA-342L Gazelle	Hel	(1982)	1983	2	
13 Cameroon	France	6	Alpha Jet	Adv trainer/strike	1981	1983	2	NG-version
						(1984)	(4)	
		. .	Milan	ATM	(1981)	1982	12	6 launchers and 12 missiles delivered
						(1983)	(36)	1982; additional deliveries under new military co-operation programme
		8	MM-40 Exocet	ShShM/SShM	1981	(1983)	(8)	Arming 1 P-48 Class FAC
		1	P-48 Class	FAC	1981	(1983)	(1)	
	USA	2	V-150 Commando	APC	1982	(1983)	(2)	
13 Central African Republic	Argentina	3	IA-58A Pucara	Trainer/COIN	1983			Total cost incl weapons and training: $12 mn
	France	5	VAB	APC	(1982)	1983	5	Delivered Apr 1983
13 Chad	France	1	C-212-200	Transport	1983	1983	1	
		4	ERC-90 Lynx	AC	(1982)	(1983)	4	
		. .	M-3	APC	(1983)	1983	(20)	
	USA	1	C-130H Hercules	Transport	1983	1983	1	
		(30)	FIM-92A Stinger	Port SAM	1983	1983	(30)	
		(30)	MIM-43A Redeye	Port SAM	1983	1983	(30)	
	Zaire	2	C-130H Hercules	Transport	(1983)	(1983)	(2)	Possibly on loan
		3	MB-326K	Trainer	(1983)	1983	3	
		3	Mirage-5	Fighter	(1983)	1983	3	
15 Chile	Brazil	2	EMB-120	Transport	(1982)			Reportedly ordered for delivery 1985
	France	50	AMX-30B	MBT	(1980)	1981	(21)	21 delivered by Liberian ship from Bordeaux Mar 1981; delivery of last 29 blocked by Mitterand government; Chile reportedly will return 21 delivered
		. .	R-440 Crotale	Landmob SAM	1981			Ordered Apr 1981; delivery withheld by Belgium at Brussels Airport; 6 firing units; part of $40 mn contract
	Germany, FR	2	Type 209	Submarine	1980	(1984)	(2)	
	South Africa	6	Cactus	Landmob SAM	1980			Probably identical with Crotale order
	Spain	(70)	C-101 Aviojet	Trainer/strike	1980	(1982)	(2)	12 delivered from Spain; assembly
						(1983)	(10)	in Chile to follow
	UK	2	County Class	Destroyer	1981	1982	1	
						(1984)	(1)	
		(12)	Jaguar	Fighter	(1984)			Negotiating
		. .	Lynx	Hel	(1984)			Negotiating; for 2 County Class destroyers
		(8)	MM-38 Exocet	ShShM	1981	1982	(4)	Arming 2 County Class destroyers
						(1984)	(4)	

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
		(16)	Seacat	ShAM/ShShM	1981	1982	(8)	Arming 2 County Class destroyers
						(1984)	(8)	
15 Colombia	Brazil	(15)	EE-11 Urutu	APC	1982	(1983)	(15)	
		20	EE-9 Cascavel	AC	1982	(1983)	(20)	
		14	EMB-326 Xavante	Trainer/COIN	1982			
	France	32	MM-40 Exocet	ShShM/SShM	(1980)	1983	(8)	Arming 4 FS-1500 Class frigates on order from FR Germany
	Germany, FR	4	FS-1500 Class	Frigate	1980	1983	1	
	Netherlands	2	F-27 Mk-600	Transport	(1984)			
	Switzerland	6	PC-6A Porter	Transport	(1981)	1983	(6)	
		10	PC-6A Porter	Transport	(1984)			
	USA	12	A-37B Dragonfly	Fighter/COIN	1982	(1983)	(12)	Ordered Dec 1982
		240	AIM-7F Sparrow	AAM	1982			US Letter of Offer Dec 1982; Skyguard air defence system
		2	Asheville Class	Frigate	1982	1983	2	Leased by Navy; for coastal patrol
		2	C-130H Hercules	Transport	(1984)			
		7	Model 300C	Hel	(1983)			
		(64)	Seasparrow	ShAM/ShShM	(1980)	1983	(16)	Arming FS-1500 Class frigates; Aspide/ Albatross launcher
13 Congo	Spain	3	Piranha Class	PC	1981	1982	1	Ordered May 1981
						1983	2	
14 Cuba	Czechoslovakia	(4)	L-39 Albatross	Trainer	(1982)	(1983)	(4)	
	USSR	. .	AA-2 Atoll	AAM	(1980)	1980	(75)	Arming MiG-23s
						1981	(75)	
						1982	(75)	
						1983	(75)	
		. .	BMP-1	MICV	(1980)	(1981)	(50)	Acc to US sources; unconfirmed
						(1982)	(50)	
						(1983)	(50)	
		. .	MiG-23	Fighter	(1980)	1980	(19)	Cuba has approx. 75 MiG-23s incl B/E interceptor, F ground attack and U trainer versions
						1981	(19)	
						1982	(19)	
						1983	(19)	
		. .	SA-6 Gainful	Landmob SAM	(1980)	(1980)	(250)	Part of air defence deal incl SA-3s; demand for reloads to replace SAMs fired unsuccessfully at US Lockheed SR-71 recce aircraft
						(1981)	(50)	
						(1982)	(50)	
						(1983)	(50)	

13 Djibouti	France	2	AS-350 Ecureuil	Hel	(1982)	1983	2	
14 Dominican Republic	USA	(8)	Model 205 UH-1H	Hel	(1983)	1983	(8)	From USAF surplus stocks
		12	T-34B Mentor	Trainer	1981	(1982)	(6)	To replace T-41
						(1983)	(6)	
15 Ecuador	Brazil	14	EMB-326 Xavante	Trainer/COIN	1982	1982	(10)	Ordered Dec 1982
						1983	(4)	
	France	10	AS-332	Hel	1982	1982	(3)	Status of deal uncertain
		(36)	MM-40 Exocet	ShShM/SShM	1979	1982	(12)	Arming 6 Esmeraldas Class corvettes
						1983	(18)	
						(1984)	(6)	
	Israel	12	Kfir-C2	Fighter/ground attack	1981			USA approved sale; option for 12 more
	Italy	(72)	Aspide	AAM/SAM/ShAM	1979	1982	(24)	Arming 6 Esmeraldas Class corvettes
						1983	(36)	
						(1984)	(12)	
		6	Esmeraldas Class	Corvette	1979	1982	2	Similar to Libyan Wadi (Assad) Class
						1983	3	
						(1984)	1	
	USA	1	L-100-30	Transport	1982			Financing problems
8 Egypt	Brazil	1	EE-11 Urutu	APC	(1983)	1983	1	For evaluation
		1	EE-9 Cascavel	AC	(1983)	1983	1	For evaluation
		10	EMB-312 Tucano	Trainer	1983	(1984)	(10)	To be followed by local assembly of 110; approx. 80 for transfer to Iraq
	China	(100)	F-7	Fighter	1982	1983	(10)	Local assembly
		(2)	Hainan Class	FAC	(1982)	1983	2	Commissioned Nov 1983; unconfirmed reports of large naval deal incl 4 Luda Class destroyers, 6 Hainan Class FACs, 6 Shanghai-2 Class PCs and 6 MSCs
		. .	SA-2 Guideline	Landmob SAM	1980			Ordered Jan 1980
	France	45	Alpha Jet	Adv trainer/strike	1981	1982	5	Direct import of 8; local assembly of 37; 10% local components; in service from Nov 1982; negotiating for 15 more
						1983	(15)	
						(1984)	(20)	
		. .	AM-39 Exocet	AShM	(1982)	(1982)	(20)	Unconfirmed
						(1983)	(20)	
		. .	AS-30L	ASM	1983			Arming Mirage-2000s
		(288)	HOT	ATM	1981			Arming 24 of 36 Gazelle helicopters ordered 1981
		20	Mirage-2000	Fighter/strike	1982			Ordered Jan 1982; total cost: $1 000 mn; option on 20-40 more

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
		16	Mirage-5SD	Fighter	1980	1983	(10)	Ordered Jun 1980
						(1984)	(6)	
		(144)	R-440 Crotale	Landmob SAM	1982	1982	(48)	
						(1983)	(96)	
		. .	R-550 Magic	AAM	1983			Arming Mirage-2000s
		36	SA-342L Gazelle	Hel	1981	1982	(2)	Last 30 assembled in Egypt
						1983	(6)	
						(1984)	(24)	
		. .	Super-530	AAM	1983			Arming Mirage-2000s
	Italy	(32)	Aspide	AAM/SAM/ShAM	(1983)	(1984)	(32)	Arming 2 F-30 Class frigates
		4	S-61R	Hel	1981	1983	4	
	Romania	200	T-55	MBT	1983	1983	(60)	Ordered Jul 1983; Romanian designation: M-77 or TR-77; some may be assembled under licence; for re-transfer to Iraq
						(1984)	(140)	
	Spain	(600)	BMR-600	ICV	1982	1983	(50)	Total cost incl 3 000 trucks and 700 coaches: $400 mn; for delivery 1983-85
		6	Cormoran Class	FAC	1982			
		2	F-30 Class	Frigate	1982	(1984)	(2)	Option on 2 more; rapid delivery due to diversion to Egypt of last 2 ships for Spanish Navy; order incl 6 Cormoran Class FACs; total cost: $1 400 mn
		4	S-70 Class	Submarine	1982			
	UK	3	HS-748-2A	Transport	1983			
		14	SRN-6	Hovercraft	1981			In addition to 3 delivered 1976; unconfirmed
	USA	600	AGM-65A	ASM	1980	(1980)	(75)	Arming F-16s
						(1981)	(100)	
						(1982)	(200)	
						(1983)	(200)	
						(1984)	(25)	
		424	AIM-7M Sparrow	AAM/SAM	(1983)			12 Skyguard btys with 2 twin 35mm AAGs and 2 quadruple Sparrow launchers; total cost: $400 mn
		300	AIM-9L	AAM	1982	1983	300	Delivered Apr 1983
		150	AIM-9L	AAM	1983			In addition to 300 delivered Apr 1983
		4	E-2C Hawkeye	AEW	1983			First 2 for delivery 1985-86; total cost for 4 aircraft: $465 mn
		40	F-16A	Fighter/strike	1980	1982	(18)	Incl a few F-16B trainers
						1983	(19)	
						1984	(3)	

34	F-16C	Fighter/strike	1982			In addition to 40 now being delivered; order incl 6 F-16D trainers; agreement in principle for a total of 150
6	F-16D	Fighter/trainer	1982			Total cost incl 34 F-16As: $975 mn
6		FAC	(1983)			MoU signed Jul 1983; to be armed with Harpoon ShShMs
..	M-109-A2 155mm	SPH	(1982)			Unspecified number for delivery from 1984-85
570	M-113-A2	APC	1980	1982	(252)	Second batch brings total to 1 100 incl all versions
				(1983)	(318)	
42	M-198 155mm	TH	(1983)			US Letter of Offer Oct 1983
26	M-48 Chaparral	AAV	1983			Replacing Soviet systems
34	M-577-A1	CPC	1979	1982	20	
				(1983)	(14)	
439	M-60-A3	MBT	1980	1981	128	
				1982	183	
				(1983)	(120)	
				(1984)	(8)	
220	M-60-A3	MBT	1982			In addition to 439 already on order; for delivery from 1984; deal incl 23 M-88-A1 ARVs
94	M-60-A3	MBT	(1983)			US Letter of Offer Sep 1983
86	M-88-A1	ARV	1980	1981	16	
				1982	13	
				(1983)	(57)	
23	M-88-A1	ARV	1982			
52	M-901 TOW	APC	1980	(1983)	(52)	Improved version of M-113-A1; armed with TOW ATMs
216	MIM-23B Hawk	Landmob SAM	1979	1982	(72)	12 btys with 6 launchers/bty; each launcher has 3 missiles; 4 additional btys on order; total requirement: 24 btys
				1983	(72)	
				1984	(72)	
72	MIM-23B Hawk	Landmob SAM	1982			Order incl 24 launch units in 4 btys; in addition to 12 btys (216 missiles and 72 launch units) ordered 1979
450	MIM-72F	SAM/ShAM	(1983)			US Letter of Offer Dec 1983; total cost incl 26 M-48 Chaparral tracked launch vehicles and training missiles: $160 mn
18	RGM-84A Harpoon	ShShM	(1983)	(1984)	(18)	US Letter of Offer Sep 1983; arming 2 F-30 Class frigates; total cost: $40 mn
..	RGM-84A Harpoon	ShShM	(1983)			Arming new FACs on order from USA; MoU signed 1983

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
		3	PC-28 Type	PC	1983			Prior to planned licence production of 6 ships
14 El Salvador	Argentina	. .	IA-58A Pucara	Trainer/COIN	1982			Deal reportedly incl FAL 7.62mm rifles; unconfirmed
13 Ethiopia	USSR	(6)	MiG-25	Fighter/interceptor	(1983)	(1983)	(6)	Reportedly delivered
		1	Polnocny Class	LST	(1982)	1983	1	In addition to 1 delivered 1981
13 Gabon	France	6	Mirage-5	Fighter	1982	(1983)	(1)	
						(1984)	(5)	
		8	Mirage-5	Fighter	1983			In addition to 6 ordered 1982
		75	VP-2000	APC	1982			
	Spain	2		LST	1981			Ordered Aug 1981; displacement: 650t; other landing craft may be on order
13 Ghana	Italy	8	SF-260TP	Trainer	1982	1983	8	
13 Guinea	Egypt	(50)	Walid	APC	1983	(1983)	(25)	Order incl mortars, machine-guns, rifles and ammunition
						(1984)	(25)	
13 Guinea Bissau	Czechoslovakia	10	L-39 Albatross	Trainer	(1981)	(1982)	(5)	
						(1983)	(5)	
15 Guyana	Brazil	. .	EE-11 Urutu	APC	1982			Undisclosed number ordered for border defence against Venezuela
		(2)	EMB-111	Mar patrol	1982			Small number ordered Oct 1982
14 Haiti	Israel	24	Kfir-C2	Fighter/ground attack	(1983)			Unconfirmed
	Italy	6	SF-260 Warrior	Trainer/COIN	1982	1983	6	
	UK	1	BN-2A Islander	Transport	(1983)	1983	1	
	USA	1	Bonanza A-36	Lightplane	(1983)	1983	1	Designation unconfirmed
		(2)	C-47	Transport	(1983)	(1983)	(2)	
14 Honduras	Brazil	2	EMB-111N	Mar patrol	(1983)			Total value incl 8 EMB-312s: $15 mn; unconfirmed
		8	EMB-312 Tucano	Trainer	(1983)			Unconfirmed agreement at Paris Air Show
	Israel	(12)	Kfir-C2	Fighter/ground attack	(1983)			Unconfirmed; sale may have been vetoed by USA

		..	M-4 Sherman	MT	(1983)			Unconfirmed; part of Kfir deal
	Spain	4	C-101 Aviojet	Trainer/strike	1983			Option on 4 more; delivery from 1986
	USA	2	C-130H Hercules	Transport	(1983)	1983	2	On loan
		12	F-5E Tiger-2	Fighter	(1983)			Ordered; USA reluctant to sell
9 India	Canada	(8)	DHC-6	Transport	(1981)			Also negotiating for licence production of some 200 DHC-6s; total cost: $350 mn
	France	..	AM-39 Exocet	AShM	1982			Arming Jaguar fighters
		..	AMX-30-155 GCT	SPG	(1984)			Negotiating sale of small number; to be followed by Indian-built Vijayanta GCT howitzers
		3700	Milan	ATM	(1981)	1982 (1983)	(100) (200)	To be followed by licence production
		40	Mirage-2000	Fighter/strike	1982			Contract provides for possible local assembly of an additional 50 and local production of 60 Mirage-2000s
		..	MM-38 Exocet	ShShM	1982			Unspecified number ordered to replace Styx ShShMs
		(240)	Super-530	AAM	1982			Arming 40 Mirage-2000 fighters
	Germany, FR	10	Do-228-200	Transport	1983			For delivery 1984; to be followed by licence production
		2	Type 1500	Submarine	(1981)			Licence production of 2-6 to follow
	Sweden	..	RBS-70	Port SAM	(1983)			Negotiating order valued at SEK500 mn
	UK	8	Jaguar	Fighter	(1982)			18 delivered on loan from RAF in 1980 prior to delivery of 40 ordered 1979; 8 returned May 1982; 1 transferred to Oman; 1 crashed; rest offered to Indian AF; unconfirmed
		(24)	Sea Eagle	AShM	1983			Arming 12 Sea King helicopters; follow-on orders expected; delivery from 1986
		6	Sea Harrier	Fighter/strike	1979	1983	6	For use with aircraft carrier 'Vikrant'
		2	Sea Harrier T-4	Fighter/trainer	1979	1983	2	Ordered Nov 1979; total cost incl 6 Sea Harriers
		20	Sea King HAS-5	Hel	1983			Contract signed Jun 1983; option on 8 more; to be armed with Sea Eagle AShMs; total value: approx. $125 mn
	USSR	..	AA-5 Ash	AAM	1980	(1980) (1981) (1982) (1983)	(90) (140) (140) (140)	Arming MiG-23s; part of Soviet arms package to India
		95	An-32 Cline	Transport	1980			Ordered Nov 1980
		..	AT-3 Sagger	ATM	1980			

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
		. .	BMP-1	MICV	(1983)			Major re-equipment deal; licence production to follow initial deliveries from USSR
		3	Kashin Class	Destroyer	1976	1980	1	Modified Kashin Class; possibly with KA-26 helicopter
						1982	1	
						1983	1	
		85	MiG-23	Fighter	(1979)	1980	(10)	Order reportedly incl 70 MiG-23BN fighters and 15 MiG-23U trainers
						1981	(25)	
						1982	(25)	
						1983	(25)	
		18	MiG-25	Fighter/interceptor	(1981)	1981	(2)	
						1982	(10)	
		. .	MiG-25 Foxhound	Fighter	(1983)			Small quantity ordered; also designated MiG-31
		. .	MiG-29	Fighter	(1983)			Undisclosed number ordered; licence production may follow
		(3)	Nanuchka Class	Corvette	1982			In addition to 3 in service
		. .	SA-9 Gaskin	Landmob SAM	(1981)	(1981)	(40)	Mounted on modified BTR-40 chassis; unconfirmed
						(1982)	(40)	
						(1983)	(40)	
		(36)	SA-N-1	ShAM	(1977)	1980	(12)	Arming 3 Kashin Class destroyers
						1982	(12)	
						1983	(12)	
		(36)	SA-N-4	ShAM	(1978)	1983	(12)	Arming Godavari Class frigates
		(36)	SSN-2 Styx	ShShM	(1977)	1980	(12)	Arming 3 Kashin Class destroyers
						1982	(12)	
						1983	(12)	
		(18)	SSN-2 Styx	ShShM	1978	1983	(6)	Arming Godavari Class frigates
		. .	T-74	MBT	(1983)			Replacing approx. 200 T-72s delivered 1981-82; licence production may follow
		3	Yevgenia Class	MSC	(1983)	1983	3	
10 Indonesia	Australia	. .	Attack Class	PC	(1981)	1982	1	In addition to 2 delivered 1973-74; being phased out by Australia
						1983	2	
		6	N-22L Nomad	Mar patrol	1980	1981	2	Indonesia has 6 N-22Bs and 12 N-22Ls
						1982	1	
						1983	1	
						1984	(2)	
	France	(48)	MM-40 Exocet	ShShM/SShM	(1982)			Arming PSMM-5 Class FACs

	Germany, FR	2	PC-57 Type	PC/FAC	1982	(1984)	(2)	Option on 6 more for local assembly not yet taken up
		2	Type 209	Submarine	1980	1983	1	In addition to 2 in service
	Korea, South	4	PSMM-5 Type	FAC	1982			In addition to 4 in service; armed with Exocet ShShMs
	UK	5	Hawk	Adv trainer/strike	1981	1983	5	In addition to 12 in service; Mk-53
	USA	3	B-737-200C	Transport	1981	1982	1	2 for AEW; 1 for VIP transport
						1983	2	
		22	Commando Ranger	APC	(1983)	(1983)	22	Total cost incl 28 Scouts: $9.6 mn
		28	Commando Scout	Recce AC	(1983)	(1983)	28	
		4	Jetfoil	Hydrofoil FAC	1983			In addition to 1 in service; ordered Oct 1983; option on 6 more and licence production; delivery to begin 1984; total cost: $150 mn
		133	M-101-A1 105mm	TH	(1981)			US Letter of Offer
		9	Model 212 UH-1N	Hel	1982	1983	9	Ordered Dec 1982; delivered Sep 1983
		9	Model 300C	Hel	1982	1983	9	Ordered Dec 1982; delivered Jul 1983
		6	Model 412	Hel	1983	1983	6	Delivered prior to planned licence production
		9	T-34C-1	Trainer	(1983)	(1984)	(9)	Total value incl spares and training: $12.4 mn
8 Iran	Argentina	(100)	TAM	MT	(1983)	(1983)	(25)	Undisclosed number reportedly delivered
	China	(100)	F-6	Fighter	(1982)	(1982)	(50)	Unconfirmed; reportedly delivered
						(1983)	(50)	
	Korea, North	(150)	T-62	MBT	(1981)	(1982)	(75)	North Korea reportedly supplied Iran with $2 bn worth of arms in 1982, incl MBTs, artillery and small arms
						(1983)	(75)	
	South Africa	. .	G-5 155mm	TH/TG	(1982)	(1983)	(12)	Unspecified number reportedly delivered
	Switzerland	(6)	PC-7	Trainer	(1983)	1983	(6)	Reportedly delivered Sep 1983
8 Iraq	Brazil	(300)	EE-11 Urutu	APC	1982			Total value incl EE-3 Jararaca: $250 mn
		(300)	EE-3 Jararaca	SC	1982			
	China	(250)	T-59	MBT	(1981)	(1982)	(130)	Unconfirmed
						(1983)	(120)	
	Egypt	(80)	EMB-312 Tucano	Trainer	(1983)			From Brazil and from Egyptian licence production; for delivery from 1984
		. .	F-6	Fighter	(1983)	1983	(10)	Chinese version of MiG-19 assembled in Egypt
		. .	F-7	Fighter	(1983)	1983	(5)	Chinese version of MiG-21 assembled in Egypt
		(250)	T-55	MBT	1981	1981	(50)	Several hundred delivered
						1982	(100)	
						1983	(100)	

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
		200	T-55	MBT	(1983)	1983	(60)	Built in Romania; transferred via Egypt
						(1984)	(140)	
	France	(150)	Alpha Jet	Adv trainer/strike	(1984)			Negotiating; partly built in France and partly locally assembled; agreement not yet signed
		(20)	AM-39 Exocet	AShM	1983	1983	(20)	Arming Super Etendard fighters
		(150)	AMX-30 Roland	AAV	1981	(1982)	(15)	Ordered Feb 1981; number unconfirmed; at least 30 delivered by 1983
						(1983)	(15)	
		85	AMX-30-155 GCT	SPG	1982			
		24	Mirage F-1C	Fighter/interceptor	1980	(1982)	(12)	
						(1983)	(12)	
		29	Mirage F-1C	Fighter/interceptor	1982	(1983)	(15)	Ordered Feb 1982
						(1984)	(14)	
		. .	R-530	AAM	1979			Delivery may have started
		(600)	Roland-2	Landmob SAM	1981	(1982)	(120)	Ordered Feb 1981
						(1983)	(120)	
		43	SA-330L Puma	Hel	1979	(1981)	(15)	Ordered Jul 1979
						(1982)	(15)	
						(1983)	(13)	
		35	SA-342K Gazelle	Hel	(1978)	(1981)	(12)	In addition to 40 previously delivered
						(1982)	(12)	
						(1983)	(11)	
		5	Super Etendard	Fighter/strike	1983	(1983)	(5)	Diverted from French order for 71; armed with AM-39 Exocet AShMs
		3	Super Frelon	Hel	(1982)			
	Italy	(224)	Aspide	AAM/SAM/ShAM	(1981)			Arming 4 Lupo Class frigates and 6 Wadi Class corvettes
		4	Lupo Class	Frigate	1980			Order incl 6 Wadi Class corvettes and 1 Stromboli Class support ship
		(60)	Otomat-2	ShShM	(1981)			Arming 4 Lupo Class frigates and 6 Wadi Class corvettes
		1	Stromboli Class	Supply ship	1980			
		6	Wadi Class	Corvette	1980			Iraqi designation: Assad Class
	Jordan	. .	GHN-45 155mm	TH/TG	(1982)	(1983)	(50)	
	Libya	(400)	EE-9 Cascavel	AC	(1982)	1983	(400)	
	Spain	. .	BMR-600	ICV	1981	(1982)	(200)	
						(1983)	(200)	
		24	Bo-105CB	Hel	(1980)	(1982)	(12)	
						(1983)	(12)	
		. .	C-101 Aviojet	Trainer/strike	(1981)			Unconfirmed

		20	C-212-200	Transport	1981			Incl in $900 mn 5-year programme
	UK	58	Saboteur	APC	1982	1982	8	
						(1983)	(50)	
	USA	6	L-100-30	Transport	1982			US ban lifted Apr 1982; unconfirmed
	USSR	(60)	MiG-23	Fighter	(1979)	1980	(20)	
						(1982)	(20)	
						(1983)	(20)	
		..	MiG-25	Fighter/interceptor	1979	(1979)	(5)	Deliveries reportedly resumed 1982
						(1980)	(5)	
						(1982)	(10)	
		..	MiG-27	Fighter/strike	(1979)	(1979)	(7)	
						(1980)	(8)	
						(1982)	(10)	
						(1983)	(10)	
		..	SA-6 Gainful	Landmob SAM	1979	(1980)	(100)	
						(1981)	(60)	
						(1982)	(60)	
						(1983)	(60)	
		..	SA-8 Gecko	Landmob SAM	(1982)	1982	(72)	
						1983	(72)	
		(100)	T-55	MBT	(1981)	1982	(50)	Transferred via Saudi Arabia; possibly also some T-54s
						1983	(50)	
		(150)	T-72	MBT	1980	(1982)	(50)	
						(1983)	(50)	
8 Israel	South Africa	2	B-707-320B	Transport	(1982)	1983	2	Also designated B-707-344C
	USA	150	AIM-7M Sparrow	AAM/SAM	1983			Arming F-15s; US Letter of Offer Jul 1983; total cost: $52 mn
		200	AIM-9L	AAM	1983			US Letter of Offer Mar 1983
		11	F-15A Eagle	Fighter/interceptor	1982			Compensatory offer due to sale of extra equipment for Saudi Arabian F-15s; order incl 22 fuel tanks, 6 spare engines and support equipment
		75	F-16A	Fighter/strike	1983			In addition to 75 in service; total cost:$2 700 mn of which half is grant and half is credit; additional offset purchases of F-16 components in Israel valued at $300 mn
		200	M-109-A1 155mm	SPH	1979			
		300	M-60-A3	MBT	1979	1980	(50)	
						1981	(50)	
						1982	(65)	
						1983	(50)	
		200	MIM-23B Hawk	Landmob SAM	1982			

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
		100	RGM-84A Harpoon	ShShM	(1979)	(1980)	(25)	At least 100 ordered to complement Gab-
						(1981)	(25)	riel ShShM; AShM version for F-4
						(1982)	(25)	probably also ordered
						(1983)	(25)	
		(24)	RGM-84A Harpoon	ShShM	(1980)	1982	(12)	Arming 2 Flagstaff-2 Class FACs
						(1983)	(12)	
13 Ivory Coast	France	1	Alpha Jet	Adv trainer/strike	1983			Replacing lost aircraft
8 Jordan	Austria	200	GHN-45 155mm	TH/TG	1982	(1982)	(18)	Acc to unconfirmed reports, an unspec-
						(1983)	(100)	ified number have been deployed in Iraq
	UK	5	Bulldog-125	Trainer	1981	1983	5	In addition to 5 ordered 1980
	USA	(60)	AGM-65C	ASM	(1983)			Unconfirmed
		(192)	BGM-71A TOW	ATM	1981			Arming 24 Model 209 Cobras
		. .	F-20 Tigershark	Fighter	(1984)			Negotiating
		. .	FIM-92A Stinger	Port SAM	1982			
		78	M-109-A2 155mm	SPH	1980			Status of deal uncertain
		81	M-113-A2	APC	1980			Ordered Jan 1980
		200	M-60-A3	MBT	1980	(1982)	(60)	Requested Jul 1979; US government ap-
						(1983)	(60)	proved sale; to replace M-47 and
								Centurion; 118 conversion kits for
								older models also being offered by USA
		30	M-88-A1	ARV	1981			Status of deal uncertain
		24	Model 209 AH-1S	Hel	1982			For delivery 1985
	USSR	240	SA-6 Gainful	Landmob SAM	(1981)			Unconfirmed
		. .	SA-7 Grail	Port SAM	(1981)			Unconfirmed
		. .	SA-8 Gecko	Landmob SAM	1983	(1983)	(60)	Total value incl 16 Shilka AAGs: $300 mn
		(16)	ZSU-23-4 Shilka	AAV	1983	(1983)	(8)	
						(1984)	(8)	
13 Kenya	Israel	(16)	Gabriel-2	ShShM	(1981)	(1981)	(4)	Being fitted on 4 Brooke Marine PCs
						(1982)	(4)	delivered 1974-75
						(1983)	(4)	
						(1984)	(4)	
	UK	42	MBT-3	MBT	1980	1981	(19)	38 MBTs and 4 ARVs; in addition to
						1982	(19)	39 (36+3) delivered 1979-80
						1983	(4)	
		70		TG	(1981)	(1983)	(35)	
						(1984)	(35)	

10 Korea, North	USSR	. .	MiG-21F	Fighter	1974	1980	(20)	
						1981	(20)	
						1982	(20)	
						1983	(20)	
10 Korea, South	Brazil	(30)	T-37C	Trainer/COIN	(1983)	1983	(30)	
	USA	(200)	AGM-65A	ASM	1977	1980	8	
		30	F-16A	Fighter/strike	(1982)			Reagan Administration lifted ban on F-16 sales to South Korea; total cost incl 6 F-16Bs: $931 mn
		6	F-16B	Fighter/trainer	1981			
		6	F-4D Phantom	Fighter/interceptor	1982			Compensation for attrition losses
		. .	FIM-92A Stinger	Port SAM	(1981)			
		42	LVTP-7A1	Amph ASSV	1982			
		1089	M-551 Sheridan	LT	1981	(1983)	(500)	
						(1984)	(589)	
		21	M-88-A1	ARV	1981	(1984)	(21)	
		170	MIM-23B Hawk	Landmob SAM	1982			Total cost incl 723 rocket motors: $68 mn
		(298)	MIM-23B Hawk	Landmob SAM	(1983)			
		(64)	RGM-84A Harpoon	ShShM	(1984)			Replacing Standard on 8 PSMM-5 FACs
8 Kuwait	France	(12)	AM-39 Exocet	AShM	1983			Arming 6 AS-332 Super Pumas
		34	AMX-13-90	LT	(1983)	(1983)	34	Incl other AMX-13 versions
		10	AMX-155 Mk-F3	SPH	1982	(1983)	10	
		6	AS-332	Hel	1983			Total cost incl AM-39 Exocet AShMs: $95 mn
		12	Mirage F-1C	Fighter/interceptor	1982			Ordered Dec 1982; armed with Super-530 AAMs; total cost: $400 mn
		(32)	MM-40 Exocet	ShShM/SShM	1980	(1982)	(4)	Arming 6 TNC-45 and 2 Type 57 FACs
						(1983)	(16)	
						(1984)	(12)	
		(72)	Super-530	AAM	1982			Arming 12 Mirage F-1Cs
	Germany, FR	2	PC-57 Type	PC/FAC	1980	1982	(1)	
						1983	(1)	
		6	TNC-45	FAC	1980	1983	(3)	
						(1984)	(3)	
	UK	(100)	Chieftain-5	MBT	(1984)			Negotiating
		12	Hawk	Adv trainer/strike	1983			Mk-64 trainer/ground attack version; for delivery from 1985; total cost: $105 mn
		4	Loadmaster	Landing craft	1983			
		(100)	FV-101 Scorpion	LT	(1983)			Unconfirmed

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
		6	SRN-6	Hovercraft	(1980)	(1982)	(2)	
						(1983)	(4)	
	USA	4840	BGM-71A TOW	ATM	1982			US Letter of Offer Feb 1982; order incl M-901 and M-113 armoured vehicles; total cost: $97 mn
		4	L-100-30	Transport	1981	(1983)	(4)	
		(188)	M-113-A2	APC	1982			
		56	M-901 TOW	APC	1982			US Letter of Offer Feb 1982
10 Laos	USSR	(34)	MiG-21F	Fighter	(1982)	(1983)	(34)	
8 Lebanon	France	70	AMX-13-105	LT	1978	1981	13	
						1982	(9)	
						1983	(10)	
		..	VAB	APC	(1978)	1981	5	
						(1982)	(10)	
						(1983)	(10)	
	Jordan	(40)	M-48 Patton	MBT	(1982)	(1983)	(40)	Deal may cover up to 100 MBTs
	UK	..	Swingfire	ATM	1980			Ordered May 1980
	USA	253	M-113-A2	APC	1983			USA also supplying $102 mn worth of ammunition
		102	M-113-A2	APC	1983			Order incl 25 M-577-A2 CPCs and 93 M-125-A2 mortar carriers; possibly similar to order for 253 APCs
		93	M-125-A2	APC	1983			
		12	M-198 155mm	TH	1982	(1982)	(6)	
						(1983)	(6)	
		34	M-48-A5	MBT	(1982)	1983	34	
		68	M-48-A5	MBT	1983			
		25	M-577-A2	CPC	1983			
		..	M-60-A3	MBT	(1983)			Unconfirmed
13 Lesotho	Italy	2	AB-412 Griffon	Hel	(1983)	1983	2	
13 Liberia	India	..	HJT-16 Kiran-2	Trainer/COIN	(1983)			Negotiating sale of small number
		6	SA-316B Chetak	Hel	1982			
	Israel	1	IAI-202 Arava	Transport	1983	(1984)	(1)	Order incl 3 for Air Liberia
12 Libya	Brazil	..	EE-11 Urutu	APC	(1984)			Advanced negotiations for package incl Cascavel AVs and Tucano, Xingu and

	..	EE-9 Cascavel	AC	(1983)			
	(8)	EMB-111N	Mar patrol	(1983)			
	..	EMB-121 Xingu	Transport	(1983)			
	(100)	EMB-312 Tucano	Trainer	(1984)			Negotiating for 100-150 aircraft
France	10	Combattante-2G	FAC	1975	1982	7	Delivery of last FAC suspended until Jan
					1983	2	1984 due to Libyan intervention in Chad
					1984	1	
	..	R-530	AAM	(1975)	(1979)	(76)	Arming Mirages; status of deal uncertain
Italy	(32)	Aspide	AAM/SAM/ShAM	(1982)	(1983)	(32)	Arming frigate 'Dat Assawari'
	20	CH-47C Chinook	Hel	(1981)			
	20	G-222L	Transport	(1979)	1981	(4)	
					1982	(6)	
					1983	(8)	
					(1984)	(2)	
	168	Otomat-1	ShShM	1977	1979	(12)	Arming 10 Combattante-2G Class FACs and
					1980	(36)	4 Wadi Class corvettes
					1982	(84)	
					1983	(36)	
	..	Otomat-2	ShShM	(1981)			Arming 4 new Wadi Class corvettes
	210	Palmaria 155mm	SPH	1981	1982	12	
					1983	(50)	
	(60)	SF-260 Warrior	Trainer/COIN	1981	(1982)	(40)	Bringing total on order to some 300
					(1983)	(20)	
	4	Wadi Class	Corvette	(1981)			In addition to 4 in service; to be armed with Otomat ShShMs
Netherlands	8	F-27 Mk-600	Transport	1981	1982	6	May be for civilian use
					1983	2	
Turkey	12	SAR-33	PC	1980	(1982)	(1)	West German design
					(1983)	(1)	
USSR	..	AA-2 Atoll	AAM	(1975)	(1976)	(60)	
					(1977)	(60)	
					(1978)	(60)	
					(1979)	(60)	
					(1980)	(60)	
					(1981)	(60)	
					(1982)	(60)	
	..	AA-6 Acrid	AAM	(1978)	(1979)	(40)	Arming MiG-25s
					(1980)	(40)	
					(1981)	(40)	
					(1982)	(40)	

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
		3	Foxtrot Class	Submarine	1978	1981	1	On order in addition to 3 in service
						1982	1	
						1983	1	
		(12)	Mi-14 Haze	Hel	(1982)	1983	(12)	For ASW
		. .	MiG-23	Fighter	(1978)	(1979)	(30)	No deliveries reported in 1983
						(1980)	(30)	
						(1981)	(20)	
						(1982)	(20)	
		. .	MiG-25	Fighter/interceptor	(1977)	(1979)	(15)	No deliveries reported in 1983
						(1980)	(15)	
						(1981)	(15)	
						(1982)	(15)	
		4	Nanuchka Class	Corvette	1980	1981	1	
						1983	1	
		3	Natya Class	MSO	(1982)	1982	1	In addition to 2 delivered 1981
						1983	2	
		(48)	SA-N-4	ShAM	1980	1981	(12)	Arming Nanuchka Class corvettes
						1983	(12)	
		(48)	SSN-2 Styx	ShShM	1980	1981	(12)	Arming Nanuchka Class corvettes
						1983	(12)	
		. .	SSN-2 Styx	ShShM	(1982)	1983	(12)	Land-based version for protection of Gulf of Sirte
	Yugoslavia	4	Koncar Class	FAC	(1983)			Unconfirmed; based on Swedish Spica design; to be armed with Styx ShShMs
13 Madagascar	France	(30)	AML-60	AC	1982			Requested but not approved
		30	AML-90	AC	1982			Ordered Jan 1982
10 Malaysia	Belgium	186	Sibmas	APC	1982	1982	(20)	Incl 162 APCs and 24 ARVs; for delivery 1982-84
						(1983)	(80)	
	France	8	MM-38 Exocet	ShShM	1981			Arming 2 FS-1500 Class frigates
		(48)	MM-40 Exocet	ShShM/SShM	(1983)			Arming 4 new Spica Class FACs
	Germany, FR	459	Condor	APC	1981	1983	(250)	
						(1984)	(209)	
		2	FS-1500 Class	Frigate	1981			Ordered Jun 1981
	Indonesia	10	Bo-105CB	Hel	(1981)	1982	(6)	
						1983	(4)	
	Italy	4	Lerici Class	Minehunter	1980	(1984)	(4)	
		12	MB-339K	Fighter/trainer	1982	1983	12	Option on 14 more

	Spain	4	C-212A Aviocar	Transport	(1980)			Acc to some sources, ordered from licence production in Indonesia
	Sweden	4	Spica Class	FAC	1983			In addition to 4 in service
	Switzerland	44	PC-7	Trainer	1981	(1984)	(33)	
	UK	29	FH-70 155mm	TH	1982			
		26	FV-101 Scorpion	LT	1982	1983	(5)	Ordered Jan 1982; total cost incl 25 Stormer APCs: $40 mn
		25	Stormer	APC	1982	1983	(5)	Ordered Jan 1982
	USA	88	A-4E Skyhawk	Fighter/bomber	1981	(1984)	(10)	63 A-4L and 25 A-4C; 40 A-4L to be refurbished by Grumman; remaining 23 A-4Ls to be stored in USA; the A-4Cs to be used for spares
		(84)	AIM-9L	AAM	(1983)			Arming F-5Es
		14	F-5E Tiger-2	Fighter	1982			US Letter of Offer Jul 1982; order incl 2 F-5Fs; total cost: $260 mn; purchase postponed due to funding problems
		2	F-5F Tiger-2	Trainer	1982			
		2	RF-5E Tigereye	Recce	1980	1983	2	
14 Mexico	Germany, FR	6	Bo-105C	Hel	(1980)	1982	4	On 6 Halcon Class PCs
						1983	2	
	Spain	6	Halcon Class	PC	1980	1982	4	Last of 6 commissioned Mar 1983
						1983	2	
	Sweden	12	Spica Class	FAC	(1981)			Negotiating
	Switzerland	55	PC-7	Trainer	1978	1979	(2)	
						1980	(10)	
						1981	(18)	
						1982	(15)	
						1983	(10)	
	USA	1	B-737-100	Transport	(1982)	1983	1	
		11	F-5E Tiger-2	Fighter	1980	1982	(5)	Total cost incl 2 F-5Fs: $115 mn
						(1983)	(6)	
		2	Gearing Class	Destroyer	(1981)	1983	2	
		1	Merlin-3A	Lightplane	(1982)	1983	1	
12 Morocco	France	. .	AML-90	AC	(1978)	(1981)	(20)	
						(1982)	(30)	
						(1983)	(30)	
		108	AMX-10RC	Recce AC	(1978)	1980	2	
						1982	(10)	
						1983	(20)	
		(3)	AMX-13 ARV	ARV	1981	1982	(2)	Saudi Arabian funding
						1983	(1)	

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
		16	AMX-155 Mk-F3	SPH	1981	1982	(8)	Saudi Arabian funding
						1983	(8)	
		1	AS-365N	Hel	(1982)	1983	1	
		(8)	MM-40 Exocet	ShShM/SShM	(1980)	1983	(8)	Arming F-30 Class frigate
		24	SA-342K Gazelle	Hel	(1980)	1982	12	
						1983	12	
		(400)	VAB	APC	(1979)	1979	(50)	Several versions
						1980	(100)	
						1981	(100)	
						1982	(100)	
						1983	(50)	
	Germany, FR	(10)	PC-57 Type	PC/FAC	(1983)			Negotiating
	Italy	(24)	Aspide	AAM/SAM/ShAM	1977	1983	(24)	Arming F-30 Class frigate
	Spain	1	F-30 Class	Frigate	1977	1983	1	Ship named 'Colonel Er-Rhamani'
	USA	381	AGM-65B	ASM	1982			USA approved sale; arming 20 F-5Es
		1	B-707-320C	Transport	1983	1983	1	For VIP use
		4	C-130H Hercules	Transport	1982			In addition to 19 in service
		108	M-60-A3	MBT	(1982)			
		3	Super King Air	Transport	(1981)	1982	2	
						1983	1	
13 Mozambique	USSR	1	An-26 Curl	Transport	(1982)	1983	1	
		(20)	MiG-21MF	Fighter	(1981)			USSR proposed new MiG-21 squadron
14 Nicaragua	Bulgaria	(25)	BTR-40PB	SC	(1982)	1983	(25)	
	France	2		PC	1981	1983	2	Arms: 2x20mm gun
	Libya	6	L-39 Albatross	Trainer	(1983)	(1983)	(6)	Unconfirmed
		1	Mystere-20	Transport	(1983)	1983	(1)	For VIP use
	USSR	. .	An-12 Cub-A	Transport	(1982)	1983	(1)	
		. .	Mi-8 Hip	Hel	(1982)	1983	(10)	
		. .	MiG-21MF	Fighter	(1984)			1 squadron to be delivered; unconfirmed
		. .	T-55	MBT	(1982)	1983	(10)	Identity of seller unconfirmed
		. .	ZSU-57-2	AAV	(1982)	1983	(10)	Identity of seller unconfirmed
13 Niger	France	. .	AML-90	AC	1981			Unspecified number ordered Mar 1981
13 Nigeria	Austria	70	Steyr-4K 7FA	APC	1982	1982	50	In addition to 23 delivered 1981
						1983	20	
	Brazil	(100)	EE-9 Cascavel	AC	1981			Designation unconfirmed; well over 100 ordered

		1	EMB-121 Xingu	Transport	1982	1983	1	Option on 1 more; may be for civilian use
	France	28	AMX-30 Roland	AAV	1982			
		. .	Milan	ATM	(1983)			Unspecified number of missiles and launchers ordered
		595	Roland-2	Landmob SAM	1982			Total value incl 28 launch vehicles: $170 mn; contract signed Mar 1982
	Germany, FR	12	Alpha Jet	Adv trainer/strike	1983			In addition to 12 in service; order placed with Dornier
		18	Do-128-6	Transport	1982	1983	(6)	Incl 2 Do-228-200s
	Italy	(16)	Aspide	AAM/SAM/ShAM	1982	1983	(16)	Second order; arming Meko-360 destroyer
		5	G-222	Transport	1982	(1983)	(2)	Ordered Jul 1982
						(1984)	(3)	
		1	Lerici Class	Minehunter	1983			Ordered Jun 1983; option on 1 more
		12	MB-339A	Trainer/strike	1983			To replace L-29 Delfin aircraft
		(25)	Palmaria 155mm	SPH	1982			
	Netherlands	2	F-27 Maritime	Mar patrol	(1982)	1983	1	
						(1984)	(1)	
	Sweden	(42)	FH-77 155mm	TH	(1983)			
	Switzerland	57	Piranha	APC	1981			
	UK	. .	Blowpipe	Port SAM	1982			Unspecified number ordered
		18	Jaguar	Fighter	1983	(1984)	(9)	Option on 18 more
		(8)	Lynx	Hel	1981	1983	1	Ordered Nov 1981; delivery delayed due
						(1984)	(2)	to lack of Nigerian base
		36	MBT-3	MBT	1981	1983	(18)	Order incl 6 ARVs and 5 BLs
		6	MBT-3 ARV	ARV	1981	1983	(3)	
		5	MBT-3 BL	BL	1981	1983	(2)	
		75	Saboteur	APC	1982			
		49	Stormer	APC	(1982)	1982	(20)	Some are reportedly Scorpion, Spartan
						1983	(29)	and Samaritan versions
		. .	Swingfire	ATM	1983			Ordered Nov 1983
	USA	3	C-130H-30	Transport	(1982)	1983	2	
						(1984)	(1)	
		5	CH-47C Chinook	Hel	1983	1983	5	Ordered Feb 1983; delivered Oct 1983
8 Oman	France	(18)	MM-40 Exocet	ShShM/SShM	1981	1982	(6)	Arming 3 Province Class FACs; 2
						1983	(6)	triple launchers on each vessel
						(1984)	(6)	
		4	SA-330L Puma	Hel	(1980)			Order unconfirmed
	Italy	. .	Palmaria 155mm	SPH	(1983)			Undisclosed number on order
	UK	. .	Blowpipe	Port SAM	1982			Ordered Dec 1982
		1		Support ship	1982			In addition to 1 delivered 1979

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
		(15)	Chieftain-5	MBT	1983			12-15 ordered in addition to 12 already in service
		12	Jaguar	Fighter	1981	1983	12	Ordered Jul 1980; in addition to 12 in service
		2	Province Class	FAC	1981	(1983)	(1)	In addition to 1 delivered 1982; to be armed with MM-40 Exocet ShShMs
						(1984)	(1)	
	USA	250	AIM-9P	AAM	1980	1982	(125)	Arming Jaguar fighters
						1983	(125)	
		2	C-130H Hercules	Transport	1981	1982	1	
						(1983)	(1)	
		6	Model 214ST	Hel	1983	(1983)	(4)	
						(1984)	(2)	
9 Pakistan	China	(52)	Q-5 Fantan-A	Fighter/ground attack	1982	1983	(30)	
						(1984)	(22)	
		. .	T-59	MBT	(1975)	(1978)	(50)	China has delivered about 50/year
						(1979)	(50)	
						(1980)	(50)	
						(1981)	(50)	
						(1982)	(50)	
						(1983)	(50)	
	France	(36)	AM-39 Exocet	AShM	(1980)	1982	(18)	Arming some of 32 Mirage-5s delivered 1980-83
						1983	(18)	
		32	Mirage-5	Fighter	1979	1980	(10)	
						1981	(10)	
						1982	(10)	
						1983	(2)	
		. .	R-530	AAM	1980	(1981)	(40)	Arming Mirage fighters
						(1982)	(40)	
						(1983)	(40)	
		(192)	R-550 Magic	AAM	1978	1980	(60)	Arming 32 Mirage-5s ordered 1979
						1981	(60)	
						1982	(60)	
						(1983)	(12)	
	Romania	4	SA-316B	Hel	(1982)	1983	4	
	Sweden	(400)	RBS-70	Port SAM	(1983)			Order reportedly incl 144 launchers; unconfirmed
	USA	1	Arcadia Class	Destroyer tender	1982	1983	1	To support Gearing Class
		1005	BGM-71A TOW	ATM	1981			Arming Cobra helicopters and M-901 AVs

		40	F-16A	Fighter/strike	1981	(1983)	(6)	First 6 to be delivered within a year of signing contract; partly paid for by Saudi Arabia; not incl in $3 200 mn aid package; Pakistan did not accept first batch due to lack of certain electronics
		..	G-134 Mohawk	Recce	(1983)			For border surveillance
		1	Gearing Class	Destroyer	(1983)	(1984)	(1)	In addition to 5 in service
		64	M-109-A2 155mm	SPH	1981	(1983)	(32)	
		36	M-109-A2 155mm	SPH	1982			In addition to 64 ordered 1981
		40	M-110-A2 203mm	SPH	1981	(1982)	(20)	
						(1983)	(20)	
		75	M-198 155mm	TH	1981			
		100	M-48-A5	MBT	1981	(1982)	(50)	
						(1983)	(50)	
		35	M-88-A1	ARV	1981			
		24	M-901 TOW	APC	1981			
		10	Model 209 AH-1S	Hel	1981	(1983)	(5)	Deal incl TOW missiles, MBTs, ARVs, anti-tank vehicles and howitzers
		10	Model 209 AH-1S	Hel	1982			Second batch ordered Oct 1982; for delivery 1984
		4	OV-10A Bronco	Trainer/COIN	1983			Ordered Jun 1983
14 Panama	USA	12	V-300 Commando	APC	1982	(1983)	(12)	First order for this vehicle
11 Papua New Guinea	Singapore	4		Landing craft	(1980)	1982	1	
						1983	1	
15 Paraguay	Brazil	(10)	EMB-110	Transport	(1983)			Negotiating
		1	Roraima Class	PC	1983			Displacement: 365t; for delivery 1985
	Chile	5	T-25 Universal	Trainer	(1983)	1983	5	
15 Peru	Argentina	80	TAM	MT	1983			Licence production may follow
	Canada	8	DHC-6	Transport	1982	(1983)	(8)	
	France	40	AM-39 Exocet	AShM	1982			Ordered Dec 1982; arming Mirage-2000s
		26	Mirage-2000	Fighter/strike	(1982)			May be cancelled due to funding problems
		(26)	Mirage-5	Fighter	(1981)			Possibly Mirage-50
		1	Mystere-20	Transport	1982	1983	1	Gift; equipped for air surveillance
	Germany, FR	(10)	Bo-105CB	Hel	(1981)	(1982)	(4)	
						(1983)	(6)	
		4	Type 209	Submarine	1976	1980	1	In addition to 2 delivered 1974-75; also designated Type 1200
						1981	1	
						1982	1	
						1983	1	

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
	Italy	96	Aspide	AAM/SAM/ShAM	1975	1979	48	Arming Lupo Class frigates
						(1983)	(24)	
		6	G-222	Transport	(1982)			Unconfirmed
		96	Otomat-1	ShShM	1974	1979	48	Arming Lupo Class frigates
						(1983)	(24)	
	USA	2	Learjet-35A	Mar patrol/transport	(1983)	1983	2	Delivered Apr 1983
		12	Model 214ST	Hel	1983			Ordered Feb 1983
	USSR	16	Mi-24 Hind-D	Hel	(1982)	1983	16	
		(150)	T-55	MBT	(1981)			Unconfirmed
10 Philippines	Korea, South	3	PSMM-5 Type	FAC	1980			
	USA	55	LVTP-7A1	Amph ASSV	1982			US Letter of Offer Feb 1982; for Marine Corps; total cost incl spares and support equipment: $64 mn
		12	Model 205 UH-1H	Hel	1983	(1983)	12	
		16	Model 412	Hel	1982			
		18	OV-10A Bronco	Trainer/COIN	1980			President Carter agreed to sell; production line to be re-opened; status of deal uncertain
		17	S-76 Spirit	Hel	1983	1983	(8)	Total cost incl 2 UH-60As: $60 mn
		2	UH-60A	Hel	1983			Contract negotiated with Sikorsky; total cost incl 17 S-76s: $60 mn
		10	V-150 Commando	APC	1982			
8 Qatar	France	..	AM-39 Exocet	AShM	(1983)			Unspecified number reportedly ordered for Commando Mk-2 helicopters; unconfirmed
		3	Combattante-3	FAC	1980	1982	1	
						1983	2	
		..	HOT	ATM	1982			Total cost incl Milan ATMs: $20 mn
		..	Milan	ATM	1982			
		14	Mirage F-1C	Fighter/interceptor	1980	1982	(7)	
						1983	(7)	
		(24)	MM-40 Exocet	ShShM/SShM	1980	1982	(8)	Arming 3 Combattante-3 Class FACs
						1983	(16)	
		(50)	MM-40 Exocet	ShShM/SShM	1980			3 coastal defence systems ordered
		..	SA-330 Puma	Hel	1980			Unspecified number ordered
		(12)	SA-342L Gazelle	Hel	(1983)			
	Portugal	8	Commando Mk-3	APC	(1983)			Unconfirmed

	UK	8	Commando Mk-3	Hel	1981	(1983)	(8)	For ASW duties
		. .	Rapier	Landmob SAM	(1981)			1 bty ordered; option on more
13 Rwanda	France	2	Rallye-235GT	Lightplane	1983	1983	1	
						(1984)	(1)	
		6	SA-342L Gazelle	Hel	(1982)	1983	6	
8 Saudi Arabia	Brazil	. .	EE-11 Urutu	APC	(1982)			Unspecified number reportedly ordered; unconfirmed
	France	(60)	AMX-10P	MICV	(1982)			
		. .	AMX-30 Shahine	AAV	1983			For delivery from 1985
		(200)	AS-15TT	AShM	1980	(1982)	(50)	Arming SA-365N Dauphin helicopters on 4 guided missile frigates
						(1983)	(50)	
						(1984)	(100)	
		(24)	AS-365N	Hel	1980	1982	(4)	20 to be armed with AS-15TT; for use on 4 frigates on order from France
						1983	(10)	
						(1984)	(10)	
		(2)	ATL-2	Mar patrol	(1983)			
		(104)	Crotale Naval	ShAM	1980			First export order of naval version; arming F-2000 Class frigates
		4	F-2000 Class	Frigate	1980			For delivery 1984-87
		. .	Mirage-4000	Fighter	(1984)			Developed with Saudi Arabian financial help; may order
		(96)	Otomat-2	ShShM	1980			Arming 4 F-2000 Class frigates
		. .	Shahine	Landmob SAM	1983			Shahine-2; for delivery from 1985
		2	Durance Class	Support ship	1980			Fuel supply ship; displacement: 10 000t
	Indonesia	40	C-212A Aviocar	Transport	1979			
	Italy	200	VCC-1	APC	1982	(1983)	(20)	Some armed with TOW ATMs
	Spain	. .	CN-235	Transport	(1983)			Deal reportedly incl AVs, ships and ammunition
	UK	8	BH-7	Hovercraft	1982			
		200	FH-70 155mm	TH	1982	(1983)	(10)	Unit cost: $0.75 mn
	USA	1600	AGM-65D	ASM	(1984)			Arming F-15s; before Congress Feb 1984
		(1200)	AIM-7F Sparrow	AAM	1978	(1982)	(100)	Arming F-15 fighters
						(1983)	(100)	
		1177	AIM-9L	AAM	1981	1982	(200)	Arming F-15 fighters; not incl in initial contract
						1983	(200)	
		(660)	AIM-9P	AAM	1979			Unconfirmed whether now replaced by AIM-9L
		2538	BGM-71A TOW	ATM	1983			US Letter of Offer; improved version; total cost: $26 mn
		5	E-3A Sentry	AEW	1981			Congress notified; the 4 USAF AWACS to be kept in Saudi Arabia until deliveries begin in 1985

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
		45	F-15A Eagle	Fighter/interceptor	1978	1982	(15)	Incl in US sales package to Middle East;
						1983	(15)	approved Feb 1978; order incl 15 TF-15A
						1984	(15)	trainers
		2	F-15C Eagle	Fighter	1980			DoD offered to sell; to be retained in USA until needed as replacement
		4	F-5E Tiger-2	Fighter	1982			Cost incl 10 RF-5Es and 1 F-5F: $350 mn
		1	F-5F Tiger-2	Trainer	1982			
		6	KC-135	Tanker/transport	(1981)			
		3	M-1 Abrams	MBT	(1983)	1983	3	For evaluation
		18	M-109-A2 155mm	SPH	1983			
		(394)	M-113-A2	APC	1983			Order incl 176 A2s, 33 M-578s, 24 M-106s, 80 M-577s, 19 M-88s, and 62 M-125s; total cost incl MGs and ammunition vehicles: $271 mn
		42	M-198 155mm	TH	1983			
		100	M-60-A3	MBT	1983			US Letter of Offer Jul 1983; equipped with 105mm gun, laser rangefinder and infra-red night sights
		10	RF-5E Tigereye	Recce	1982			For delivery from Sep 1984
		15	TF-15A Eagle	Trainer	1978	1981	(6)	Incl in US sales package to Middle East;
						1982	(6)	approved Feb 1978
						1983	(3)	
		579	V-150 Commando	APC	(1980)	1981	(100)	For modernization of National Guard
						1982	(100)	
						1983	(100)	
11 Seychelles	Italy	(1)		PC	1981	1983	1	Follow-on order expected
10 Singapore	France	150	AMX-13	LT	1978	(1980)	(30)	
						(1981)	(30)	
						(1982)	(30)	
						(1983)	(30)	
		6	AS-350 Ecureuil	Hel	1982			For Navy; unconfirmed
	Italy	30	S-211	Trainer	1983			For delivery from 1984; local assembly planned; firm order for 10, option on 20; total cost: $60 mn
		6	SF-260 Warrior	Trainer/COIN	1982			In addition to 6 delivered 1980
	UK	(240)	Rapier	Landmob SAM	1981			In addition to 10 btys previously acquired

	USA	40	A-4S Skyhawk-2	Fighter/bomber	1981			
		200	AGM-65A	ASM	1981			Total cost incl launchers: $26 mn
		(200)	AIM-9P	AAM	(1982)	(1983)	(200)	Total cost: $12 mn
		4	E-2C Hawkeye	AEW	(1983)			Pending congressional approval; total cost: $601 mn; delivery to start 1985
		(162)	MIM-23B Hawk	Landmob SAM	(1982)			Additional missiles and launchers reportedly on order
13 Somalia	France	50	VLRA	Recce AC	(1983)			
	Italy	(100)	M-47 Patton	MBT	1982	1983	(100)	
	United Arab Emirates	4	BN-2A Islander	Transport	(1983)	1983	4	Gift
		8	Hunter FGA-9	Fighter/ground attack	(1983)	1983	8	
	USA	(12)	M-163 Vulcan	AAV	1981	(1983)	(12)	Order incl 3 TPS/43 defence radars; in exchange for US base rights in Berbera and Mogadishu
		. .	MIM-23B Hawk	Landmob SAM	1982	1982	(12)	Began arriving Aug 1982 as part of US emergency aid; designation unconfirmed
						(1983)	(36)	
9 Sri Lanka	Singapore	2	Model 212	Hel	(1983)	1983	2	
	USA	4	Model 206B	Hel	(1983)	(1983)	(4)	
13 Sudan	France	15	M-3	APC	1980	1983	15	
		10	SA-330L Puma	Hel	1978			Unconfirmed
	UK	10	BAC-167	Trainer/COIN	(1983)	(1984)	(10)	Identity of buyer unconfirmed
	USA	2	C-130H Hercules	Transport	1979			Ordered Feb 1979; 6 C-130Es in AF use
		10	F-5E Tiger-2	Fighter	1979			
		2	V-150 Commando	APC	1982	1983	2	
8 Syria	Czechoslovakia	4	L-39 Albatross	Trainer	(1983)	1983	4	
	Italy	18	AB-212ASW	Hel	(1984)			
		6	CH-47C Chinook	Hel	(1984)			
		12	SH-3D Sea King	Hel	(1984)			
	USSR	. .	AA-2 Atoll	AAM	(1979)	1979	(48)	Arming MiG fighters now being delivered
						1980	(96)	
						1981	(96)	
						1982	(96)	
						1983	(96)	
		(800)	BMP-1	MICV	1981	1982	(200)	Order reportedly incl 4 Nanuchka Class corvettes, 2 Tu-126 AEW aircraft, 700 122/152mm howitzers, 5 squadrons of MiG-23/25s and 4 squadrons of Su-22s; total value: $2 000 mn; Saudi Arabian funding
						1983	(300)	

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
		(200)	M-1973 152mm	SPG	1981	1982	(50)	Designation unconfirmed
						1983	(50)	
		(500)	M-1974 122mm	SPH	1981	1982	(100)	Designation unconfirmed
						1983	(100)	
		..	MiG-23	Fighter	1981	1982	(15)	
						1983	(70)	
		..	MIG-25RE	Recce	1981	1982	(15)	Unspecified number of new recce version
						1983	(15)	reportedly delivered Apr-May 1982;
								some sources report 3 squadrons on order
		4	Nanuchka Class	Corvette	1981			
		..	SA-5 Gammon	SAM	1982	(1983)	(56)	
		..	SA-7 Grail	Port SAM	1978	(1979)	(25)	
						(1980)	(25)	
						(1981)	(25)	
						(1982)	(25)	
						(1983)	(50)	
		..	SA-8 Gecko	Landmob SAM	1982	(1982)	(48)	Designation unconfirmed; part of up-
						(1983)	(48)	grading of SAM network around major
								Syrian cities; deal incl MiG-27
								fighter aircraft
		..	SA-9 Gaskin	Landmob SAM	1978	(1980)	(48)	
						(1981)	(48)	
						(1982)	(48)	
						(1983)	(48)	
		..	SS-21	SSM	(1983)	(1983)	(10)	Unconfirmed
		(60)	Su-22 Fitter-J	Fighter/ground attack	1981	1982	(30)	4 squadrons
						1983	(30)	
		..	T-62	MBT	1982	1982	(200)	
						1983	(200)	
		..	T-72	MBT	1980	1980	(150)	
						1981	(150)	
						1982	(150)	
						1983	(150)	
		2	Tu-126	AEW	1981			
		..	ZSU-23-4 Shilka	AAV	1981	(1982)	(25)	
						(1983)	(25)	
10 Taiwan	Netherlands	2	Zwaardvis Class	Submarine	1981			Request for 2 more turned down by Dutch government 1983

	USA	100	AIM-7F Sparrow	AAM	(1983)			May be cancelled due to Swiss refusal to sell Skyguard air defence system
		1013	BGM-71A TOW	ATM	1980			DoD notified Congress; incl 49 launchers
		66	F-104G	Fighter	(1979)	1982	23	
						1983	43	
		2	Gearing Class	Destroyer	(1982)	1983	2	In addition to 11 in service
		25	M-109-A2 155mm	SPH	1980	1983	(25)	
		357	M-113-A2	APC	1982			140 APCs, 90 M-106-A2 and 72 M-125-A2 mortar carriers, 31 CPCs and 24 of the ambulance version
		33	M-88-A1	ARV	(1983)			US Letter of Offer Jul 1983; offer incl 384 MIM-72F Chaparral SAMs, 120 Sea Chaparral ShAMs, 170 SM-1 Standard ShAM/ShShMs, 100 AIM-7F Sparrow AAM/SAMs, 309 M-48-A5 tank conversion kits,and spare parts; total cost: $530 mn
		280	MIM-23B Hawk	Landmob SAM	1980			Sale approved by Congress Oct 1980
		90	MIM-23B Hawk	Landmob SAM	1981			DoD notified Congress; in addition to 4 battalions already purchased; to enter war reserve
		384	MIM-72F	SAM/ShAM	(1983)			
		170	RIM-66A/SM-1	ShAM/ShShM	(1983)			
		120	Sea Chaparral	ShAM	(1983)			
10 Thailand	Australia	20	N-22B Nomad	Mar patrol	1981	1982	2	Order signed Mar 1982; for delivery 1982-84
						1983	9	
						(1984)	(9)	
		4	N-22B Nomad	Mar patrol	1983			In addition to 20 delivered 1982-84; first 2 for delivery Jun 1984
	France	(12)	MM-38 Exocet	ShShM	(1981)	(1982)	(4)	Arming 3 MV-400 Class FACs
						(1983)	(8)	
		..	MM-40 Exocet	ShShM/SShM	(1983)			For coastal defence; unconfirmed
	Germany, FR	47	RFB Fantrainer	Trainer	1982	(1984)	(7)	Joint venture incl local manufacture of some parts and assembly in Thailand; planned delivery schedule: 1984-7, 1985-22, 1986-18
	Indonesia	(25)	Bo-105CB	Hel	(1979)	(1983)	2	
	Italy	(24)	Aspide	AAM/SAM/ShAM	1983			To arm 2 corvettes ordered from USA
		3	MV-400 Class	FAC	1979	1982	1	
						1983	2	
	Netherlands	3	F-27 Maritime	Mar patrol	1982	1984	3	For delivery 1984; in addition to 11 in service
	UK	..	Blowpipe	Port SAM	1982			Additional batch ordered

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
	USA	3	C-130H-30	Transport	1981	1982	2	Ordered Nov 1981
						1983	1	
		2		Corvette	1983			Ordered May 1983; for delivery 1986-87; similar to Badr Class for Saudi Arabia
		8	F-5E Tiger-2	Fighter	(1983)			In addition to 32 in service
		148	M-113-A2	APC	1982			Total cost incl 40 trucks: $33 mn
		18	M-198 155mm	TH	1982	1983	18	Delivered Apr 1983; deployed on Kampuchean border; total cost: $17 mn
		20	MIM-43A Redeye	Port SAM	(1982)	1983	20	Airlifted to Thailand Apr 1983
		. .	MIM-43A Redeye	Port SAM	1983	1983	(50)	Large number supplied
		12	Model 205 UH-1H	Hel	1982			Total value incl spares and support equipment: $30 mn; surplus
		2	RF-5E Tigereye	Recce	(1983)			Reportedly on order
		(16)	RGM-84A Harpoon	ShShM	1983			Arming 2 corvettes on order from USA
		4	UH-60A	Hel	1983			Thailand may buy Model-214ST instead
		(164)	V-150 Commando	APC	1978	(1980)	(20)	
						(1981)	(20)	
						(1982)	(20)	
						(1983)	(20)	
13 Togo	USA	1	L-100-20	Transport	(1981)			Probably cancelled
12 Tunisia	Brazil	. .	EE-11 Urutu	APC	1982	1983	(24)	
		(18)	EE-9 Cascavel	AC	1982	(1983)	(18)	
	France	3	Combattante-3	FAC	1981	1983	1	Armed with Exocet ShShMs
						(1984)	(2)	
		(24)	MM-40 Exocet	ShShM/SShM	1981	1983	(8)	Arming 3 Combattante-3 Class FACs
						(1984)	(16)	
	USA	2	C-130H Hercules	Transport	(1983)			To replace old transport aircraft
		6	F-5E Tiger-2	Fighter	1982			
		6	F-5F Tiger-2	Trainer	1982	1983	(4)	4 of 6 reportedly ordered late 1981
		19	M-109-A2 155mm	SPH	1981			
		54	M-60-A3	MBT	1982			
13 Uganda	USA	3	Model 206B	Hel	(1982)	1982	(2)	
						1983	(1)	
		3	Model 214B	Hel	(1981)	1982	(2)	
						1983	(1)	

8 United Arab Emirates	Brazil	66	EE-11 Urutu	APC	1980	(1982)	(33)	For Dubai
						(1983)	(33)	
	France	8	AS-332	Hel	1982	1983	(4)	
						(1984)	(4)	
		33	Mirage-2000	Fighter/strike	1983			15 more added to original order for 18 signed May 1983; for Abu Dhabi; for delivery from 1985-86
	Italy	. .	AB-212	Hel	(1981)			Unspecified number; for Abu Dhabi
		18	OF-40	MBT	1981	1982	(12)	For Dubai; option on more
						1983	(6)	
		22	OF-40	MBT	(1982)			Mk-2 version incl some ARVs; for Dubai; in addition to 18 delivered 1982-83
		5	SF-260TP	Trainer	1982	(1983)	(5)	For Dubai
	UK	24	Hawk	Adv trainer/strike	1983			Ordered Jan 1983; Mk-61
		. .	Rapier	Landmob SAM	(1984)			For Dubai
		20	FV-101 Scorpion	LT	(1983)			Unconfirmed
	USA	1085	BGM-71A TOW	ATM	1981			Total cost incl 54 launchers and 101 practice missiles: $28 mn
		1	C-130H-30	Transport	(1982)	1983	1	
		343	MIM-23B Hawk	Landmob SAM	1981			DoD intends to sell; total cost incl 7 launch units, support equipment and training: $800 mn
13 Upper Volta	Brazil	. .	EE-9 Cascavel	AC	(1981)	(1983)	(10)	Unspecified number reportedly delivered
	France	2	AS-365	Hel	(1983)	1983	2	For VIP use
15 Uruguay	Austria	. .	Cuirassier	LT/TD	1980			Undisclosed number on order; unconfirmed
	Spain	5	C-212-200	Transport	1981	1982	1	
						1983	(4)	
	USA	5	S-2G Tracker	ASW/mar patrol	1982			
15 Venezuela	Brazil	30	EE-11 Urutu	APC	1983			
	Canada	19	CF-5A	Fighter	1982	1983	19	15 fighters and 4 two-seat trainers
	France	. .	AMX-13-90	LT	(1984)			Advanced negotiations for several dozen AMX-13 vehicles
		(60)	Roland-2	Landmob SAM	1982			Approximately 10 launch units ordered; unconfirmed
	Israel	2	IAI-201 Arava	Transport	(1981)	1983	2	
	Italy	8	G-222	Transport	(1982)	1983	(4)	6 for AF, 2 for Army
						1984	(4)	
		(6)		PC	1983			5-6 PCs ordered; for maritime patrol
	Korea, South	4		Landing craft	1982			
	Poland	5	An-2 Colt	Lightplane	1980			Unconfirmed
	USA	2	C-130H-30	Transport	1981			Unconfirmed

Region code/ Recipient	Supplier	No. ordered	Weapon designation	Weapon description	Year of order	Year of delivery	No. delivered	Comments
		18	F-16A	Fighter/strike	1981	1983	(3)	Total cost for 24 F-16s: $500 mn; first unit delivered Sep 1983
		6	F-16B	Fighter/trainer	1981	1983	(3)	
		2	Super King Air	Transport	(1982)	1983	2	Designation unconfirmed
8 Yemen, South	USSR	. .	T-62	MBT	1980	1980	(20)	Ordered Jun 1980
						1981	(20)	
						(1982)	(50)	
						(1983)	(50)	
13 Zimbabwe	Brazil	30	EE-9 Cascavel	AC	1983			Option on 60 more
	China	(25)	F-7	Fighter	(1983)	(1983)	(25)	Chinese offer incl training; deliveries unconfirmed
	Italy	2	AB-412 Griffon	Hel	(1983)			
		5	SF-260 Warrior	Trainer/COIN	(1982)	1983	5	
	Spain	6	C-212-200	Transport	1982	1982	1	
						1983	4	
						(1984)	(1)	
	UK	4	Hawk	Adv trainer/strike	(1983)			Negotiating; Mk-60; in addition to 8 delivered 1982
		5	Hunter FGA-9	Fighter/ground attack	1983	(1983)	5	Replacing aircraft destroyed in sabotage attack 1982

Appendix 7C

Register of licensed production of major conventional weapons in industrialized and Third World countries, 1983

This appendix includes licensed production of major weapons for which either the licence was bought, production was under way, or production was completed during 1983.

The value of weapons produced under licence is included in the arms *trade* statistics. It is important to note that the arms trade statistics in chapter 7 cover, for licensed production, only those major weapons *actually produced* and off the assembly line in the relevant year or period. Consequently, this register covers items not included in the statistics (for example, items on order which have not been produced yet), and the statistics also include items not in this register for 1983 (for example, items for which production was completed during 1979–82).

"Licensed production is included in the aggregated arms trade statistics and is valued in the same way as the arms trade. For example, an F-15 fighter built under US licence in Japan has the same value as a US-built F-15 purchased by Japan. When a country first produces a weapon under licence (for example, US helicopters produced in Italy), this transaction is first calculated as an Italian import from the USA. When Italy then exports these helicopters, for example to Libya, this is calculated again, as a Libyan import. In such cases the same weapon is thus calculated twice, which has been found to be a better reflection of the actual transfer of military technology than other methods." (See appendix 7D.)

The sources and methods used for the data collection, and the conventions, abbreviations and acronyms used, are explained in appendix 7D. The entries in the register are made alphabetically, by licensee, licenser and weapon designation.

Region code/ Country	Licenser	No. ordered	Weapon designation	Weapon description	Year of licence	Year of production	No. produced	Comments
I. Industrialized countries								
11 Australia	France	1	Durance Class	Support ship	1977			Under construction since 1980
	UK	19	Fremantle Class	FAC	1977	1980	1	First ship delivered from UK; also designated PCF-420 Class
						1981	3	
						1982	3	
						1983	4	
4 Belgium	USA	514	AIFV	MICV	1979	1982	(140)	Total number ordered: 1 189 incl 525 M-113s; unit cost: $100 000
						1983	(180)	
		96	F-16A	Fighter/strike	1977	1979	14	
						1980	9	
						1981	16	
						1982	19	
						1983	19	
						(1984)	(19)	
		44	F-16A	Fighter/strike	1983			In addition to 116 F-16A/Bs on order; offset share: 80%
		20	F-16B	Fighter/trainer	1977	1979	4	
						1980	3	
						1981	3	
						1982	3	
						1983	3	
						(1984)	(4)	
		525	M-113-A2	APC	1979			
5 Czechoslovakia	USSR	(1900)	T-72	MBT	1978	(1981)	(300)	
						(1982)	(300)	
						(1983)	(300)	
4 France	USA	. .	FR-172K Hawk XP	Trainer	(1975)	1977	(25)	
						1978	(25)	

							1979	(25)	
							1980	(10)	
							1981	(10)	
							1982	(10)	
							1983	(10)	
			..	FT-337 Milirole	Trainer	1969	1975	12	Designation: FTB-337 Milirole; exported to Africa
							1976	12	
							1977	12	
							1978	12	
							1979	10	
							1980	3	
							1981	(5)	
							1982	(5)	
							1983	(5)	
4	Germany, FR	USA	6700	AIM-9L	AAM	1977	1981	(200)	For delivery 1981-87; NATO co-production programme
							1982	(1000)	
							1983	(1000)	
			75000	NATO Stinger	Port SAM	1983			US Letter of Offer Apr 1983; NATO co-production; initial batch of 13 000; cost of US parts and support: $200 mn
4	Greece	Austria	100	Steyr-4K 7FA	APC	1981	1982	(10)	Production started by Steyr-Hellas in Saloniki 1982; Greek designation: Leonidas; Greece may also produce recce and AAV versions
							1983	(20)	
4	Italy	France	23000	Milan	ATM	1980			
			..	Roland-2	Landmob SAM	(1983)			OTO-Melara negotiating with Euromissile for licence production
		Germany, FR	..	Cobra-2000	ATM	1974	1974	(500)	
							1975	(1000)	
							1976	(1000)	
							1977	(1000)	
							1978	(1000)	
							1979	(1000)	
							1980	(1000)	
							1981	(1000)	
							1982	(1000)	
							(1983)	(1000)	

Region code/ Country	Licenser	No. ordered	Weapon designation	Weapon description	Year of licence	Year of pro- duction	No. produced	Comments
	USA	. .	AB-205A-1	Hel	1969	1977	(120)	
						1978	(120)	
						1979	(120)	
						1980	(120)	
						1981	(60)	
						1982	(60)	
						1983	(60)	
		. .	AB-206B-3	Hel	1972	1978	(50)	
						1979	(50)	
						1980	(50)	
						1981	(50)	
						1982	(50)	
						1983	(50)	
		. .	AB-206B-LR	Hel	1978	1979	(50)	
						1980	(50)	
						1981	(50)	
						1982	(50)	
						1983	(50)	
		. .	AB-212	Hel	1970	1979	(10)	In production since 1971
						1980	(10)	
						1981	(10)	
						1982	(10)	
						1983	(10)	
		. .	AB-212ASW	Hel	1975	1978	(30)	Current production rate: 4-5/month
						1979	(30)	
						1980	(27)	
						1981	(48)	
						1982	(48)	
						1983	(48)	
		. .	AB-412 Griffon	Hel	1980	1982	(1)	Military version of Bell Model 412; Italy holds marketing rights
						1983	(3)	
		. .	AGM-65D	ASM	(1983)			Selenia to produce under licence for delivery to NATO Europe
		(170)	CH-47C Chinook	Hel	1968	1977	(12)	Licence production began 1970
						1978	(12)	
						1979	(12)	
						1980	(12)	
						1981	(12)	
						1982	(12)	
						1983	(12)	

		..	M-113-A1	APC	1963	1977	(150)	
						1978	(150)	
						1979	(150)	
						1980	(150)	
						1981	(150)	
						1982	(150)	
						1983	(150)	
		500	Model 500MD	Hel	1976	1977	(12)	
						1978	(12)	
						1979	(20)	
						1980	(20)	
						1981	(20)	
						1982	(20)	
						1983	(20)	
		..	S-61R	Hel	1972	1976	(2)	In production since 1974
						1977	(2)	
						1978	(3)	
						1979	(3)	
						1980	(3)	
						1981	(3)	
						1982	(3)	
						1983	(3)	
		..	SH-3D Sea King	Hel	1965	1977	(12)	In production since 1969
						1978	(12)	
						1979	(12)	
						1980	(2)	
						1981	(2)	
						1982	(2)	
						1983	(2)	
10 Japan	USA	..	AIM-7E Sparrow	AAM	1972	1977	(90)	Total number produced for F-4E fighters: 700; to continue in production for use with F-15 Eagle fighters
						1978	(90)	
						1979	(90)	
						1980	(90)	
						1981	(90)	
						1982	(100)	
						1983	(100)	
		1350	AIM-7F Sparrow	AAM	(1979)	1980	(50)	Arming F-15s
						1981	(100)	
						1982	(100)	
						1983	(100)	
		500	AIM-9L	AAM	(1982)			

Region code/ Country	Licenser	No. ordered	Weapon designation	Weapon description	Year of licence	Year of pro- duction	No. produced	Comments
		100	F-15J Eagle	Fighter/interceptor	1977	1981	10	Order incl 88 fighter and 12 two-seat trainer versions; some 12 delivered directly from USA
						1982	13	
						1983	17	
						(1984)	(17)	
		. .	MIM-23B Hawk	Landmob SAM	1978	1978	(100)	
						1979	(100)	
						1980	(100)	
						1981	(100)	
						1982	(100)	
						1983	(100)	
		. .	Model 205 UH-1H	Hel	1972	1973	(5)	
						1974	(9)	
						1975	(9)	
						1976	(9)	
						1977	(9)	
						1978	(9)	
						1979	(9)	
						1980	(9)	
						1981	(5)	
						1982	(6)	
						1983	(6)	
		54	Model 209 AH-1S	Hel	1982	1983	4	First batch of 12 to be delivered by Fuji 1983-85
		. .	Model 214ST	Hel	1980			Joint production programme for military and civilian markets; agreement signed by Bell Textron and Mitsui in Oct 1980
		. .	OH-6D	Hel	1977	1978	(12)	Identical to Hughes Model-500D
						1979	(12)	
						1980	(12)	
						1981	(8)	
						1982	(8)	
						1983	(6)	
		42	P-3C Orion	ASW/mar patrol	1978	1982	(5)	
						1983	(8)	
		. .	S-61B	Hel	1965	1977	(20)	
						1978	(30)	
						1979	(33)	
						1980	(10)	
						1981	(10)	

						1982	4	
						1983	(6)	
		(78)	Seasparrow	ShAM	1980	(1980)	(3)	Arming various Japanese-built frigates and destroyers
						(1981)	(6)	
						(1982)	(6)	
						(1983)	(6)	
						(1984)	(12)	
		51	SH-3B	Hel	1979	1981	(6)	
						1982	(8)	
						1983	(5)	
4 Netherlands	USA	840	AIFV	MICV	1981	(1983)	(200)	In addition to 880 in service; 173 will be M-901 TOW version; Dutch designation: YPR-765
		80	F-16A	Fighter/strike	1975	1979	(3)	
						1980	(15)	
						1981	(18)	
						1982	(18)	
						1983	(18)	
						(1984)	(8)	
		22	F-16A	Fighter/strike	1980	(1984)	(11)	Order incl 18 F-16As and 4 F-16Bs
		18	F-16A	Fighter/strike	1981			
		12	F-16A	Fighter/strike	1982			
		22	F-16B	Fighter/trainer	1975	1979	(2)	
						1980	(4)	
						1981	(5)	
						1982	(5)	
						1983	(4)	
						(1984)	(2)	
		86	M-109-A2 155mm	SPH	(1980)	1981	(12)	First 6 delivered Jul 1981; Dutch Army already has 118 old M-109s
						1982	(24)	
						1983	(24)	
5 Poland	USSR	. .	An-2 Colt	Lightplane	1960	1977	(200)	
						1978	(200)	
						1979	(200)	
						1980	(200)	
						1981	(200)	
						1982	(100)	
						1983	(100)	
		. .	An-28	Transport	1978	1983	(5)	
						(1984)	(10)	

Region code/ Country	Licenser	No. ordered	Weapon designation	Weapon description	Year of licence	Year of production	No. produced	Comments
		. .	Mi-2 Hoplite	Hel	(1956)	1979	(200)	In production since 1957; 3 000 built by end-1979
						1980	(200)	
						1981	(200)	
						1982	(200)	
						1983	(200)	
		(1900)	T-72	MBT	(1978)	(1980)	(50)	In production
						(1981)	(300)	
						(1982)	(300)	
						(1983)	(200)	
4 Portugal	Netherlands	2	Kortenaer Class	Frigate	1983			On order; 1 to be delivered directly; 2 to be licence-produced
5 Romania	China	17	Huchuan Class	Hydrofoil FAC	(1973)	1974	1	Follow-on to 3 delivered directly
						1975	(2)	
						1976	(2)	
						1977	(2)	
						1978	(2)	
						1979	(2)	
						1980	(2)	
						1981	(1)	
						1982	(2)	
						1983	(1)	
	France	. .	SA-316B	Hel	1971	1977	25	More than 200 produced by 1981
						1978	25	
						1979	25	
						1980	25	
						1981	25	
						1982	(25)	
						1983	(25)	
		. .	SA-330 Puma	Hel	1977	1978	(20)	Production rate: 20-30 per year
						1979	(20)	
						1980	(20)	
						1981	(20)	
						1982	(19)	
						1983	(25)	
	UK	25	BAC-111	Transport	1979	1980	(3)	Total cost: $410 mn plus $205 mn for licence production of Rolls-Royce Spey engine; 20 aircraft for Romanian AF
						1981	(3)	
						1982	(3)	
						1983	(3)	

		. .	BN-2A Defender	Transport	1968	1977	(30)	In production since 1969; about 400 produced by 1983
						1978	(30)	
						1979	(30)	
						1980	(25)	
						1981	(20)	
						1982	(20)	
						1983	(20)	
4 Spain	France	8	S-70 Class	Submarine	1975	1982	1	4 for Spain, 4 for Egypt; 67% local input
						1983	1	
	USA	3	FFG-7 Class	Frigate	1977			
7 Switzerland	UK	60	Rapier	Landmob SAM	1980			60 towed Rapier systems with Blindfire radar ordered
	USA	. .	FGM-77A Dragon	ATM	(1981)	(1983)	(500)	Agreement reached Aug 1981; further details not specified
		38	F-5E Tiger-2	Fighter	1980	1981	(13)	Order incl 32 F-5E fighters and 6 F-5F trainers; local assembly; in addition to 72 in service
						1982	(13)	
						1983	(12)	
4 Turkey	Germany, FR	. .	Cobra-2000	ATM	1970	(1981)	(100)	Has 85 systems in use; current status of production programme uncertain
						(1982)	(100)	
						(1983)	(100)	
		13	SAR-33 Type	PC	1976	1978	(2)	Prototype delivered from FR Germany 1977 for trials; 12 built in Turkey
						1979	(2)	
						1980	(2)	
						1981	(2)	
						1982	(2)	
						1983	(2)	
		(8)	Type 209	Submarine	1974	1981	(1)	Built under licence in addition to 3 delivered from FR Germany
						1983	(1)	
4 UK	France	(50000)	Milan	ATM	1976	1979	(2000)	
						1980	(2000)	
						1981	(2000)	
						1982	(2000)	
						1983	(2000)	
	USA	1709	AIM-9L	AAM	1977	1982	(100)	NATO co-production programme
						(1983)	(200)	
		(8000)	BGM-71A TOW	ATM	(1981)			US government offer to UK Army
		. .	UGM-84A Harpoon	SuShM	(1980)	1981	(8)	For evaluation; to arm Valiant Class submarines

Region code/ Country	Licenser	No. ordered	Weapon designation	Weapon description	Year of licence	Year of pro- duction	No. produced	Comments
1 USA	France	595	Roland-2	Landmob SAM	1974			Total procurement: 595 missiles and 27 launch units; to be procured by National Guard
	UK	(309)	T-45 Hawk	Adv trainer/strike	1982			BAe and McDonnell-Douglas will co-produce new trainer for US Navy
6 Yugoslavia	France	132	SA-342 Gazelle	Hel	1971	1978	(15)	New contract for version L signed Dec 1982
						1979	(15)	
						1980	(15)	
						1981	(15)	
						1982	(15)	
						1983	(15)	

II. Third World countries

Region code/ Country	Licenser	No. ordered	Weapon designation	Weapon description	Year of licence	Year of pro- duction	No. produced	Comments
12 Algeria	UK	4	Kebir Class	PC	1981			In addition to 2 delivered from UK
15 Argentina	France	. .	VAB	APC	(1981)	1981	2	To be armed with HOT ATMs on order from Euromissile; receiving 2 prototypes for evaluation
	Germany, FR	6	Meko-140 Type	Frigate	1980	(1983)	(1)	
		(300)	TAM	MT	(1976)	1981	(40)	220 plus 80 for Peru; further orders expected
						1982	(70)	
						1983	(70)	
		4	Type 1700	Submarine	1977			
		300	VCTP	ICV	1976	1981	(25)	Similar to Marder MICV
						1982	(100)	
						1983	(100)	
	USA	. .	Arrow-3	Trainer	1977	1981	(10)	Local development of licence-produced Piper aircraft; for use as military trainer
						1982	(10)	
						(1983)	(10)	
		120	Model 500D	Hel	1972	1977	(5)	Assembly of knocked-down components
						1978	(5)	
						1979	(5)	
						1980	(10)	
						1981	(10)	

							1982	(10)	
							1983	(10)	
15	Brazil	France	. .	AS-332	Hel	(1984)			Negotiating since 1980
			200	AS-350M Esquilo	Hel	1978	1979	(6)	10-year programme
							1980	(20)	
							1981	(20)	
							1982	(20)	
							1983	(20)	
			30	SA-315B Gaviao	Hel	1978	1979	(3)	France owns 45% of new company; assembly of 30 over 10 years, most for civilian market
							1980	(3)	
							1981	(3)	
							1982	(3)	
							1983	(3)	
		Germany, FR	1	Type 209	Submarine	1982			In addition to 1 purchased directly; hull and some components to be built in Brazil
		Italy	(79)	AM-X	Fighter/ground attack	1981			Joint production of new Italian fighter/ ground attack aircraft; production to begin 1984
		UK	1	Niteroi Class	Frigate	1981			Ordered Jun 1981; training ship; for completion 1985
		USA	. .	EMB-Piper	Lightplane	1974	1975	(70)	EMBRAER/Neiva produces 12 types of Piper-designed light aircraft
							1976	(70)	
							1977	(70)	
							1978	(70)	
							1979	(70)	
							1980	(70)	
							1981	(70)	
							1982	(70)	
							1983	(70)	
15	Chile	France	2	Batral Type	LST	1979	1982	1	
							1983	1	
		Switzerland	. .	Piranha	APC	1980	1981	(20)	Chile produces 4- and 6-wheeled versions
							1982	(50)	
							1983	(50)	
		USA	134	PA-28 Cherokee	Trainer	1980	1981	(10)	Built by Indaer; Chile also produces Piper-designed T-35 Pillan trainer and is assembling C-101 Aviojet trainers
							1982	(30)	
							1983	(30)	
			100	T-35 Pillan	Trainer	1980	(1982)	(5)	Deliveries to start 1983; production rate: 20/year
							(1983)	(20)	

Region code/ Country	Licenser	No. ordered	Weapon designation	Weapon description	Year of licence	Year of pro-duction	No. produced	Comments
8 Egypt	Brazil	110	EMB-312 Tucano	Trainer	1983			In addition to 10 delivered directly; option on 60 more
	France	. .	AS-332	Hel	1983			Ordered Dec 1983
	UK	. .	FV-101 Scorpion	LT	1982			UK reportedly agreed to provide factory for licence production
		(5000)	Swingfire	ATM	1977	1979	(250)	
						1980	(500)	
						1981	(500)	
						1982	(500)	
						1983	(500)	
9 India	France	(10000)	Milan	ATM	1981			
		140	SA-315B Lama	Hel	1971	1973	(6)	First 40 assembly only, then licence production of 100 from local raw materials
						1974	(10)	
						1975	(10)	
						1976	(10)	
						1977	(10)	
						1978	(10)	
						1979	(10)	
						1980	(10)	
						1981	(10)	
						1982	(15)	
						1983	(15)	
		. .	SA-316B Chetak	Hel	(1962)	1978	(15)	HAL has built 221 since 1965
						1979	(15)	
						1980	(15)	
						1981	(30)	
						1982	(20)	
						1983	(20)	
		. .	Vijayanta GCT	SPH	(1984)			Negotiating; adaption of French GCT 155mm turret to Indian-built tank
	Germany, FR	150	Do-228	Transport	1983	1984	(3)	Licence agreement signed 29 Nov 1983; 10 aircraft directly from FR Germany; assembly of 25-30 aircraft followed by licence production from 1984; also for civilian use
		2	Type 1500	Submarine	1981			Option on 4 more
	UK	3	Godavari Class	Destroyer	1978	1983	1	Improved Leander Class design; follow-on to Nilgiri Class

		20	HS-748M	Transport	1972	1975	2	
						1976	2	
						1977	2	
						1978	2	
						1979	2	
						1980	(3)	
						1981	(2)	
						1982	(2)	
						1983	(2)	
						(1984)	(1)	
		45	Jaguar	Fighter	1979	1981	1	Local production of components; in addition to 40 purchased directly
						1982	3	
						1983	8	
						(1984)	(15)	
		31	Jaguar	Fighter	1983			In addition to 45 now being assembled under licence
	USSR	..	AA-2 Atoll	AAM	1972	1973	30	Arming MiG fighters
						1974	60	
						1975	120	
						1976	120	
						1977	120	
						1978	90	
						1979	60	
						1980	(60)	
						1981	(90)	
						1982	(90)	
						1983	(90)	
		(50)	MiG-21bis	Fighter	1976	1980	(10)	In addition to 100 previously assembled from kits
						1981	(10)	
						1982	(12)	
						1983	(12)	
						(1984)	(6)	
		(200)	MiG-27	Fighter/ground attack	1983			Agreement signed Jul 1983; production to start 1984/85
10 Indonesia	France	(26)	AS-332	Hel	(1980)	1982	(1)	
						1983	(2)	
		(8)	SA-330L Puma	Hel	1980	1982	3	
						1983	(3)	
	Germany, FR	(100)	Bk-117	Hel	1983			Licence production to start 1985

Region code/ Country	Licenser	No. ordered	Weapon designation	Weapon description	Year of licence	Year of pro-duction	No. produced	Comments
		(140)	Bo-105CB	Hel	1975	1976	(10)	
						1977	(10)	
						1978	(10)	
						1979	(10)	
						1980	(15)	
						1981	(15)	
						1982	(15)	
						1983	(17)	
	Spain	92	C-212A Aviocar	Transport	1975	1976	(3)	New plant set up in 1976
						1977	(7)	
						1978	(7)	
						1979	(8)	
						1980	(8)	
						1981	(8)	
						1982	(10)	
						1983	(12)	
	USA	100	Model 412	Hel	1982			For military and commercial use; unconfirmed
8 Israel	USA	45	Dabur Class	PC	1973	1977	8	
						1978	8	
						1979	8	
						1980	(3)	
						1981	(3)	
						1982	(3)	
						1983	(3)	
		2	Flagstaff-2 Class	Hydrofoil FAC	1977	1982	(1)	Option on 10 more
						1983	(1)	
10 Korea, South	Italy	(350)	Type 6614	APC	1976	1977	(50)	
						1978	(50)	
						1979	(50)	
						1980	(50)	
						1981	(50)	
						1982	(50)	
						1983	(50)	
	USA	(68)	F-5E Tiger-2	Fighter	1980	1982	(3)	Incl 36 F-5Es and 32 F-5Fs
						1983	(12)	
		. .	Model 500D	Hel	(1979)	1979	(30)	Some 100 delivered early 1980

							1980	(30)	
							1981	(30)	
							1982	(30)	
							1983	(30)	
			..	Model 500MD	Hel	1976	1978	10	
							1979	10	
							1980	(15)	
							1981	(15)	
							1982	(15)	
							1983	(15)	
12	Libya	Italy	(140)	SF-260 Warrior	Trainer/COIN	1977			In addition to 140 purchased directly; new assembly plant constructed with Italian assistance; programme may be abandoned
13	Nigeria	Austria	(200)	Steyr-4K 7FA	APC	(1981)			Various versions to be built; possibly also Cuirassier TD
9	Pakistan	Sweden	(117)	Supporter	Trainer/strike	1974	1977	(10)	
							1978	(15)	
							1979	(20)	
							1980	(20)	
							1981	(20)	
							1982	(20)	
							(1983)	(20)	
15	Peru	Italy	60	MB-339A	Trainer/strike	1981			Will include an unspecified number of MB-339K Veltro-2
			2	Lupo Class	Frigate	1974	(1983)	(1)	In addition to first 2 delivered from Italy
10	Philippines	Germany, FR	(48)	Bo-105C	Hel	1974	1976	(6)	Initial batch completed 1983
							1977	(6)	
							1978	(6)	
							1979	(6)	
							1980	(6)	
							1981	(6)	
							1982	(6)	
							1983	(6)	

Region code/ Country	Licenser	No. ordered	Weapon designation	Weapon description	Year of licence	Year of production	No. produced	Comments
	UK	100	BN-2A Defender	Transport	1974	1974	6	Phase 1: 6 delivered from UK in 1974;
						1975	14	phase 2: 14 delivered empty and unpainted:
						1976	20	phase 3: assembly of 20 from kits;
						1982	(20)	phase 4: local manufacture of 60
						1983	(20)	
						(1984)	(20)	
10 Singapore	Germany, FR	3	PC-57 Type	PC/FAC	1980	1983	3	
13 South Africa	France	. .	Cactus	Landmob SAM	1974	1978	(100)	
						1979	(100)	
						1980	(100)	
						1981	(100)	
						1982	(100)	
						1983	(100)	
	Israel	9	Reshef Class	FAC	1977	1978	1	In addition to 3 previously acquired;
						1979	1	armed with 6 Scorpioen ShShMs derived
						1980	2	from Israeli Gabriel ShShM
						1982	1	
						1983	1	
	Italy	. .	Impala-2	Trainer/COIN	1974	1974	4	Also designated MB-326K
						1976	(12)	
						1977	(12)	
						1978	(12)	
						1979	(12)	
						1980	(12)	
						1981	(12)	
						1982	(12)	
						1983	(12)	
10 Taiwan	Israel	(34)	Dvora Class	FAC	(1979)	1980	(1)	Taiwanese designation: Hai Ou Class;
						1981	(10)	arms: 2 Hsiung Feng ShShMs (derived
						1982	(10)	from Israeli Gabriel ShShM)
						1983	(10)	
		. .	Gabriel-2	ShShM	1977	1980	(18)	Arming Lung Chiang Class (PSMM-5) and
						1981	(18)	Hai Ou Class (Dvora) FACs; Taiwanese
						1982	(18)	designation: Hsiung Feng
						1983	(18)	
	USA	(212)	F-5E Tiger-2	Fighter	1973	1974	(2)	

				1975	(8)	
				1976	(16)	
				1977	(24)	
				1978	(48)	
				1979	(48)	
				1980	(24)	
				1981	(16)	
				1982	(14)	
				1983	(12)	
30	F-5E Tiger-2	Fighter	1982			Total cost incl 30 F-5Fs: $620 mn
(36)	F-5F Tiger-2	Trainer	1973	1974	(1)	
				1975	(3)	
				1976	(4)	
				1977	(4)	
				1978	(4)	
				1979	(4)	
				1980	(4)	
				1981	(4)	
				1982	(4)	
				1983	(4)	
30	F-5F Tiger-2	Trainer	1982			
(10)	PSMM-5 Type	FAC	(1980)	(1983)	(2)	Production re-started after 2 delivered 1978-79; arms: 4 Hsiung Feng ShShMs (derivative of Israeli Gabriel ShShM)

Appendix 7D

Sources and methods for the world arms production and trade data

This appendix describes the sources and methods used in the preparation of the SIPRI registers of world arms production and world arms trade. The registers, which are computerized, also constitute the base material for tables and figures presented in the world arms production and world arms trade chapters.

I. Purpose of the data

Together with the data for world military expenditure, the arms production and arms trade data form the nucleus of a comprehensive, quantitative and qualitative survey of world armaments. The arms registers show the origin, flow, costs and main characteristics of the major weapons now being acquired in all countries.

The arms production files include all the major weapons in production or under development in all countries of the world during a given calendar year. Arms production registers are published from time to time in the SIPRI Yearbooks.

The arms trade registers cover all major weapons on order or delivered to all countries during a given calendar year. Four registers are included in the Yearbooks: arms imports and licensed production for industrialized and Third World countries, respectively.

All countries are listed in the registers in alphabetical order; the world region to which each country belongs is indicated in the first column (for the key to the region code, see the conventions and abbreviations in section VI). The absence of a country from the registers means that no activity of the type indicated has been found for that country.

II. Definitions and criteria

The arms production and arms trade data cover the four categories of 'major weapons'—that is, aircraft, armoured vehicles, missiles and warships. Strictly speaking, all of these except missiles are potential 'weapon platforms', while missiles are part of 'weapon systems'. However, our use of the term 'weapon' or 'major weapon' by and large conforms with general practice. The great majority of the aircraft, armoured vehicles and warships entered in the files are armed; as such, they constitute either the central component of a weapon system, which is generally identified by reference to that platform, or a major unitary fighting system.

In the arms production files, the criterion for selection of major weapon items is that of military application. However, some categories have been excluded from these files, such as aerobatic aeroplanes, harbour tugs and icebreakers.

In the arms trade registers, the criterion for selection of major weapon items is the identity of the buyer—that is, items either destined for or purchased by the armed forces of the buyer country.

The selection of entries for *aircraft* and *warships* presents no particular problems. If an item is purchased by or on behalf of the armed forces of the recipient country, it is included irrespective of type. The category *armoured vehicles* includes all types of tanks, tank destroyers, armoured cars, armoured personnel carriers, infantry combat vehicles as well as self-propelled and towed guns and howitzers. Military trucks, however, are not included. The category *missiles* is meant to include only guided missiles, although the distinction between missiles and rockets is sometimes unclear in the reference works used as sources. In principle, unguided rockets are not included.

All types of arms transfer are included—that is, direct sales, military aid, gifts, loans and grants. Weapons for police forces are as a rule not included. The entry of any arms transfer is made in accordance with the four-category division of major weapons. This means that when, for example, a missile-armed ship or aircraft is purchased, the missiles are entered separately in the arms trade register.

Dates and numbers

Both the order dates and the delivery dates for arms transactions are continuously being revised in the light of new information. The *order date* should ideally be the date on which the sales contract was signed. However, this information is often not available. Order dates given within parentheses, thus *(1980)*, indicate either an estimated date or a preliminary date of order—for example, the known date of the decision to acquire a weapon. In order to enable the reader to follow the development of any given arms transaction, all the *delivery dates* are followed by a column of figures indicating the number of items delivered that year.

The exact number of weapons ordered as well as the number of weapons delivered per year may not always be known and may need to be estimated.

Such estimates are also given within parentheses. There are various aids for making these estimates: in the case of aircraft, the size of squadrons is usually known and this provides a relatively reliable basis for estimating the number of a new type of aircraft to be introduced. It is also possible to learn from the information on production of the weapon type in the supplier country how many of a certain type of aircraft can reasonably be expected to be exported in one year.

The number of missiles involved in one transaction poses the greatest problem in the arms trade data collecton. The information is often limited to the bare fact that a certain missile system has been bought to arm a certain type of aircraft, warship or armoured vehicle. In such cases it is, however, possible to ascertain how many aircraft will be armed with the missile and how many launchers each aircraft has. But for estimating the exact number of missiles, a rule of thumb is used. It is assumed that there are at least three missiles per launcher: thus, if a new air-to-air missile is purchased for 30 fighter aircraft with two launchers per plane, the number of missiles will be $30 \times 2 \times 3$, or 180. The estimate of three missiles per launcher is also used for warships. Numbers of surface-to-air missiles are calculated primarily on the basis of the launcher—if it is a fixed platform, information is usually available on the size and equipment of a battery or an army battalion equipped with missiles. Numbers of small anti-tank missiles involved in arms transactions are calculated using an estimate of 20 missiles per launch unit.

III. The data collection

Reliability

The data in the arms production and trade files are collected each year from technical, commercial and military publications and journals as well as from a number of daily newspapers, reference books and other literature (see also section V). The common criterion for all these sources is that they are published and available to the general public. Thus, for each weapon project listed in the arms production registers and for each arms transfer listed in the trade registers, there is a wide variety of sources of information. The data and the sources are stored in the computer and can be displayed on request.

Before the data are published, judgement on the reliability of the various sources must first be made. As a rule, reports from one single source are not considered reliable enough; ideally, a minimum of five independent sources is required for a reliable report on one item of data.

The greatest difficulty is not, however, ascertaining the reliability of the data which are published and available, but rather the 'missing data'. Experience with this data collection has shown that, in time, all arms transactions are reported in the published literature, but it often takes a number of years before enough such reports appear, so that, for instance, the information on arms transfers for 1983 will not be sufficiently complete until 1985.

The data

The computerized data include the following.

(*a*) For the *arms production file:* weapon designation, weapon category, designing and producing country, weapon description, the time span for a weapon development project, technical data on weight, speed and range, manufacturing company, the number of weapons planned for production, production rate, the SIPRI value estimate (either for new, second-hand or refurbished weapons), the source for this estimate (see also section IV), and the year of licence if relevant.

(*b*) For the *arms trade file:* buyer, seller, weapon designation, weapon category, date of order, date of final delivery, status of the weapon (new, second-hand or refurbished), buyer and seller organization (for example, government, army, air force, navy, commercial), number ordered, terms of the deal (cash, credit, gift, military aid, loan, offset, arms for oil, illegal, licensed production), total and unit real sales price if available, and delivery years and numbers.

For each entry the source is noted. When the data base is fully computerized, for all countries from 1945 to the current year, a more detailed and useful analysis can be made.

IV. The value of the arms trade

The SIPRI system for evaluating the arms trade was designed as a *trend-measuring device*, to enable the measurement of changes in the total flow of major weapons and its geographic pattern. Expressed in monetary terms, this heterogeneous flow reflects both the quantity and the quality of the weapons transferred. Aggregated values and percentages are based only on *actual deliveries* during the year or years covered in the tables and figures in which they are presented.

SIPRI independently evaluated the arms trade by constructing a list of comparable prices in 1968 dollars, based on such actual prices as were known at that time and on such criteria as weight, speed and role of the weapon. These criteria differ for each category of weapon. (The choice of base year is due to the fact that the SIPRI arms data collection was begun in 1968, at a time when very little published information was available on the prices of weapons.)

The monetary values chosen do not, therefore, necessarily correspond to the actual prices paid, which vary considerably depending on different pricing methods, the length of production runs, and the terms involved in individual transactions—the actual sales price for a given weapon system differs according to the buyer and the coverage of the deal. For instance a deal may or may not cover spare parts, training, support equipment, compensation and offset arrangements for the local industries in the buying country, and so on.

Furthermore, to use only actual sales prices—assuming that the information were available for all deals, which it is not—military aid and grants would be excluded, and the total flow of arms would therefore not be measured.

The 'pricing' of new weapons developed after 1968 is based on information from various producers on the so-called ex-factory unit cost or 'fly-away' unit cost for Western weapons. For weapons for which all price information is lacking, a comparison is made with a known weapon of the same type as regards performance criteria, and the weapon is valued accordingly. The final check of the reliability of this performance comparison is made by a military panel on which all the armed services are represented.

This means that the SIPRI valuation system is not automatically comparable to official economic statistics such as gross domestic product, public expenditure and export/import figures. However, this valuation system has served the purpose for which it was designed, particularly in the absence of other reliable national or international statistics on the flow of arms. The individual 'prices' are less essential to this valuation system than two other main considerations, namely, that the method of pricing is applied consistently and that the more sophisticated weapons are always given a higher value than the less sophisticated ones. The original price list, based on constant 1968 US dollars, was first inflated to reflect 1973 price levels and then to reflect 1975 price levels. The method used to obtain the factor needed was to construct a weighted index, using only three countries—the USA (60), the UK (20) and France (20)—as the major Western arms-exporting countries, and the wholesale consumer price index for the same countries. The factor arrived at for the 1973 values was 1.3 and for 1975, 1.7.

Each weapon obtains three separate values—new, second-hand and refurbished. Missiles, however, are only valued as new. Licensed production is included in the aggregated trade statistics and is valued in the same way as the arms trade. For example, an F-15 fighter aircraft built under US licence in Japan has the same value as a US-built F-15 purchased by Japan. When a country first produces a weapon under licence (for example, US helicopters produced in Italy), this transaction is first calculated as an Italian import from the USA. When Italy then exports these helicopters, for example to Libya, this is calculated again, as a Libyan import. In such cases the same weapon is thus calculated twice, which has been found to be a better reflection of the actual transfer of military technology than other methods.

V. The SIPRI sources

The sources of the data presented in the registers are of five general types; official national documents; journals and periodicals; newspapers; books, monographs and annual reference works; and documents issued by international and intergovernmental organizations. The common criterion for all these sources is that they are open sources, available to the general public. The official national documents include budgets; parliamentary or congressional proceedings; reports and hearings; statistics, White Papers, annual reports and other documents issued by governments and agencies; and statements by government officials and spokesmen.

The total number of sources regularly perused for data is at present about 200. The following sources represent a selection of the first-priority sources for the arms production and trade data.

Journals and periodicals

Afrique Défense (Paris)
Air et Cosmos (Paris)
Air Force Magazine (Washington)
Antimilitarismus Information (Frankfurt/M)
Armed Forces Journal (Washington)
Asia Monitor (Hong Kong)
Asian Defence Journal (Kuala Lumpur)
Aviation Week & Space Technology (New York)
Beiträge zur Konfliktforschung (Cologne)
Campaign against Arms Trade (London)
Current News (Washington)
Defence Today (Rome)
Defensa (Madrid)
Defense & Economy World Report and Survey (Washington)
Defense & Foreign Affairs Daily (Washington)
Defense & Foreign Affairs Digest (Washington)
Defense Daily (Washington)
Defense Electronics (Palo Alto)
Défense & Armement (Paris)
Europa Archiv (Bonn)
Far Eastern Economic Review (Hong Kong)
Flight International (Sutton, UK)
Interavia (Geneva)
Interavia Airletter (Geneva)
International Defense Review (Geneva)
Internationella Studier (Stockholm)
Jane's Defence Review (London)
Keesing's Contemporary Archives (Bristol)
Latin America Weekly Report (London)

Marine-Rundschau (Stuttgart)
Maritime Defence International (London)
Middle East Review (New York)
Milavnews (Stapleford)
Military Electronics & Countermeasures (Santa Clara, Calif.)
Military Technology (Cologne)
NACLA Report on the Americas (New York)
NATO's Fifteen Nations (Brussels)
Naval Forces (Aldershot, UK)
Navy International (Dorking, UK)
New Scientist (London)
News Review (Institute for Defense Studies & Analyses, New Delhi)
Osteuropa (Munich)
Science (Washington)
Soldat und Technik (Frankfurt/M)
Soviet Aerospace (Washington)
Soviet Military Review (Moscow)
Der Spiegel (Hamburg)
Tecnologia Militar (Bonn)
Voennij Vestnik (Moscow)
Wehrtechnik (Bonn-Duisdorf)
World Missile Forecast (Ridgefield)
Österreichische Militärische Zeitung (Vienna)

Newspapers

Dagens Nyheter (Stockholm)
Daily Telegraph (London)
Financial Times (London)
Frankfurter Allgemeine Zeitung (Frankfurt/M)
Hsin Hua News (London)
International Herald Tribune (Paris)
Izvestia (Moscow)
Jerusalem Post (Jerusalem)
Le Monde (Paris)
Le Monde Diplomatique (Paris)
Neue Zürcher Zeitung (Zurich)
New York Times (New York)
Pravda (Moscow)
Svenska Dagbladet (Stockholm)
The Guardian (London)
The Times (London)
Washington Post (Washington)

Annual reference publications

'Aerospace Forecast and Inventory', annually in *Aviation Week & Space Technology* (McGraw-Hill, New York)
Defense and Foreign Affairs Handbook (Copley & Associates, Washington)
Interavia Data: Air Forces of the World (Interavia S.A., Geneva)
Interavia Data: Aircraft Armament (Interavia S.A., Geneva)
Interavia Data: World Aircraft Production (Interavia S.A., Geneva)
International Air Forces and Military Aircraft Directory (Aviation Advisory Services, Stapleford, UK)
Jane's All the World's Aircraft (Macdonald & Co., London)
Jane's Fighting Ships (Macdonald & Co., London)
Jane's Infantry Weapons (Macdonald & Co., London)
Jane's Weapon Systems (Macdonald & Co., London)
Jane's Armour and Artillery, (Macdonald & Co., London)
'Military Aircraft of the World' and 'Missile Forces of the World', annually in *Flight International* (IPC Transport Press, Sutton, UK)
The Military Balance (International Institute for Strategic Studies, London)

VI. Conventions

The following conventions are used in the arms production and trade registers:

Conventions

..	Information not available
( )	Uncertain data or SIPRI estimate

Abbreviations and acronyms

AA	Anti-aircraft
AAG	Anti-aircraft gun
AALC	Amphibious assault landing craft
AAM	Air-to-air missile
AAV	Anti-aircraft vehicle
AC	Armoured car
Acc to	According to
ADV	Air defence version
Adv	Advanced
AEV	Armoured engineering vehicle
AEW	Airborne early-warning system
AF	Air Force
ALCM	Air-launched cruise missile
Amph	Amphibious vehicle/amphibian aircraft
APC	Armoured personnel carrier
ARM	Anti-radar missile
ARV	Armoured recovery vehicle
AShM	Air-to-ship missile
ASM	Air-to-surface missile
ASSV	Assault vehicle
ASuM	Air-to-submarine missile
ASW	Anti-submarine warfare
ATM	Anti-tank missile
ATW	Anti-tank weapon
AV	Armoured vehicle
BL	Bridge-layer
Bty	Battery
COIN	Counter-insurgency
CPC	Command post carrier
ECM	Electronic countermeasures
EW	Electronic warfare
FAC	Fast attack craft (missile/torpedo-armed)
FSCV	Fire support combat vehicle
FY	Fiscal Year

Hel	Helicopter
ICV	Infantry combat vehicle
IDS	Interdictor/strike version
Incl	Including/includes
Landmob	Land-mobile (missile)
LAV	Light armoured vehicle
LSH	Heavy-lift ship
LST	Tank landing ship
LT	Light tank
Mar patrol	Maritime patrol aircraft
MBT	Main battle tank
MG	Machine-gun
MICV	Mechanized infantry combat vehicle
Mk	Mark
MoU	Memorandum of understanding
MPWS	Mobile protected weapon system
MRCA	Multi-role combat aircraft
MSC	Minesweeper, coastal
MSO	Minesweeper, ocean
MT	Medium tank
PC	Patrol craft (gun-armed/unarmed)
Port	Portable
Recce	Reconnaissance (aircraft/vehicle)
Repl	Replenishment
RL	Rocket launcher
SAM	Surface-to-air missile
SAR	Search and rescue
SC	Scout car
ShAM	Ship-to-air missile
ShShM	Ship-to-ship missile
ShSuM	Ship-to-submarine missile
SLBM	Submarine-launched ballistic missile
SPG	Self-propelled gun
SPH	Self-propelled howitzer
SSBN	Nuclear-powered, ballistic missile-equipped submarine
SShM	Surface-to-ship missile
SSM	Surface-to-surface missile
SuAM	Submarine-to-air missile
Sub	Submarine
SuShM	Submarine-to-ship missile
TD	Tank destroyer
TG	Towed gun
TH	Towed howitzer

Region codes

1 USA
2 USSR
3 China
4 NATO, excl. USA
5 WTO, excl. USSR
6 Other Europe, Eastern[1]
7 Other Europe, Western[1]
8 Middle East
9 South Asia
10 Far East
11 Oceania
12 North Africa
13 Sub-Saharan Africa
14 Central America
15 South America

[1] Regions 6 and 7 are given together as one region in the military expenditure data.

8. 'Deep strike': new technologies for conventional interdiction

PER BERG and GUNILLA HEROLF

Superscript numbers refer to the list of notes and references at the end of the chapter.

I. Introduction: strengthening conventional deterrence

In an area of nuclear weapon parity, threats of deliberate escalation beyond the nuclear threshold gradually diminish in credibility. NATO therefore feels the need to address the perceived conventional weapon imbalance.[1] There are several possible approaches to this credibility problem, such as rearmament, transarmament (alternative defence options), arms control and disarmament. NATO has, predominantly, chosen rearmament. One main effort has been to exploit emerging technologies for striking deep into enemy territory.

The proponents of 'deep strike'[2] maintain that the new conventional weapon technologies offer a solution to NATO's perceived inferiority in conventional weapons and a comparatively cheap way of raising the nuclear threshold and reducing reliance on nuclear weapons within the NATO doctrine of flexible response.

Sceptics have raised serious doubts, based on the technological difficulties that are likely to arise, particularly taking battlefield conditions and enemy technical and operational countermeasures into account. At their meeting in December 1983, the NATO defence ministers agreed to study the emerging technologies further, but the European NATO allies voiced concern about both total costs and the sharing of the lucrative industrial contracts that will result (the 'two-way street').[3]

Even if deep strike should prove technologically and economically feasible—at least some of the suggested weapons are likely to be developed—there are serious arms control implications. These technologies could prove destabilizing by enhancing the pre-emptive incentives on both sides, especially when combined with such offensive operational doctrines as the US 'AirLand Battle' and the Soviet 'operational manoeuvre groups' (OMGs). If, on the other hand, some of the deep strike technologies are used to reinforce and monitor less provocative defence postures, such as disengagement zones, their contribution could prove both security- and confidence-building.

II. Interdiction

To 'interdict' by NATO definition means "to isolate, or seal off an area by any means; to deny the use of a route or approach".[4] Interdiction therefore aims at isolating the battlefield, thus preventing additional enemy forces from influencing the direct (close) battle. The entire arsenal of modern warfare may be applied to interdiction: conventional, chemical or nuclear munitions, electronic warfare, deception, naval or ground operations, and so on.

Although interdiction may be carried out by any means, it has been considered to lie mainly within the air force domain. The definition of air interdiction is: "Air operations conducted to destroy, neutralize, or delay the enemy's military potential before it can be brought to bear effectively against friendly forces, at such distance from friendly forces that detailed integration of each air mission with the fire and movement of friendly forces is not required."[5]

At the lower end of the range spectrum is close air support, which does require such "detailed integration" with one's own forces. The dividing line between air interdiction and close air support is not fixed, but could somewhat arbitrarily be put at the range of the weapons organic to the ground forces being supported, that is, some 30 km (the present range of field artillery and multiple rocket launchers).[6]

At the far end of the range spectrum, interdiction may reach deep into enemy territory, but it does *not* include attacks on the enemy's political, population or industrial centres, nor on its strategic arsenal. These targets are left to strategic bombardment.

The area of interdiction must be viewed as a continuum beyond about 30 km from the forward edge of the battle area (FEBA), and battle relevance is more important than battlefield proximity.[7] However, the depth of the interdiction has implications for both its potential payoff and costs.

The possible targets of interdiction are diverse. They may be soft or hard (from open-air fuel dumps to command and control bunkers and armoured vehicles), and they may be fixed (such as bridges, highway junctions or other permanent installations) or mobile (whether moving or stationary). Even more important is the function the target performs within the enemy force structure. The main categories of function are force (combat units), supply (logistical units and infrastructure), and command and control.

Airfields constitute a special class of target. Attacking them is part of the counter-air mission of tactical airpower, which includes both offensive (attacking an enemy's airpower over or on its own territory) and defensive operations. While not strictly part of interdiction, offensive counter-air missions are conceptually similar and will be treated as such. Airpower remains a key element in modern warfare, as illustrated by the wars in Lebanon and over the Falkland/Malvinas Islands. A very effective way of reducing enemy air sortie generation rates is by attacking airfields, best illustrated by events of the 1967 Middle East war.[8]

III. Technologies for conventional interdiction

A prerequisite for interdiction is to have the means to establish the position of the intended targets. Another condition is to have an efficient, unjammable C^3 (command, control and communications) system. Other vital elements are high-precision, long-range weapon systems.

Surveillance and target-acquisition systems

The location of such fixed targets as bridges, railway shunting yards and airfields is usually known in advance from maps, satellite photographs and other means. In order to be able to attack moving targets, however, a type of surveillance system which can track them and transmit the data in real time is needed. For example, information about a column of tanks moving along a road must be forwarded as the movement takes place since the targets may be far away from their original positions when the aircraft or missile attacks.

Since present radar systems lack the capability to discern moving targets, Joint Stars or JSTARS (Joint Surveillance and Target Attack Radar System) is currently being developed with the US Air Force as primarily responsible. The Army requirement is for a wide-area surveillance system able to identify moving ground targets. The Air Force requests a longer-range radar with both fixed and moving target indicators and a weapon guidance capability. Joint Stars was initiated in 1982 but builds on the technology of two earlier programmes: the SOTAS (Stand-Off Target Acquisition System) of the Army and the Pave Mover of the Air Force.[9]

The main application of Joint Stars will be the detection and transmission of information on such moving targets as armoured formations, but it will also be used for fixed targets such as ammunition storage areas and command and control centres. Information from the Joint Stars radar will be passed to a ground data-processing station, where it will be analysed to find potential targets. The weapon guidance function will also track missiles and aircraft moving toward the targets and provide guidance updates to correct their trajectories.

Joint Stars will be implemented in a step-by-step fashion. The first step will be to fill the requirements of the Army, these being the less demanding. The Initial Operating Capability (IOC) for the Army is scheduled for 1987. For the Air Force, where the data link for weapon guidance is an important element, the IOC will be a few years later.[10]

Aircraft carrying the Joint Stars radar will fly parallel to borders, at a distance of some 50 km to avoid fire while scanning the area on the other side. The range of the radar is usually quoted to be between 150 and

200 km. The Army will deploy the Joint Stars radar on its OV-1D aircraft. The Air Force prefers to deploy it on the C-18 aircraft, a derivative of the Boeing 707, but has been instructed by Congress and the Department of Defense to use the TR-1 instead.[11] The C-18 is large enough to permit some airborne data processing, while the smaller size of the TR-1 and the OV-1D necessitates data processing on the ground.

Other systems can also be used to perform tasks similar to those of the Joint Stars radar. The PLSS (Precision Location Strike System) is an airborne sensor system which will be mounted on TR-1 aircraft and co-ordinated with Joint Stars. This system can locate and identify radio-emitting sources, including jammers. It will have a range of about 130 km. When a strike is ordered the PLSS system would lead the aircraft to computed points, at which the weapons are released.[12] The AWACS (Airborne Warning and Control System) radar which is deployed on E-3A aircraft can give increased warning time of aircraft taking off from air bases on the other side of the border and can also establish the position of secondary air bases by tracking aircraft as they land. New types of electro-optical imaging cameras will be able to provide surveillance during daytime even through haze and smoke and over long distances. For areas closer to the front, remotely piloted vehicles (RPVs) can be used. An RPV can provide real-time information up to 50 km from its data-link terminal.[13]

Command, control and communications

The demands which the plan for attack into the rear area places on the C^3 structure are great. Information is created in vast amounts, emanating from different sources. The system must therefore be able to sort unimportant information from important information in order to provide a usable basis for decisions. These decisions must quickly reach the operators of the weapon systems, and feedback from operations must be given promptly. The task is also made more difficult by the necessary co-ordination within the NATO alliance. The ground and air forces will also have to co-ordinate their operations. Keeping C^3 invulnerable to enemy jamming is essential. The JTIDS (Joint Tactical Information Distribution System) has been adopted as the basis for communications throughout NATO. This system for data and voice transmission is claimed to be highly jam-resistant. Additionally, the space-based Milstar communications system is being developed to give long-range jam-resistant communications. It is estimated that this system will become fully operational in the early 1990s. Similarly, the opponent's C^3 installations are considered to be important targets not only for destruction but also for jamming. The EF-111A aircraft can be used for jamming at stand-off distances. The ALQ-99 jamming system of the EF-111A is claimed to blind hostile radars far behind enemy lines. Unattended expendable jammers (UEJ) can be dispersed into the deep attack area in a number of ways; they can be air-dropped, weapon-delivered or RPV-borne. They have the advantage, compared to the stand-off jammer, of interfering less with one's own communications.[14]

Weapons against fixed targets

Some fixed targets have been termed 'high-value, time-sensitive targets'. 'High-value' refers to their vital function for the outcome of a war. 'Time-sensitive' refers to the fact that the effect of an attack on them depends heavily on the timing. This group consists of main air bases as well as chokepoints and important underground constructions. Since very few of these targets are located close to the border, they can be attacked almost solely by long-range interdiction. With advance knowledge of the positions of these targets, attacks are not restricted to the area covered by a surveillance system.

Airfields

Among the fixed targets, main air bases have high priority. Apart from runways, they also include such targets as weapon and fuel depots, aircraft out in the open and hardened shelters for aircraft. The main WTO operating bases would be attacked before their aircraft returned from the first-wave attack; the aircraft would thus be forced to go to secondary operating bases. The resulting dispersal would degrade subsequent sortie rates. The aircraft would also be more vulnerable owing to the absence of strong air defence and hardened shelters. Since the location of these WTO dispersal bases would be identified by the AWACS system as the returning aircraft are directed to them, they could then be attacked by NATO aircraft.

The present strategy for attacking main air bases with conventional munitions is by aircraft alone. Attack by both aircraft and missiles is envisaged in the future. New efficient runway penetrators, as well as dispensers fitted to the aircraft and containing a great number of sub-munitions, will reduce the number of aircraft sorties considered necessary. Ballistic and cruise missiles have the advantages of being unmanned and able to carry sub-munitions.[15]

One method of attacking runways is to use a penetrator bomb such as the French Durandal. The weapon is released by the aircraft at a very low altitude and thereafter retarded by two parachutes until it assumes an angle at which it will not ricochet. A rocket booster is then ignited to give a high impact velocity to enable the bomb to penetrate the runway. It then explodes after a firing delay. This weapon, in full production since 1978, has been ordered by 10 countries, including the USA, which is deploying it in Europe.[16]

Another means of attacking runways is by dispensers such as the JP233. This weapon system, being developed in the UK, consists of two dispensers, carrying cratering sub-munitions and area denial mines. The SG357 runway-cratering bomblet incorporates two warheads, the primary one used for implanting the secondary one, which can detonate to produce a large crater. The HB876 area denial mine is released simultaneously in order to make post-attack clearance more difficult and time consuming. The JP233 is scheduled to enter service in 1985.[17]

The MW-1 (*Mehrzweckwaffe*), developed in FR Germany and scheduled to enter service in 1984, is a dispenser system similar to the JP233. The sub-munition is ejected sideways from 112 tubes. The runway-cratering Stabo (*Startbahn-Bombe*) uses a propelling charge which makes the warhead penetrate the runway, after which a second charge detonates. Other sub-munitions intended for attack on operating bases are the MUSPA (*Multi-Splitter Passiv und Aktiv*) area denial mine with a sensor which can tell when aircraft are taxiing or taking off, and the ASW (*Anti-Shelter-Waffe*) sub-munition. The ASW is designed to penetrate hardened aircraft shelters to destroy aircraft inside them. The ASW is at a less advanced stage of development than the other sub-munitions mentioned.[18]

JP233 and MW-1 are so-called captive systems, which means that the aircraft will have to pass over the target when releasing the sub-munition. To reduce the vulnerability of the aircraft, the development of smaller dispenser systems has been instigated which could be launched up to tens of kilometres from the target by adding an engine or wings.[19]

Cruise missiles for this application would have a range of several hundred kilometres. While the US MRASM (medium-range air-to-surface missile), which included an airfield attack version, was cancelled in 1983, a new long-range cruise missile is being developed by Lockheed. This programme is run by the Navy but the Air Force has agreed to be associated with it. Unlike the MRASM the new missile employs stealth technology, giving a smaller radar signature, thereby delaying discovery.[20]

In November 1983 the governments of the USA, FR Germany and the UK signed an agreement on the development of an LRSOM (long-range stand-off missile). The range of the missile will be at least 200 km, and it is scheduled to enter service in the 1990s. The current candidates appear to be a version of the British Sea Eagle missile and the Messerschmitt–Bölkow–Blohm (MBB)–McDonnell Douglas Stand-Off Missile (SOM) which is based on the MW-1.[21]

Ballistic missiles have certain advantages over other missiles for attack on main operating bases. They have greater speed, and their ballistic trajectory makes them less vulnerable to air defence. The US AXE project envisages the use of ballistic missiles in hardened sites to deliver sub-munitions on runways and other fixed high-value, time-sensitive targets.[22] Three missiles have been suggested, all based on existing missiles.

The first of these, the CAM-40, is a derivative of the US Pershing II missile. A two-stage version of the Pershing II is claimed to have a long enough range to reach all WTO main operating bases from anywhere in western Europe, and a one-stage version would cover 70 per cent of them. A radar area-correlation terminal-guidance system would be used. The re-entry vehicle would have two or three bays containing runway penetrators. With a re-entry velocity of Mach 12, they can penetrate the runway, after which the charge explodes. It is possible to time the fuse, so some penetrators will act as mines.[23]

Another candidate missile for the AXE project is the BOSS (Ballistic Offensive Suppression System). This is a delta-wing glider launched by the booster of a Trident missile into a ballistic trajectory, which in contrast to the CAM-40 is endo-atmospheric. The range of the missile would be about 650 km and the guidance is of the stellar inertial type, which sights a single star to provide mid-course updating. This system would give the BOSS a circular error probable (CEP) of only 30–45 m, depending on the distance to the target. The runway penetrators consist of eight clusters and penetrate the runway before exploding. A third candidate, proposed by the US Army, is the 'Incredible Hulk', also known as TABAS or TABASCO. This missile would use booster components from the Thor/Delta or Saturn space rocket. It would be able to carry a payload of 25 tonnes.[24]

Other missiles like the smaller T-16 and T-22 can also be used to attack runways and other fixed targets.

Chokepoints

Other fixed targets are chokepoints such as bridges, railway yards and highway junctions. If these are attacked at an early stage, the opponent's forward movement will be considerably slowed down. The crossing of the Elbe River by an army could, for example, take seven days instead of the normal two if all the bridges were destroyed.[25]

Laser-guided bombs and air-to-ground missiles such as the Maverick can attack these targets. The ballistic and cruise missiles mentioned above would, however, be preferred since they have sufficient range to allow for launch on the western side of the border coupled with high-precision terminal guidance. A missile attack on bridges would be followed by an aircraft attack on the provisional bridges which would be constructed as well as on the ground forces amassed at these points.

Underground constructions

The most efficient munition for destroying bunkers for C^3 and storage of nuclear weapons and fuel would have a length/diameter ratio of 10:1 in order not to bounce up to the surface again. The Bunkered Target Munition (BTM) which is of this type is currently being developed in the USA.[26]

Ballistic missiles are best suited to carry this kind of munition. The same ballistic missiles envisaged for airfield attack could be used. The CAM-40, for example, could carry eight BTMs. Cruise missiles and aircraft would avoid radars by flying very low. A pop-up manoeuvre by the munition would then be necessary to attack the target at an angle of 60° to the ground. It would also have to increase its speed. Since cruise missiles could carry only about three BTMs, more missiles would be needed than if ballistic missiles were employed, the number depending on the size of the bunker area.[27]

Assessments

It is argued by proponents of new weapons for the interdiction mission that their use could considerably increase the effectiveness of interdiction. For example, four sorties of an aircraft such as the F-4 or F-111, carrying a bomb like the Durandal, would be sufficient to put a runway out of action. For aircraft fitted with MW-1 or SAW dispensers, only one or two sorties would give the same effect. However, attacking aircraft must be escorted by other aircraft to fight off the opponent's air defences. The anticipated attrition rate for such missions is 20–50 per cent. If, instead, missiles were used to attack these targets, five cruise missiles like the MRASM, two to three CAM-40s or one BOSS would be sufficient to put a runway out of use. One Incredible Hulk missile alone can even destroy a whole base. It has been estimated that 800 CAM-40s would be required to keep the 40 most important main air bases inoperable for three days. It would require around 300 CAM-40s to destroy some 100 choke-points.[28]

However, doubts have been raised as to the feasibility of carrying out deep strikes. It is claimed that more research is needed for the development of these weapons. For example, many of the components of the sub-munition would need to be miniaturized to make room for explosives. Also, the JP233, the STABO and other airfield attack sub-munitions which have two sets of explosives have not worked very well in tests. The same applies also to other types of sub-munition.[29]

The new weapons will also pose a number of problems for arms control. These problems are discussed in section VI.

Weapons against mobile targets

Mobile targets are the advancing forces and the tactical nuclear missiles and their support units. Mobile targets in the rear area can at present only be attacked by aircraft-launched weapons with limited stand-off capability. The introduction of dispenser-carried sub-munitions is supposed to give increased effect since it would reduce the number of aircraft sorties. Later on, further advantages would come from the introduction of missiles guided by Joint Stars and sub-munitions with terminal homing capability.

The West German MW-1 dispenser will employ the KB44 anti-armour bomblet which has an additional fragmentation effect against soft targets, the MUSA multi-splinter mine which is effective against semi-hard targets like truck convoys, and the MIFF anti-tank mine. The US equivalents are the CEM (cluster effects munition) and the Gator mine. The USA has also developed the AMIS (anti-material incendiary sub-munition) fire munition which could destroy light armoured vehicles.[30]

The most important US weapon for interdiction is the Joint Tactical Missile System (JTACMS).[31] This system would bring together the Army's CSWS (Corps Support Weapon System) and the Air Force's CSW (Conventional Standoff Weapon) programmes. The Army requirement was for a ground-launched weapon delivering a range of warheads, including nuclear and chemical warheads and terminal-guided sub-munitions. The Air Force requested an air-launched missile for attack of rear-area targets and for defence suppression. This missile would be capable of launch from aircraft ranging in size from the F-16 to the B-52. In 1982 these two programmes were merged into the JTACMS with the Army as primarily responsible.[32]

The requirement is for a missile that can be air- and ground-launched against targets deep behind enemy lines. The design parameters are expected to be determined by the Army and the Air Force in early 1984. The missile will draw heavily on the Assault Breaker which was a technology demonstration programme for non-nuclear attack of second-echelon forces. The Assault Breaker programme, which started in 1978 (and also included the SOTAS and the Pave Mover radars), made a number of tests using the Martin Marietta T-16, based on the Patriot ground-to-air missile, and the Vought T-22, based on the Lance missile. These two missiles are the main competitors for the contract for which also the T-19, a version of the SRAM missile developed by Boeing, is competing.[33]

Both the T-16 and the T-22 would use an inertial guidance system—the T-16 with a mechanical gyroscope and a stellar inertial unit, and the T-22 using the more accurate ring laser gyroscope. The missile selected will vary in range, payload and size according to its application. For Army use it will weigh up to 1 360 kg and have a range of up to 250 km. The Air Force request varies with the aircraft: the HF-16 weapon would have a range of around 180 km, while the range of the B-52-launched missile would be considerably longer.[34]

The US Air Force is of the opinion that the T-16 and the T-22 might still be too heavy for fighter aircraft. Another design, the NV-150, suggested by Northrop, has aroused the interest of the Air Force. The NV-150 is a turbojet-propelled stealth cruise missile, with a range of more than 370 km, intended for inertial and global positioning system (GPS) guidance. The GPS consists of a number of satellites emitting time-synchronized coded signals which can be received by the missile. By noting the time of arrival of signals from the different emitters, the missile can calculate its own position. The manufacturing process of this missile would be extremely innovative, "stamping the missiles out like plastic toys," which is said to reduce the price of the missile considerably. The cruise missile advantages of long range and heavy payload in comparison to the weight of the weapon should also be weighed against the lesser vulnerability of the ballistic missile.[35]

Whichever proposal will be selected for the JTACMS, the initial missile to be fielded will probably be a weapon having inertial guidance without further aid from Joint Stars, the Precision Location Strike System or the Global Positioning System. Thus initially the JTACMS will only be able to attack fixed targets.[36]

The introduction of guided sub-munitions would also come at a further stage. The Army would, for the initial version, prefer to use the non-nuclear warhead of the Lance missile on the JTACMS. This warhead is used against unarmoured targets. The Vought Corporation claims that the destruction of the C^3 and logistics support of the opponent would be much more decisive for the outcome of the war than the destruction of a similar proportion of armoured vehicles. This type of target is not particularly mobile and a real-time capability is therefore not considered necessary.[37]

Two types of guided sub-munition were tested as part of the Assault Breaker programme. The terminally guided sub-munition (TGSM), after ejection from the missile, would use a parachute to retard its descent. At a predetermined height it would start to scan the surface in any of four patterns, which are either elliptical or circular depending upon the shape of the target. The instruction on which pattern to select is given to the missile in flight after analysis of information from the Joint Stars radar. The infra-red (IR) seeker, which has been tested on the TGSM, would be tuned to the heat emissions typical of a tank and would automatically home on such targets. When impacting, the shaped-charge warhead would form a jet of molten metal to penetrate the target's armour.

The Skeet sub-munition, also tested in the Assault Breaker programme, works in a similar fashion. Four Skeets are carried by an SDVA (Skeet delivery vehicle assembly), which is ejected by the missile, deploying a parachute and at a height of 30 m releasing the Skeets in pairs. The IR seeker (the same type as that tested on the TGSM) would scan the ground in a circular pattern. When the characteristic heat signature of a tank is detected, the detonation of the SFF (self-forging fragment) warhead is triggered. This detonation forms a heavy metal disc (of copper, tantalum or depleted uranium) inside the warhead into a streamlined projectile which travels at an extremely high velocity and thereby penetrates the target by its kinetic energy. If the intended target is not detected, the charge is detonated in a different way to produce a maximal effect against personnel and lightly armoured vehicles.[38]

At the 'lower end' of the interdiction spectrum, the MLRS (multi-launch rocket system) has been operational since 1983. It will soon be able to fire anti-tank mines to a distance of 40 km. The third phase is to equip it with terminally guided sub-munitions, probably using millimetre-wave radar guidance. This version will be operational in the late 1980s and have a range of more than 30 km.[39]

Assessments

The implementation of new methods for attacking second-echelon forces is seen by its proponents as a major step in increasing the capability to fight a conventional war.

The crucial task of surveillance and target acquisition is claimed to be less difficult because of the knowledge already acquired by observing exercises and studying topographic conditions and communications networks, on the basis of which probable patterns of movement could be predicted. The potential of the Joint Stars radar was demonstrated in a test in which it located a single tank at a range of more than 150 km.[40]

The effects of the weapons have been estimated. A Soviet division contains about 3 000 vehicles. It is believed that it would be replaced when 60 per cent of the division, that is, 1 800 vehicles, have been destroyed. For free-falling 250-kg bombs this is thought to require 2 200 aircraft sorties. With unguided sub-munitions only 300 sorties would be needed, and for guided sub-munitions the number is further reduced to some 50–60 sorties.[41]

There has also been much criticism of the second-echelon attack strategy. The estimates mentioned above for the effect of the weapons have been claimed to be largely incorrect, owing to technical inaccuracies and organizational misperceptions.[42] It is also claimed that the attack would probably not proceed as envisaged. Tests have been performed on components and some of them have been successful, but many others have failed. The tests also seem to have been performed under favourable conditions, such as with no countermeasures and in a type of terrain where tanks are highly visible. Above all there have as yet been no tests where all the components of the system—the airborne radar, the missile and the munition—have been successfully used together.

Doubts have also been voiced as to the capability of the Joint Stars radar. There have been problems with radars at much shorter ranges than those cited for this radar. Additionally, the size and complexity of data emanating from it are vast. Even without outside interference it is an extremely difficult task to carry out this process of collecting, evaluating and dispersing data. Since electronics now replaces human beings for several functions, the system is also bound to be less adaptive to new conditions. The centralized structure of the system makes it a high-priority target. Furthermore, the position of the aircraft makes the system vulnerable. The WTO would also have systems to home on to emitting sources for destroying and jamming. The survival of the whole system thus depends on staying one step ahead in technology.

IV. Current proposals

Despite the controversial December 1979 NATO decision to deploy new long-range theatre nuclear missiles in Europe, the main emphasis of current NATO rearmament is on conventional weaponry. Nine of the ten 'task forces' of the NATO Long Term Defence Programme (LTDP) concerned across-the-board improvements of the conventional force posture.[43] According to one of the key US officials behind President Carter's LTDP initiative, R. W. Komer, the tenth task force—TNF (theatre nuclear forces) modernization—was merely "an add-on designed to reassure our European friends that no 'gap' in the deterrent spectrum would be allowed to develop while we all focused on strengthening our conventional shield".[44]

Although improvement in conventional weapon technology was not accorded a separate task force as such, it was regarded as the implicit common denominator of the LTDP. The NATO summit meeting in Bonn in June 1982 stated that NATO would "explore ways to take full advantage both technically and economically of emerging technologies, especially to improve conventional defence".[45] This is known as the 'Weinberger initiative' since it was the US Secretary of Defense who suggested to the NATO defence ministers in May 1982 that the Alliance should study the use of emerging technologies for conventional defence. At the December 1982 NATO ministerial meeting, Weinberger presented a US proposal along these lines, focusing on the areas of defence against first-echelon attack, interdiction of Warsaw Treaty Organization (WTO) follow-on forces, improving counter-air capability, enhancing command, control, communications and intelligence (C^3I), and disrupting WTO C^3.[46]

The idea of exploiting emerging technologies for conventional interdiction has been pursued primarily by the US R&D communities in the military services, various civilian research institutions and the military industry.[47] At official NATO level, attention has focused on the two concepts of 'follow-on forces attack' (FOFA) and the US Army AirLand Battle doctrine (ALB).

The 'Rogers Plan' is the label put by the mass media on the call in the autumn of 1982 by US General B. W. Rogers, SACEUR (Supreme Allied Commander, Europe) for general improvements in NATO's conventional defence capabilities, including readiness, sustainability and new technologies. Development of the key concept of attacking WTO follow-on forces began in late 1979.[48] It was approved by the Military Committee in October 1981,[49] and the intra-Alliance decision-making process continues.

In a Congressional hearing last spring, Rogers described these plans:

> Let me describe our concept of operations of which striking deep is a subconcept.
>
> We charge our lead divisions, the divisions occupying our general defensive position, each to handle two enemy divisions opposite them. Those are the first and second tactical echelon divisions of the Warsaw Pact's first operational echelon.
>
> Our second subconcept of operations calls for our reserves . . . to take care of the enemy's second operational echelon forces or any Operational Maneuver Groups—exploiting forces—which may have broken through.
>
> Then our third subconcept calls for us to attack both mobile and fixed targets in the enemy's rear area.
>
> What I am talking about is interdiction. We have had interdiction from time immemorial, but this will be very accurate and on specific targets which we would quickly locate, target, get the information to a joint tactical fusion center where human judgment is exercised by man and pass it to a weapon system to attack the target before it leaves.[50]

The FOFA concept apparently envisages interdicting the full range of targets—including airfields, combat and supply units, lines of communications, C^3I installations, and so on.[51] Interdictive strikes will be carried out across the entire European battlefield, up to and including the three westernmost military districts (the Baltic, White Russian and Carpathian) of the Soviet Union.[52]

There are many similarities between the FOFA ideas and the new US Army AirLand Battle doctrine. AirLand Battle, as put forth in the new field manual on 'operations',[53] incorporates many changes compared with the previous doctrine of 'active defence'.[54] It incorporates concepts such as the 'extended' and the 'integrated' battlefield: extended in depth, time and range of assets; integrated since use of conventional, nuclear, chemical and electronic warfare is contemplated.

The links to the FOFA plan are obvious: lacking the necessary geographic depth to allow trading space for time, NATO should extend the battlefield into enemy territory. This is to be accomplished through 'deep attacks' on the enemy's follow-on echelons, thus preventing them from reinforcing the front line forces. There are, however, significant differences in how these second-echelon attacks are to be carried out, differences that NATO officials are understandably keen to point out.[55] The AirLand Battle doctrine implies deep attacks by counter-offensives on the ground, as well as integrated nuclear and chemical strikes. This of course raises serious arms control questions, which will not be discussed in this chapter. There has also been some confusion with the US Army futuristic AirLand Battle 2000, which discusses the battlefield of the period 1995–2015.[56]

As far as range is concerned, however, AirLand Battle is more modest in its approach than FOFA, although this may be due to division of responsibility between the armed services rather than to choice.[57] The main emphasis is on battlefield air interdiction,[58] the purpose of which is "to bring airpower to bear on those enemy forces not yet engaged but positioned to directly affect the land battle. To be more specific . . . enemy second echelon regiments or divisions, moving toward contact with friendly troops already engaged by enemy first echelon regiments/divisions."[59]

Battlefield air interdiction would mainly be applied to the area from close air support up to the corps' "area of influence",[60] that is, from 30 km to some 150 km.[61] Battlefield air interdiction is clearly aimed at 'force' rather than 'supply' interdiction, and in NATO it is considered part of offensive air support (also including close air support and tactical reconnaissance).

V. *'Defend forward' or 'strike deep'?*

With finite and, even in the USA, increasingly constrained resources available for the military sector, defence planners will have to make a careful assessment of the costs and benefits involved when deciding on which doctrines and associated weapon systems to choose.[62]

Even if the technological problems discussed in section III are solved and realistic cost estimates made, several important questions remain to be addressed. Which targets should be attacked, and to what effect? Will the adversary devise appropriate technical and operational countermeasures?

Empirical studies of the benefits of interdiction campaigns have concentrated on experience from World War II, the Korean War, and—although less relevant in a European scenario—the Viet Nam War. The

Rand Corporation has carried out a number of studies on interdiction. One report finds that:

The problem of the interdiction planner is to match his air resources (taking target acquisition, weapons, and delivery accuracies into account) against a set of targets which, if destroyed or damaged, will produce the most favourable *net payoffs* in the context of the particular operational situation. ... Attacks intended to delay supply buildup usually, and attacks against route structure often, require the continuous application of air resources over time. ... Moreover, even if supply interdiction is successful, the payoffs are often long deferred.[63]

Moreover, the supply interdiction campaign studies were almost invariably conducted with air superiority, a key factor in cost assessments. Under realistic central European battlefield conditions, with strong enemy air defences,[64] dense road networks and 'short war' postures (with significant supplies up front, organic to units), supply interdiction could prove even less cost effective.

For these reasons there is growing awareness that attacks against forces en route—against manoeuvre-unit vehicles—can be particularly attractive if the operational situation is suitable: the target is fleeting but usually concentrated compared with resupply convoys; only a short-term commitment of air resources is needed to earn some immediate dividends; and experience suggests that such dividends can sometimes be very high indeed.[65]

One of the first public signs of recognition that the US Air Force was (and had for a long time been) interested in interdiction against enemy combat forces—which could prove more lucrative than simply 'applying the tourniquet' to lines of communication—came in an article on 'tactical counterforce' in 1974. The definition offered was very similar to that of battlefield air interdiction:

Tactical Counterforce has as its objective the destruction or disruption of major ground forces that threaten, but are not engaged with, friendly ground forces. The targets are enemy firepower elements located beyond the forward edge of the battle area. Because it strikes directly at enemy land forces rather than at lines of communication, Tactical Counterforce differs from current perceptions and from the traditional emphasis of interdiction.[66]

Although attacking enemy combat units may be more attractive than severing the lines of communication, the costs involved may also be higher. The targets are hard (armoured) and mobile, thus increasing the requirements for real-time C^3 and target acquisition, as well as for accurate and lethal sub-munitions. Moreover, the targets are often dispersed, calling for area weapons. Some of these problems may be solved if one accepts simply stopping the vehicles temporarily rather than totally destroying them. Such counter-mobility interdiction could be carried out through remotely laid mines, which are relatively cheap, cover large areas, and have effects of longer duration (until they are cleared or self-destruct).[67]

Generally, the cost of each of the links in the interdiction chain—intelligence, surveillance and target acquisition; command, control and communications; delivery vehicles; and munitions—increases with range (with the possible exception of the munitions). Also, combat vehicles in the far rear area are less likely to suffer a 'catastrophic' secondary explosion, since they are not combat-loaded.[68] On the other hand, enemy air defences are likely to be stronger near the front.

The adversary can be expected to develop countermeasures against every link in the long and vulnerable chain of interdiction. Active countermeasures may be offensive, such as counter-air, or defensive, including air defence (possibly anti-tactical missile systems) and disrupting the different terminal guidance systems (flares against infra-red guidance, and chaff or electronic jamming against radar guidance; smoke optimalized against different parts of the electromagnetic spectrum). Among the passive countermeasures, there are various deception techniques such as dispersion, camouflage, and so on. Electronic warfare will be widely employed.

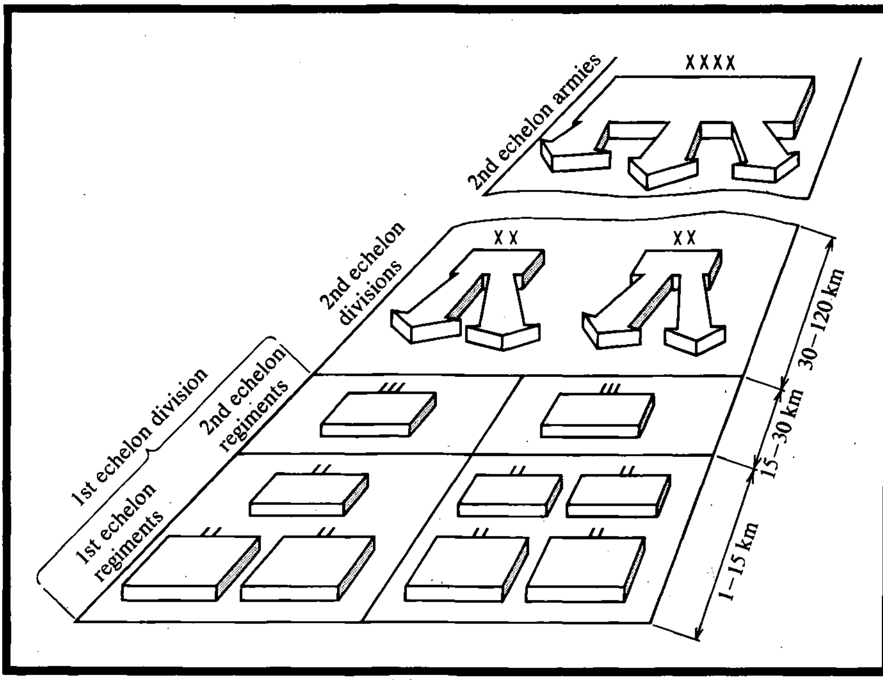
The fundamental threat assessment underlying the 'deep strike' concept is based on a rather stereotyped view of Soviet World War II operations —more specifically, the use of second echelons.[69] A second (or, rarely, a third) echelon is a portion (usually one-third to one-half) of a unit kept to the rear of the attacking first echelon. The purpose of this second wave is to keep up the momentum of the attack, either to achieve a breakthrough or to exploit it. The aim of 'deep strike' is to interdict such second echelons, thus keeping the force ratios at the front at manageable levels (no more than 3:1 in favour of the attacker). However, the second echelon assumption may be seriously flawed, on several accounts.

First, it is a question of on what levels of command the Soviet Union will choose two echelons rather than one. As is shown in figure 8.1, this has clear implications for the optimal range to seek for one's weapon systems.

At theatre level, the WTO second strategic echelon will consist mainly of forces in the western Soviet Union. Interdicting these formations as they move westwards is likely to have but marginal and delayed effects, owing to the long range and alternative routes.

The fronts (the largest Soviet military formation, usually consisting of four armies) of the first strategic echelon—the groups of Soviet forces in eastern Europe—are likely to deploy their armies in two echelons only if NATO defences are properly deployed; against weak and hastily prepared defences, a Soviet front might use only a single echelon of armies (up to 120 km), although with a strong operational reserve.[70] This seems to be accepted in the AirLand Battle doctrine, where the main emphasis is on battlefield interdiction (up to 150 km).

Figure 8.1. Artist's impression of Soviet military echelons, as seen by the USA



Whether the armies will deploy their (usually) four divisions in one or two echelons is once again dependent on the state of NATO defences, but the likelihood of second-echelon divisions is large enough to warrant devoting 'deep strike' resources to attacking them (at ranges of 30–120 km).[71]

Second, it is not only the depth to which the Soviet Union is likely to deploy its various units that is of importance, but also their intended functions. The US Army feels that this is of no major significance: "Whether our enemy is stylistically echeloned [as shown in figure 8.1] is not really critical, what is important is that superiority in numbers permits him to keep a significant portion of his force out of the fight with freedom to commit it either to overwhelm or bypass the friendly forces."[72] For the USSR, "The distinction of the second echelon from the reserve was that it was created ahead of time with a precisely defined mission—to intensify the force of attack of troops of the first echelon from a specific position and exploit success in depth."[73] Echelons would form in pre-arranged positions with pre-determined missions, thus becoming lucrative targets and being clearly relevant to the front-line battle. Reserves, on the other hand, would be smaller, dispersed, and would be used flexibly whenever need arose (that is, they would group for combat only when and if the first echelon fails or a breakthrough has been achieved). Once again, the status of NATO forward defences would be decisive.

This leads us to the third and most crucial conceptual flaw: the Soviet Union may penetrate NATO defences before they have been properly deployed. The USSR is believed to prefer that any war in Europe should be kept short, both in order to prevent NATO from bringing their globally superior resources to bear, and—most importantly—to avoid escalation to the nuclear level. This could be achieved through a surprise attack before NATO is fully mobilized or forward deployed, thus not requiring a second echelon or a breakthrough operation at all, rather imitating German infiltration tactics of World War I.[74] As soon as possible, preferably on the first day of the war, the USSR would hope to insert one or more operational manoeuvre groups behind NATO lines.

OMGs would be tank-heavy formations of divisional (at army level) or corps (at front level) size, organized on an *ad hoc* basis at very short notice (a few hours).[75] The OMGs would make a nuclear response by NATO less likely by rapidly crumbling NATO defences. This would leave NATO little time to decide on a first use. OMGs could destroy NATO tactical nuclear resources in deep raids, and would make less attractive nuclear targets through intermingling with NATO forces and population centres. Rogers seems to be aware of the dangers of OMGs,[76] but the reserves to stop them may not be there—they are another competitor for scarce resources.

It is a question of getting one's priorities right. NATO would have to create a credible, 'non-surprisable' defence up front in order to force the USSR to echelon; the two defence concepts are complementary, but without a strong NATO forward defence, there may be no second echelons to 'strike deep' into. Rogers pays lip service to this fact:

> [T]his ability to strike deeply is not to be acquired at the expense of our ability at the FEBA. On the contrary, defending the FEBA and attacking the follow-on forces are complementary and mutually reinforcing facets of the ACE [Allied Command, Europe] concept of operations: defense at the FEBA protects our means to conduct attacks on the follow-on forces, and striking deep will keep the force ratios at the FEBA manageable.[77]

Once again, it is a question of a conscious choice of which military investments to make. The allocation of resources between the 'defence in contact' at FEBA and the 'deep strikes' depends on the kind of cost-benefit assessment discussed above. It is likely that costs will increase and benefits decrease with required range. Cost estimates of the different deep strike proposals are necessarily very sketchy, and probably over-optimistic. The technologies for attacks at shorter range, on the other hand, are already available, relatively cheap, and could be vastly improved by the sub-munitions and surveillance capabilities developed for deep strike. And, finally, the majority of enemy targets, and those with most direct influence on the battle, are at the front.[78]

VI. Arms control implications

The 'technological imperative' is commonly acknowledged to be one of the main driving forces behind the arms race. There is much industrial interest in the R,D&A (research, development and acquisition) aspects of deep strike technologies. Therefore, we may expect another turn of the arms race spiral if these new technologies are fully pursued.

However, fiscal restraints may impede the growth of deep strike. General Rogers has been quoted to the effect that the required conventional capabilities could be attained towards the end of this decade at a cost of about 4 per cent real increase per year in NATO military expenditures.[79] This might seem a small sacrifice. However, few NATO countries manage even to achieve the increase agreed to with the LTDP, the so-called '3 per cent solution'.[80]

Moroever, Rogers has clarified his points somewhat:

> What I have actually stated is that the current force goals (1983–88) which NATO nations have accepted can be achieved with a 4% real increase in defense spending for each of those six years. Included in those force goals are some systems aimed at attacking follow-on forces; however, all of those systems needed are not available in the time frame of the 1983–1988 force goals and will be included in later iterations of the goals which are agreed on a biannual basis.[81]

It is clear that development of deep strike capabilities in full may eventually demand even larger resources. In real terms, the estimates of the cost of these new proposals are necessarily vague. The European Security Study puts it at $20 billion (± 50 per cent) over a 10-year period, which again "could be accommodated within a level of expenditure approximately 1 per cent higher than the current NATO norm of 3 per cent annual real growth".[82] The history of arms development advises us to treat such preliminary estimates with scepticism.

However, if deep strike capabilities are generally believed to enhance the credibility of the conventional component of NATO's flexible response posture, the public might prove willing to foot the high bill. The consensus on NATO policy has suffered considerably because of this lack of credibility; the dilemmas and untenability of an 'early-first-use' policy have dawned on the public much as a result of the peace education process that has taken place in the shadow of the euromissiles.[83]

Crisis stability

The surveillance technologies associated with deep strike could perform an important monitoring function during peace-time. The intelligence gathered could be used to verify compliance with arms control agreements, reduce the fear of surprise attack, as well as in preparation for such an attack. The net stabilizing effect is dependent on factors such as the vulnerability of the surveillance installations and platforms and on the overall force postures on both sides.

This also applies to the deep strike weapons themselves. If they are vulnerable to pre-emption, and at the same time are coupled to a strategy of forward deployment and ground counter-offensives, they may seriously decrease crisis stability. If the WTO felt that a war was inevitable, it is argued above that they might choose to strike first, before NATO forces are fully deployed. The incentives for pre-emption would be even greater if the USSR developed deep strike capabilities of its own: they would be eminently suitable for interdicting the forward movement of NATO reinforcements to the front. For instance, the Dutch corps on the north German plain will consist of 10 brigades when fully deployed. Of these, only one is permanently deployed in FR Germany (some 100 km from the border with the GDR); the other nine (of which four would have to be mobilized) must move an average of 300 km up to their general defensive positions.[84]

The destabilizing potential of counter-air strikes is particularly worrying. This is especially so for the ballistic missile option. The 'time urgency' in attacking enemy airfields depends on the scenario. Unless one aims at destroying the enemy air forces on the ground in a first strike, the short flight times of ballistic missiles are not needed (ballistic missiles have of course other factors in their favour, such as relative invulnerability).

The arguments made about surprise attacks and crisis stability point to one of the more fundamental dilemmas for Western defence planners—the stronger NATO's eventual, fully mobilized forward defences, the fewer resources remain for the standing forces and peace-time readiness, and the stronger will be surprise attack incentives for the WTO. The less confident the USSR is of eventual victory in a long drawn-out war, the stronger are Soviet pre-emptive inclinations if they believe war to be inevitable.[85]

No-first-use and the nuclear threshold

The overriding concern of our world today is avoiding a nuclear war. Once the nuclear threshold has been crossed, through the employment of nuclear weapons, the chances are that no intermediate halting line ('firebreak') may be established before the total, cataclysmic holocaust, threatening the extinction of the human race. The key issue is therefore to prevent nuclear weapons from being used in the first place, and there have been numerous calls for the adoption by the nuclear powers of no-first-use declarations.[86]

The decision on first use of nuclear weapons would be a grave one indeed. Apart from the fundamental moral aspects and the force of world opinion, the main factors influencing such a decision—and thus the level of the nuclear threshold—would be the likely enemy retaliatory measures, military utility and necessity, and collateral damage. Improvements in conventional military capabilities could raise the threshold by reducing the need for and offering alternatives to nuclear weapons.

Some of the problems of assessing the net impact of deep strike technologies in this context—in terms of technological problems, possible operational misperceptions and opportunity costs—are mentioned above. If deep strike does not work as planned, if fewer resources are devoted to NATO's standing forward defences, and the WTO adopts a more pre-emptive posture, the nuclear threshold may indeed be lowered.

Nevertheless, the idea that an improved conventional deterrent would raise the threshold and de-emphasize the role of nuclear weapons in NATO strategy is a basic premise of the Rogers Plan, although General Rogers himself explicitly rejects NATO adoption of no-first-use.[87] This aspect of deep strike has also been stressed by one of the most important supporters of the idea, Senator S. Nunn.[88] Together with Senator E. Kennedy, he introduced an amendment to the Senate defence appropriations bill that barred, for one year, expenditures on research, development, testing, evaluation or procurement for integration of a nuclear warhead into the joint tactical missile system. Kennedy voiced his concern that a basically conventional system should not be turned into a nuclear one: "We should not permit a system that is supposed to raise the nuclear threshold in Europe to be turned into a system that will lower this threshold".[89] Whether, in fact, a nuclear version of the JTACMS—if and when developed—will actually lower the threshold as compared to its current, shorter-range predecessor, the Lance, is open to debate. The conclusions on the threshold-raising qualities of conventional deep strike remain, however. When discussing deep strike and the nuclear threshold, it should also be remembered that the previous US Army doctrine stressed nuclear attacks on second-echelon and reserve forces.[90]

The counter-argument has been made that new deep strike technologies will lower the threshold through 'blurring' the distinction between nuclear and conventional weapons. This may be wrong. Comparisons between the destructiveness of low-yield (a few kilotons of TNT) nuclear warheads and conventional deep strike weapons are based on estimated destruction of point targets (say, a company of 10 armoured vehicles). There is no similarity in area of destruction. That a conventionally armed missile could destroy as many tanks as a low-yield nuclear missile, without corresponding collateral damage to civilians, could only serve to increase the inhibitions against—and reduce the need for—using the latter.[91]

As mentioned above, some of the deep strike weapons could be equipped with nuclear warheads. It has been argued that preparations for actual launch of such missiles could be interpreted by the opposite side as nuclear actions, leading to pressures for nuclear pre-emption or launch-on-warning. This is a fundamental dilemma of all dual-capable weapon systems, the problems being more severe the longer the range (and the more vital the installations that may be reached) and the shorter the flight time. Dual-capable systems would, on the other hand, be more numerous and thus less vulnerable than nuclear-dedicated systems. However, some of the dual-capable systems would have to be retained for nuclear eventualities, weakening conventional capabilities when most needed. The problem could best be addressed by maintaining a separate, dedicated, invulnerable retaliatory nuclear force, keeping the deep strike systems for a strictly conventional role.

'Deep strike' and LRTNF negotiations

Several proposed deep strike weapons are based on nuclear missiles with a range of more than 1 000 km, the lower limit of the adjourned LRTNF negotiations. Distinctions between the conventional missiles and their nuclear counterparts would be necessary in order to achieve a verifiable reduction in the numbers of nuclear missiles.

Various measures have been suggested to accomplish this distinction. Differences in deployment practices (like base security arrangements) can be observed by satellites and by other means. This method could be complemented by inviting on-site inspections. Physical differences between the nuclear and conventional versions are naturally also highly desirable. Neither this nor any of the other methods would, however, prevent the replacement of conventional with nuclear warheads immediately before an attack. To guard against this, conventional long-range missiles would also have to be included in the restricted numbers agreed upon.[92]

Since weapons of a lower range than 1 000 km have not been included in LRTNF negotiations, circumvention of an agreement can be achieved by forward basing of shorter-range systems. If the area of negotiations is extended down to a range of some 200 km, many of the proposed deep strike weapons would fall in this category. Such an extension could also be a dissuading factor against the development of dual-capable, nuclear warhead versions of deep strike missiles. Circumvention of an LRTNF agreement could also come about due to the non-inclusion in the negotiations of aircraft and sea-launched cruise missiles.[93]

Transarmament

A structural change of the armed forces, a transarmament process, could be used to produce a new type of defence—non-provocative defence. Transarmament would then have the same aim as disarmament measures—to reduce the risks of a war breaking out. The transarmament method has the advantage of not requiring negotiations before implementation. The two methods are, however, not mutually exclusive: transarmament might lead to disarmament measures.

A number of outlines for non-provocative defence systems have been presented. These usually envisage the employment of small mobile units equipped with portable short-range weapons. The units would attack enemy forces as they enter their assigned area, reducing the enemy's numbers and lowering his speed. In addition, artillery deployed at some distance from the border and border sensors are usually included in these outlines.

While the deep strike plans as currently envisaged do not fit into a non-provocative defence concept, several components could be incorporated to increase the efficiency of non-provocative defence without losing its defensive character. The incorporation of an efficient surveillance system would thus increase the time to prepare for an impending attack. Efforts made to create efficient unjammable communications systems could be taken advantage of. Much of the development in sub-munitions, guidance and warheads carried out for deep strike weapons would apply also to short-range weapons of the non-provocative defence concept.

Disengagement zones

From time to time, the idea has been put forward that a disengagement zone in central Europe could serve both to reduce the fears of surprise attack and to raise the nuclear threshold.[94] This zone could combine the withdrawal of battlefield nuclear weapons with the removal of major conventional weapons that are particularly suited for offensive use, and could cover some 100 km on each side of the inter-alliance border.[95]

Such zonal arrangements could combine disarmament, transarmament and rearmament measures. In the disarmament context, zones could be coupled to agreements in Vienna or, preferably, to all-European solutions incorporating graduated zones from the Atlantic Ocean to the Ural Mountains, with more severe restrictions of military activities and deployments closer to the central European dividing line. Whereas a mutually binding and verifiable agreement on such a zone would be preferable, its unilateral adoption by either side could well lead to increased security for both, thus enhancing their 'common security'.

Within this combined disengagement zone, defences could be 'trans-armed' along the lines discussed above. Such an arrangement would reduce tension because of its less offensive and non-provocative nature; in addition it would significantly reduce the opponent's possibilities and incentives for surprise attack. A potential aggressor would have to move his forces through a network of territorial defence units, which could reveal his main avenues of attack, slow him down by forcing him to deploy from road to battle formation, and inflict considerable attrition, especially on his vulnerable logistical tail. It would be very difficult to predict the total disruptive effects suffered by an invader within the zone, but this uncertainty would in itself contribute to deterrence, especially as the weakened invasion force would face the defender's fresh, fully mobilized counter-attack units once he has crossed the zone.

Deep strike weapons could enhance the credibility of such a defensive concept. The entire invasion force (both first and subsequent 'echelons') would be targetable, over a distance of at least 100 km (200 km if the zone, by agreement, extends bilaterally into enemy territory, banning the deployment of offensive combat units there). In order to keep up his momentum and speed, the invader would have to stay on the roads, offering ideal targets. In any war in central Europe, especially with offensive operational doctrines like AirLand Battle and the Soviet OMGs, there would rapidly develop a non-linear, intermingled battle. In such a mêlée, the light, unmechanized territorial defence units would have a decidedly different electromagnetic signature from that of the enemy's attacking armoured forces, so that the defender would need to show little self-restraint—that is, would not need to fear attacking its own troops—when firing deep strike weapons from the rear areas (where they are less vulnerable) into the zone. This is another reason why this suggested re-arrangement of NATO defences would be less vulnerable to the development of corresponding deep strike capabilities by the WTO. In addition, the vulnerable movement of NATO units from peace-time barracks to their wartime fighting positions would be reduced.

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[62] Based on World War II operations analysis, these assessments have become increasingly systematic and complex. For an introduction to such systems analysis, see Quade, E. S. (ed.), *Analysis for Military Decisions* (Rand McNally, Chicago, 1967). This chapter is confined to pointing out elements which might be included in such an analysis, with very limited opportunity cost speculations.

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[64] Rasmussen, R. D., 'The central Europe battlefield—doctrinal implications for counterair-interdiction', *Air University Review*, July-August 1978, pp. 2–20.
[65] Dews and Kozaczka (note 63), p. 14.
[66] Bray, L. W., Jr., 'Tactical counterforce', *Air Force Magazine*, Vol. 57, No. 6, June 1974, pp. 36–40.
[67] Walker, J. K., Jr., *Air Scatterable Land Mines As An Air Force Munition*, P-5955 (The Rand Corporation, Santa Monica, Calif., 1978).
[68] Canby (note 42).
[69] For a good introduction to the 'echelon' concept, see Vigor, P. H., 'Soviet army wave attack philosophy', *International Defense Review*, Vol. 12, No. 1, 1979, pp. 43–46.
[70] Hemsley, J., *Soviet Troop Control* (Brassey's, Oxford, 1982), p. 130.
[71] Echeloning seems to be rather standard practice up to divisional level (30 km); cf. Hemsley (note 70), p. 130. For an alternative view, that even divisions and regiments may deploy in single echelons, see Vigor, P. H., 'Soviet echeloning', *Military Review*, Vol. 62, No. 8, August 1982, pp. 69–74.
[72] US Department of the Army, TRADOC (note 61), p. 5.
[73] Sidorenko, A. A., *The Offensive* (Moscow, 1970), (Translated by the US Air Force, published by the US Government Printing Office), p. 97.
[74] Lupfer, T. T., *The Dynamics of Doctrine: The Changes in German Tactical Doctrine During the First World War*, Leavenworth Papers No. 4 (US Army Command and General Staff College, Fort Leavenworth, Ks., 1981).
[75] The best presentation of the OMG concept is Donnelly, C. N., 'The Soviet operational manoeuvre group—a new challenge for NATO', *International Defense Review*, Vol. 15, No. 9, 1982, pp. 1177–85. Some authors claim that Soviet forces in the GDR and Czechoslovakia are already prepared for OMG missions; see Dick, C. J., 'Soviet operational manoeuvre groups —a closer look', *International Defense Review*, Vol. 16, No. 6, 1983, pp. 769–76; Urban, M. L., 'Central group of forces', *Armed Forces*, September 1983, pp. 333–37. Others maintain that it is only a desirable option; see e.g. Lippert, G., 'Die "operativen Manövergruppen" der Sowjetarmee—eine neue Herausforderung für die NATO?', *Soldat und Technik*, Vol. 26, No. 11, November 1983, pp. 596–602; and, above all, that it should be considered in its broader context, cf. Hines, J. G. & Peterson, P. A., 'The Warsaw Pact strategic offensive—the OMG in context', *International Defense Review*, Vol. 16, No. 10, 1983, pp. 1391–95.
[76] US Congress (note 50).
[77] Rogers (note 51), p. 18.
[78] A Rand study on WTO rear area activities shows that daylight target opportunities in the first 30 km beyond FEBA could outnumber all those—day and night—at greater depth. Wise, R. A. *et al.*, *A Model of Vehicle Activity in the Warsaw Pact Tactical Rear During A Conventional Attack Against NATO*, N-1495-AF (The Rand Corporation, Santa Monica, Calif., 1980).
[79] *Atlantic News*, No. 1437, 7 July 1982, p. 2.
[80] See chapter 3.
[81] Rogers (note 55).
[82] ESECS (note 1), p. 35.
[83] International Institute for Strategic Studies, 'Defence and Consensus: The Domestic Aspects of Western Security', Parts 1–3, *Adelphi Papers*, Nos. 182–184 (IISS, London, 1983); see also appendix A.
[84] Rogers, B. W., Statement to the standing committees for foreign affairs and defence of the Second Chamber, The Netherlands Parliament, The Hague, 13 January 1983 (mimeo).
[85] Epstein, J. M., 'On conventional deterrence in Europe: questions of Soviet confidence', *Orbis*, Vol. 26, No. 1, spring 1982, pp. 71–86.
[86] Blackaby, F., Goldblat, J. and Lodgaard, S. (eds), *No-First-Use*, SIPRI (Taylor & Francis, London, 1984).
[87] Rogers, B. W., 'Greater flexibility for NATO's flexible response', *Strategic Review*, Vol. 11, No. 2, spring 1983, pp. 11–19.
[88] Nunn, S., *NATO: Can the Alliance Be Saved?* Report to the Senate Armed Services Committee (US Government Printing Office, Washington, D.C., 1982).
[89] US Congress, *Congressional Record*, Senate CR S15584, 7 November 1983.
[90] Doughty, R. A., *The Evolution of US Army Tactical Doctrine, 1946–76*, Leavenworth Papers No. 1 (US Army Command and General Staff College, Fort Leavenworth, Ks., 1979).

[91] However, 'blurring' the distinction from the other direction by making less destructive and more selective 'mini-nukes' (less than 1 kt) or warheads with special 'tailored' effects, could indeed lower the threshold by decreasing the inhibitions against their employment. This is one of the arguments behind the increased deterrent effects attributed to the neutron bomb, with its enhanced radiation/reduced blast effects. Will the threshold on the WTO side then not be correspondingly lowered, as they see decreasing chances of conventional victory? The near certainty of NATO retaliation and eventual escalation to the strategic level will remain; in effect, one may say that the 'conventional war threshold' is raised.

[92] Wit, J. S., 'Deep Strike, NATO's new defense concept and its implications for arms control', *Arms Control Today*, Vol. 13, No. 10, November 1983.

[93] Lodgaard, S., in SIPRI, *World Armaments and Disarmament, SIPRI Yearbook 1983* (Taylor & Francis, London, 1983), p. 4.

[94] Lodgaard, S. and Thee, M. (eds), *Nuclear Disengagement in Europe*, SIPRI (Taylor & Francis, London, 1983); for the historical background see Paper 1 of their book, by M. Saeter, 'Nuclear disengagement efforts 1955–80: politics of *status quo* or political change?' pp. 53–69.

[95] Lodgaard, S. and Berg, P., 'Disengagement and nuclear weapon-free zones: raising the nuclear threshold', Paper 5 in *Nuclear Disengagement in Europe* (note 94), pp. 101–14.

9. Chemical and biological warfare: developments in 1983

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Superscript numbers refer to the list of notes and square-bracketed numbers, thus [1], *refer to the list of references in the bibliography at the end of the chapter.*

I. Introduction and summary

This chapter records developments in the field of chemical and biological warfare (CBW) since the review published in *SIPRI Yearbook 1982* [164] and its update in *SIPRI Yearbook 1983* [166]. It concentrates on developments bearing directly upon the prospects for effective CBW disarmament. The perspective continues to be that of a Western observer.

At the time of writing (December 1983), chemical weapons have gained a new prominence from the apparent breakdown of the nuclear weapon talks in Geneva (START and INF) and the force reduction talks in Vienna (MBFR), for they are now the subject of the only intergovernmental arms negotiations involving both superpowers for which a definite date of recommencement has been set. The CW talks are taking place within the CD/CW—the *Ad Hoc* Working Group on Chemical Weapons of the multilateral Committee on Disarmament (CD) in Geneva—which reconvenes on 16 January 1984. It may turn out that the present confrontational attitudes of the superpowers will damage the CD, too, when it reconvenes, as the Conference on Disarmament, on 7 February 1984. In that event, even if the CD/CW is remandated for the year, it may prove a largely empty shell. But there are several factors, including the US Presidential and Congressional elections, militating against this, so that the substantial achievements of the CD/CW during 1983 may still begin to bear some fruit in 1984.

It cannot be said that CW is the most pressing of the security problems currently confronting the international community, yet the manner in which it is finally brought under control could have major implications for arms control in more important areas. The objective that has formally been accepted in the CW talks is not a mere ceiling or set of limitations but comprehensive disarmament, with all that would imply for the relative status of brute military power as determinant of national security. Further, the peculiarities of CW technology, and of the industrial base which provides it, require verification and other confidence-building measures of an exceptionally innovative kind if the chemical weapons convention that is being sought is to have lasting security value. Should that goal be achieved, obstacles to worthwhile agreement on nuclear and even conventional armaments would be diminished, and the prospects for constraining the overall arms race correspondingly enhanced.

The chief developments bearing upon CBW arms control during 1983 may be reviewed under three main headings: the progress made in the CD towards CW disarmament, concurrent moves in the field of CW armament and rearmament, and the reports alleging violations of the existing CBW arms control agreements.

Developments within the CD are reviewed in chapter 17. Here in summary are the main points. In February 1983 the Vice-President of the United States informed the CD that the USA "would like to see ... negotiations undertaken on a treaty" banning chemical weapons [51], and six days later the US delegation submitted a long paper setting out its views on what exactly such a treaty should provide [94]. The Administration of President Reagan had thus, for the first time, disclosed in detail its attitudes towards CW arms control. These attitudes did not differ in any major degree from those of the previous Administration. The CD already had before it the Soviet 'Basic Provisions' of June 1982 [36], a similar though less detailed outline-treaty paper which envisaged, for the first time in any specific Soviet disarmament proposal since the days of the League of Nations, some application of *systematic* international on-site inspection. What had thus at last taken shape within the CD were outer bounds within which a potentially worthwhile compromise might be negotiated. The gap between the US Detailed Views and the Soviet Basic Provisions was not small, but, although the USSR continued to attract criticism from Western and non-aligned countries for withholding clarification of key features of its position, the concessions it had made by the end of the summer session of the CD had slightly narrowed the gap. However, neither the USSR nor its closest Warsaw Treaty Organization (WTO) allies accepted the invitation extended by the USA [95] to CD members to visit, in November 1983, the CW stockpile location in Utah at which a demilitarization facility for CW agents and munitions was to be displayed [211] for the purposes of a workshop on the verification of CW stockpile destruction. Prominent in the background to the CD's proceedings was the drive by the US Administration to modernize US CW capabilities, most evident in the unprecedented intensity with which the White House was again seeking to persuade the Congress to fund procurement of new nerve-gas munitions. The high point of the CD's work in 1983 came with the adoption of a report from the CD/CW setting out clearly the state of both agreement and disagreement on more than 100 of the subordinate issues on which consensus must be reached before the projected chemical weapons convention can be concluded. This document [1] displays the full magnitude of the task ahead, but it also provides both a constructive framework and a new degree of obligation upon the participating states for proceeding with that task.

Developments during 1983 under the other two headings, armament and use-allegations, are reviewed in this chapter. With regard to armament they were marked by two contradictory actions of the US Congress. The first, coming immediately after the September 1983 shooting down of the jumbo jet on Korean Air Lines flight 007, was legislation authorizing full-scale production of binary nerve-gas munitions. The second, six weeks later, was legislation expressly denying funding for that purpose during the 1984 fiscal year. As to armament developments in other countries, the USSR continued to maintain its silence on its own programmes. So did France. Information purporting to describe Soviet programmes was, however, released in new detail by the US Defense Department. Reports that certain countries outside the main superpower alliances are now arming with CBW weapons acquired, in some cases, new credibility during the year, but no definite substantiation. Iraq must now be added to the list of alleged possessor states [166a].

With regard to allegations of use of CBW weapons, there were further developments concerning the Yellow Rain and related reports, none of which make it easier, however, for objective observers to judge whether toxic weapons really have or have not been used in Afghanistan and South-East Asia on the scale portrayed by the US government. What has become clearer is that most—maybe all—of the publicly disclosed evidence pointing to use of toxic weapons in Laos and Kampuchea does not in fact exclude the possibility of natural causation for the reported death and disease. Meanwhile, the Group of Consultant Experts convened by the UN Secretary-General in accordance with a resolution of the 37th General Assembly has made an interim report on the types of machinery and procedure that should be available if there are any further allegations of toxic-weapon employment. In December 1983 just such a complaint was lodged with the Secretary-General by Iran against Iraq.

In the final part of this chapter there is a bibliography which serves both to identify the documentation cited in the preceding parts and to record noteworthy publications during the year that addressed CBW matters less directly relevant to the current negotiations. Among these are publications having to do with protection against CBW attack [33, 34, 129, 135b, 143, 151, 171, 187]. This is an area of the CBW field which, in terms of expenditure, technical change and evolving military doctrine, has displayed much development during 1983. This is unlikely to abate in the near future, and with both superpowers and their allies continuing to invest heavily in the anti-chemical protection of their forces[1] the trend is likely to extend, as is beginning already [135a], to regions outside the area of the immediate superpower confrontation. Both danger and benefit may be seen in this: danger, in that acquisition of a full array of anti-chemical protection may also substantially reduce the lead time to acquisition of offensive CW capability; benefit, in that even a modest anti-chemical protective stance can reduce the military attractions of chemical weapons that might be directed against it. For this latter reason, it may be judged important that the projected chemical weapons convention should not constrain anti-chemical protection, for, if it were to do so, that could both increase incentives to violate the treaty and make states less inclined to accept whatever risks might be inherent in a verification system that was less than a perfect guarantor of full compliance, a system which would in any case be unattainable.

The other topics addressed only in the bibliography are: biological warfare [47, 81, 158, 193], including the matter of the Sverdlovsk anthrax [83, 167, 183]; the herbicide operations, and their aftermath, of the Viet Nam War [70, 121, 138, 191]; other aspects of CW history [180]; and the increasing attention paid during 1983 to the idea of regional approaches to CW disarmament [189], including ideas for and against a European chemical weapon-free zone [5, 6, 7, 20, 23, 26, 30, 31, 93, 149, 152, 168].

II. Developments in the field of CW armament

Recent information about the CW armament programmes of NATO and the WTO is reviewed here. As usual most of the available information is from and about the United States. The USSR continues to disclose nothing at all about its offensive CW capabilities. What is known of them comes mainly from Western foreign-intelligence machinery by way of publicists, its credibility being coloured accordingly.

The United States and other NATO countries

Events during 1983 were dominated by the progress of the US Administration's programme to modernize its CW forces with the new binary nerve-gas munitions. In 1982 the Congress[2] had declined to allow transition of the binary programme into full-scale production, but without prejudice to reconsideration of the matter during 1983 [166].

The Joint Chiefs of Staff made their position plain at the outset of the year:

> The present limited stockpile of chemical munitions for offensive employment is inadequate to deny the Warsaw Pact a significant military advantage from chemical use. —NATO weapons will not force Warsaw Pact forces to adopt the same restrictive

protective stance imposed by the Warsaw Pact chemical threat. Major improvements in CW protective and retaliatory capabilities are imperative if NATO is to have an effective CW deterrent. [55]

The Secretary of Defense made himself equally plain:

Improvement of the US chemical deterrent posture is essential both to eliminate the Soviet Union's current incentive to use chemical weapons and to provide an incentive for them to negotiate seriously a comprehensive, verifiable chemical weapons ban. . . . The Soviet Union has made massive investments in chemical warfare capabilities. The current extreme imbalance in capabilities between us and the Soviets could have catastrophic consequences. [56]

The Defense Secretary's new five-year defence-planning goals that were promulgated in March 1983 [58] stated that "the JCS-established US-only requirements for 155-mm GB2 projectiles and the Bigeye bomb" were to be procured by October 1989.

As to the likelihood of the "chemical weapons ban" being agreed internationally, however, the view of the Administration was that this was "not a real possibility for the foreseeable future" [53]. It was, nevertheless, as a 'bargaining chip' first and foremost that the Administration presented the binary programme to the Congress. The US representative at the Geneva CW talks was on hand in Washington during critical floor-votes in the Senate [106a] to explain why prosecution of the programme was important to his negotiations, and otherwise involved himself in the lobbying [91, 92].

The NATO Supreme Commander (SACEUR) was also conspicuous in his public support of the programme [74, 75]. During the previous year he had told the Senate that "it is more important to me to have the modern adequate chemical capability to retaliate than the neutron weapon" [72]. It is not clear how widely his views are shared by the military leaders of other member states. Their views are presumably now in a state of flux as NATO moves uneasily towards a 'deep strike' concept for the defence of its region, as in the Supreme Commander's own 'follow-on force attack' concept. Such concepts include a role for long-range chemical weapons; and the Bigeye VX2 spraybomb was repeatedly labelled a 'deep strike' weapon in 1983 Congressional testimony [e.g. 62, 63]. During 1982 SACEUR told the Congress that there had been no "formal agreement by the senior levels of NATO" but that "unofficially" the US decision to move ahead with binaries had been "supported" [73]. The question of deploying additional chemical weapons in NATO Europe is being studied by an executive working group of the NATO Military Committee, according to a Congressional report released in March 1983 [103] which also said that the question was "likely to be considered by NATO political authorities after the INF issue has been resolved". As

Table 9.1. Status of US facilities for full-scale production of binary munitions, as of 1983

Production facility: Product	Production facility: Location	Year funded (fiscal year)	Production-ready date[a]
Facilities for the 155-mm GB2 howitzer projectile, M687 (target:[b] 500 000 rounds, by end-1987)			
Component metal parts	Louisiana Army Ammunition Plant	1982 (PAA)	Jun 1984
M21 canisters filled with OPA reactant[c]	Not yet decided (presumably a commercial facility)	Not yet funded	Later than Oct 1984[d]
Dichlor feedstock, to supplement the existing stockpile	To be decided in Mar 1984[e]	Not yet funded[f]	*Sep 1985*[g]
DF precursor, from dichlor feedstock M20 canisters filled with DF precursor Loaded, assembled and packed M687 projectiles	Integrated Binary Production Facility (IBPF), Pine Bluff Arsenal, Arkansas	1981 (MCA) 1982 (PAA)	Feb 1985
Facilities for the 500-lb VX2 spraybomb, BLU-80/B Bigeye (target:[b] 40 000 rounds, by end-1989)			
Component metal parts	The Marquardt Company, Van Nuys, California (initially)	Apparently not yet funded[h]	*1986*
Ballonets filled with NE reactant[i]	Not yet decided (presumably a commercial facility)	Not yet funded	No information
QL precursor, to supplement the existing stockpile	To be decided in Jan 1984[j]	Not yet funded[k]	*Jan 1986*
QL-filled, closed and packed Bigeye spraybombs	IBPF, Pine Bluff Arsenal, Arkansas[l]	Not yet funded[m]	*Jun 1986*
Facilities for follow-on IVA2 binary munitions (for MLRS, JTACMS, GLCM, etc.)			
All these munitions are still in the concept-formulation stage of development, so production before 1989 appears improbable.			

Source: Unless indicated otherwise in the notes below, Defense Department testimony to the House Defense Appropriations Subcommittee during and after the 'Chemical Warfare Programs' hearing on 12 April 1983 [67].

Conventions: MCA and PAA for, respectively, 'Military Construction, Army' and 'Procurement of Ammunition, Army', these being different budget headings. MLRS, Multiple Launch Rocket System. JTACMS, Joint Tactical Missile System. GLCM, Ground-Launched Cruise Missile.

[a] The dates given in italics in this column are from the schedules current when the fiscal year 1984 budget was submitted to the Congress. Now that the Congress has denied most of the binary appropriations sought in the budget, the schedules are being revised. In the case of the dichlor production facility, the Defense Department has predicted "at least a full year's slippage".

[b] Target as of February 1983 [57], the completion dates being set by the Defense Secretary's *Fiscal Year 1985–89 Defense Guidance* [58]. The actual numbers of rounds sought are classified, the figures given here being estimates from the best available unclassified information [165]. These estimates are thought to correspond quite closely to the requirements approved by the Joint Chiefs of Staff for US forces only [57]. NATO as a whole has yet to specify its requirements, if any, for binary munitions [73].

[c] The binary-reactant formulation coded OPA comprises 72 per cent isopropanol (IP) with 28 per cent of isopropylamine (KZ) as reaction promoter [80]. The DF precursor incorporates a stabilizer [79], apparently about 2 per cent of NN′-diisopropylcarbodiimide [78]; the same also seems to be the case for QL, the precursor used in Bigeye.

[d] Having regard to the requirement that they be fabricated from Marlex, an 18-month lead time was forecast for OPA-filled M21 canisters in April 1983.

[e] The three principal options currently under study are: (*a*) Muscle Shoals Phosphate Development Works, Tennessee Valley Authority, by refurbishing and modernizing the dichlor plant that had been built there by the Army during the 1950s to support GB production, last modernized in 1964; (*b*) Newport Army Ammunition Plant (NAAP), Indiana, by adaptation of the SW production line that forms part of the stand-by VX production facility there, last operated in 1968; and (*c*) a commercial facility using government-purchased equipment.

[f] Funding was sought in the fiscal year 1984 appropriations, but was denied by the Congress in November 1983. Such an appropriation became necessary in 1982 when potential commercial sources that the Army had hitherto been relying upon indicated that they could supply dichlor only if they received facilitation funds.

[g] Provided the dichlor production facility were established at Muscle Shoals (see note *e* above). Establishment at NAAP would delay production readiness until March 1986.

[h] Funding was sought in the fiscal year 1983 appropriations but was denied by the Congress in August 1982. It was sought again in the fiscal year 1984 budget as amended [106], but the request was apparently either withdrawn by the Administration (possibly in favour of a reprogramming action) or subsumed within the Congressional denying actions of November 1983.

[i] Binary reactant NE is powdered rhombic sulphur [80].

[j] The three principal options currently under study are: (*a*) IBPF, Pine Bluff Arsenal; (*b*) NAAP, by modernization of the QL production line that forms part of the stand-by VX production facility there; and (*c*) a commercial facility using government-purchased equipment.

[k] Funding was sought in the fiscal year 1984 appropriations, but was denied by the Congress in November 1983.

[l] But if QL is to be produced at NAAP (see note *j* above), the QL-fill and Bigeye-LAP operations might also be facilitated there.

[m] Less than half of the MCA funding that had been sought in the fiscal year 1983 appropriations was approved by the Congress—funding sufficient only for the construction of a hazardous-waste landfill and clean-up of a chemically contaminated area in the vicinity of the projected Bigeye building site. In February 1983 the Army was planning to submit a fiscal year 1983 reprogramming request to make up the shortfall in MCA funding [76]. Facilitation (PAA) funding was sought in the fiscal year 1984 appropriations, but was denied by the Congress in November 1983.

M 2

far as US binary munitions are concerned, no such additional deployment will become possible until well after February 1985 and probably not before 1987 (see table 9.1).

With regard to opinion in FR Germany, the defence White Paper published in October 1983 stated that it is "indispensable for NATO ... to maintain a capacity for reprisals, albeit limited in size, in order to deter any aggressor from using chemical weapons" [22]. Although neither this statement nor earlier ones by the Kohl Administration [e.g., 18] suggest that FR Germany would welcome an expansion of the US chemical-weapon depots to which it is host, they are less overtly negative in their tone than those of the previous Administration.

In Britain, as in FR Germany, the administration continued during 1983 to emphasize its view of the importance of CW arms control and to contribute actively to the negotiations. Only towards the end of the year did the possibility resurface[3] of British CW armament—abandoned in 1955 with the closure of the mustard-gas bomb-filling line then in production at Runcorn [182] and subsequent disposal of the militarily significant stockpiles of these and other chemical munitions—with what appears to have been the release of a trial balloon at a non-attributable Defence Ministry press briefing [227]. Rumours of US chemical-weapon depots in the UK remain unsubstantiated, though from Moscow Tass again asserted their existence, asserting the same for Italy too [43].

The French government maintained its silence on its CW armament programme. In August 1982 it disclosed a demilitarization operation that had been conducted during the 1950s on a stockpile of phosgene shell at the Defence Ministry plant at Pont-de-Claix, near Grenoble [17].

Meanwhile, in the United States, procurement of binary munitions had joined the MX missile and the B-1 bomber as the three defence issues most hotly contested by the Administration in the Congress during 1983 [e.g., 218, 245]. The Yellow Rain matter (reviewed later in this chapter) was prominent in the advocacy of binaries [136, 173]. The General Accounting Office provided Congressional committees with three reports [117, 118, 119], the first and longest of which was critical of the Administration's CW programme to date. In September the White House finally gained the authorization needed to commence full-scale binary production, but it later failed to get appropriations to effect this during fiscal year 1984. The twists and turns of Congressional actions during the year, confusing to foreign onlookers, are summarized in table 9.2 below; and a good analysis has been published [140]. Some commentators have claimed to see a correlation between these different actions and inflexions in Soviet CW negotiating behaviour in Geneva. The shooting down of Korean Air Lines flight 007 in September undoubtedly promoted the House decision in favour of authorization [196, 200, 219, 246].

Table 9.2. Actions of the US Congress during 1983 on the Administration's fiscal year 1984 requests to support procurement of binary munitions

	Committee-stage action		
Chamber	Subcommittee	Full committee	Floor action
Legislation to authorize the programme			
House of Representatives	..	..	*15 Jun:* Votes 256–161 against
Senate	*7 Apr:* Warner Committee hearings	*28 Jun:* Armed Services Committee reports in favour	*13 Jul:* Tied vote, then presidential casting vote in favour
House-Senate Conference	*4 Aug:* Reports in favour, with Senate's one-for-one freeze proviso and its other provisos that no binary munitions be assembled prior to 1 Oct 85 and only upon Presidential certification thereafter		*13 Sep:* Senate accepts the Conference position *15 Sep:* House accepts the Conference position
Legislation to fund the programme			
House of Representatives	*12 Apr:* Defense Subcommittee hearings *20 Sep:* Reports in favour of halved programme	*20 Oct:* Committee on Appropriations votes 28–22 against	*2 Nov:* In effect votes against *15 Nov:* Votes 258–165 to instruct its conferees to reject Senate position
Senate	*6 Oct:* Defers decision to full committee	*31 Oct:* Committee on Appropriations votes 14–12 against	*8 Nov:* Tied vote, then presidential casting vote in favour but with a one-for-two build-down proviso, no assembly prior to 1 Oct 85, and presidential certification thereafter
House-Senate Conference	*17 Nov:* Reports against		Both Chambers subsequently accept the conference rejection

Source: Newspaper reports.

It will be seen from the summary given in table 9.1 of the state of the programme at the beginning of 1983 that the chief immediate effect of the Congressional actions will probably be to delay construction of plant needed to produce chemical feedstock for one of the reactants used in the binary artillery round. It will also delay construction of Bigeye-related plant, but what in September was reported to be an 18-month delay [203] had anyway been imposed by a design defect in Bigeye encountered in October 1982 [82, 112, 200, 202, 243, 244]. Neither binary R&D nor construction of the artillery-round assembly plant will be affected. It is reasonable to assume that the budget for fiscal year 1985, which the President will submit to the Congress early in 1984, will request the denied appropriations. But it may perhaps also be assumed that the issue will be less strongly fought in 1984. Pro-binary votes cast during 1983 have already become a liability in the election campaigns of some Presidential candidates [218, 220].

Public debate on the matter of the adequacy of the existing US stockpile of chemical weapons will no doubt be rejoined. But since there can be no objective test, short of war itself, of the size and composition of the retaliatory stockpile that is actually capable of deterring adversary resort to CW—if, indeed, any such stockpile is capable of doing so—opinions are bound to remain divided. The US Army apparently believes that an artillery-munitions stockpile providing less than one chemical round per six conventional rounds would be inadequate [244]. Regarding the existing stockpile of non-binary 155-mm and 8-inch artillery nerve-gas shells, the Defense Department told the Senate in February 1983 that "the quantity is in the range of sufficiency (at least for US forces) and actually is higher than the planned acquisition quantity for the binary projectile" [66], later repeating this to the House [57]; binary replacement was needed chiefly to counter age and deterioration. Yet in March the interim report of the Defense Secretary's Blue Ribbon Panel on Chemical Stockpile Status recorded the panel's agreement that the "military utility of 155 mm and 8-inch munitions in stockpile has not been seriously degraded to date".[4] A greater focus on long-range chemical weapons can perhaps be expected in the 1984 public debate of stockpile adequacy: would acquisition of Bigeye in fact add significantly to whatever deterrence is already provided by the existing supply of 'deep strike' chemical weapons—comprising, as it does, 1 000-odd reusable aircraft spraytanks for VX and 10 000-odd sarin-filled aircraft bombs, all of them reportedly serviceable?

The present state of the US programme for incapacitating chemical weapons is obscure. All existing stocks of agent BZ and BZ-filled munitions are due to be destroyed during 1986–88 at a facility currently being designed at Pine Bluff Arsenal [76]. In 1981, Army R&D planning and

Table 9.3. Some prominent glycollate incapacitating agents

	Chemical structure, $R^1O.CO.C(OH)R^2R^3$		
US Army symbol	R^1	R^2	R^3
EA 2277 (BZ)	3-quinuclidinyl	phenyl	phenyl
EA 3580	N-methyl-4-piperidyl	phenyl	cyclobutyl
EA 3834[a]	N-methyl-4-piperidyl	phenyl	isopropyl
CAR 302 196	N-methyl-4-piperidyl	1-propynyl	cyclopentyl
EA 5302	(33% wt solution of EA 3834B in EA 4923)[b]		

[a] In the early 1970s it was this candidate agent that was accepted for weaponization as a replacement for BZ. Its median incapacitating airborne dosage (ICt50) for inhalation by man is quoted as 73 mg-min/m³ (as against 112 mg-min/m³ for BZ) [69], and in solution it can display a strong percutaneous activity.

[b] EA 4923, a substituted cycloheptatriene, is a volatile liquid irritant agent having an ICt50 in man some four times greater than that of CS.

programming guidance had envisaged a wide range of new munitions to take their place, warheads for the Multiple Launch Rocket System (MLRS) and cruise missiles among them, becoming ready for full-scale development soon after 1988. Yet in the 1984 budget request no funding was explicitly sought. The chemical identities of all those candidate incapacitating agents that have been tested on human volunteers have recently been declassified. Those of the currently leading candidates to replace BZ, all being also psychotropic glycollates, are listed in table 9.3, this being a matter of some relevance in the CD's present quest for an adequate definition of agent 'precursors'.

The Soviet Union and other WTO countries

In April and June, articles published in the Red Army newspaper about an apparent scandal within the Chemical Troops [38] suggested that leadership changes were imminent within the Soviet CW administration. Other than that, official Soviet and WTO publications indicated little during 1983 about developments in CW posture, and nothing at all about Soviet and WTO CW armament.

In contrast, official US sources during 1983 disclosed rather more of Western intelligence on such matters than they had done previously, evidently moving to redress the impression created by Defense Department testimony to the Congress during 1982 that there were major gaps in that intelligence [166]. This will undoubtedly stimulate publicists to add yet more to the sensationalist (often absurdly so [e.g., 142]) literature on the subject. A Pentagon critique of the first of the 1983 Comptroller-General reports on CW, a critique that was made available to members of Congress in June at the time of the first major floor-vote on the binary programme, included the following:

> In fact we know a great deal including . . .: The location of Soviet chemical and biological agent production facilities. The location and level and types of activity at the Soviet chemical proving ground. The location of chemical weapon storage depots in the USSR and the fact that stocks have increased since 1969. The USSR has chemical weapons deployed with tactical units. The types of agents in the Soviet stockpile, the types of chemical weapons, which agents are in which weapon types, and their weapon effects and employment data. Their employment doctrine, including the types of targets they intend to attack with chemical weapons.

Such specificity of knowledge may be reassuring to those who see intractable problems in verifying CW disarmament. In October the Defense Department published a booklet addressing each of these topics in greater detail [202] (though with no less lack of candour), illustrated with artists' impressions of Soviet CW installations [68]. It told of new test facilities at the Shikhany proving ground having been constructed since the late

1970s; of a test of munitions conducted there in early 1980; of increases in the volume of matériel stored at various CW depot locations across the USSR; and of a captured German World War II nerve-gas factory located within the Volgograd Chemical Combine. A further novelty in the booklet was its listing of specifically weapon-related tasks among the "primary responsibilities" of the Chemical Troops, such as: "advisors to the front commanders for chemical weapons and tactics for their use"; "research and development programs for weapons"; "production and storage of chemical weapons"; and "training of all forces for chemical employment". The booklet's preface, signed by the senior Defense Department official having direct CW responsibilities, stated what in earlier years had been asserted in public only by less authoritative spokesmen: "The Soviet Union continues to test, produce and stockpile chemical weapons. . . . The continued testing of chemical weapons at expanding test facilities, enlarged storage capacity for chemical agents and weapons, and the existence of active production facilities are among the indicators of unabated Soviet chemical weapons activities" [60].

The booklet did not, however, address the particular matters on which ignorance had been acknowledged during 1982 [166]. Thus, no estimate was given of total stockpile size, beyond the implication that it was very large; those estimates which have been developed within the US defence and intelligence community, the upper bounds of which range between 30 000 and 700 000 tons of CW agent, evidently remain highly tentative and unsubstantiated by hard information [130]. Again, on the matter of stocks of Soviet chemical weapons forward-deployed in eastern Europe, the booklet spoke only of depots inside the USSR. In September, the NATO Supreme Commander declined to confirm a view dating from 1981 that "19 or 23 Soviet offensive chemical sites . . . had been moved forward", stating only: "We do know that they have chemical storage sites built in forward areas . . . which we believe contain chemical weapons" [75]. West German officials had in 1982 spoken of "substantial stockpiles of Soviet chemical weapons on the territory of East European States and the German Democratic Republic" [19], including "hardened" silos for chemical weapons in the German Democratic Republic [21].

The GDR continued to publish extensively on matters of anti-chemical protection and CW disarmament [e.g., 27, 28]. In July, the occasion of the 30th anniversary of the Army Chemical Service was marked by publications on its history [25] and, by its commanding officer, on its functions [24].

III. Allegations of CBW

Published reports of CBW during 1983

There were reports of toxic weapons being used during 1983 in Kampuchea [13, 90, 185, 198, 204, 231, 238], Laos [131, 237] and the Iranian border area of northern Iraq [32, 160, 207, 229]. There were repetitions of the allegations of earlier years that toxic weapons had been used in Eritrea [163] and Afghanistan [141, 144, 150, 206], but instances during 1983 were not cited in the publications under review here. There were published dispatches from particular *mujahideen* areas of Afghanistan during 1983 which specifically reported the absence of toxic-warfare indications [e.g., 154]. The reported CBW incidents in South-East Asia—collectively referred to here as the 'Yellow Rain' allegations—were less numerous than previously. It was reported in June, with attribution to senior US government officials, that US intelligence agencies had "begun a major study to determine whether the apparent lull is real and what its significance might be" [217]. Since then, however, an increase in Yellow Rain episodes has been reported [248].

Both unofficial and governmental—Chinese [13] and US [90]—agencies propagated the reports relating to Kampuchea, attributing them to Thai military sources [198, 231], US officials [238] or Kampuchean "rebels" [204] and refugees [90, 185]. The incidents were said to have occurred during January [204, 231], February [185, 238], March [13, 90] and June [198]. The information on the Laotian incidents, said to have occurred in April [237], May [131] and June [131], came from H'Mong refugees in Thailand.

The Gulf War allegations emanated from Iranian government agencies and told of Iraqi use of artillery- and air-delivered blister agents in Kurdistan during August, October and November. Tehran supported its charges against Iraq with medical testimony, and provided facilities for foreign journalists and doctors to examine purported victims. It requested an investigation by the United Nations [230].

Public positions of governments on the allegations

It is too soon to record the public positions of governments on the new Gulf War CW allegations, which are being prosecuted by Iran much more vigorously than its allegations of 1980–82, this time expressly implicating the USSR or France as supplier of the chemical weapons [160]. The Iraqi government is said to be resisting UN investigation [230].

The Ethiopian government has formally denied charges of chemical warfare in Eritrea [14, 15].

The Soviet government has continued to reject in the strongest terms the Afghanistan and Yellow Rain allegations [e.g., 42]. In February it issued a detailed critique [35] of the Shultz Report, in which the US government had further detailed and publicized its charges [166]. In March *Pravda* accused the CIA of having planted faked Yellow Rain evidence inside Laos [41], and *Trud* quoted a report of US agents having equipped an Afghan rebel group with "poison gas grenades" [126].

The US government continued to cite Yellow Rain evidence throughout 1983 in charging the USSR with violating international conventional and customary law proscribing CBW, though still without bringing the matter before the UN Security Council. Public statements of accusation came from all quarters of the US leadership, from the President [48, 49, 50], Vice President [51] and Joint Chiefs of Staff [55] downwards, and from the Congress[5] [e.g., 107 and 108] no less than the Administration. In May the US Information Agency disseminated from its many outlets around the world an illustrated brochure detailing the charges [96] and purchased advertising space in the newspapers of countries such as Bangladesh and Singapore for the same purpose [212]. The prevailing perception in Washington was summarized as follows by Under-Secretary of State Lawrence Eagleburger: "On the basis of thousands of pieces of mutually corroborative evidence, the United States has concluded that chemical and toxin weapons are being used by the Soviets, the Vietnamese and the Lao against innocent men, women and children in Afghanistan, Kampuchea and Laos" [84]. In August the US government issued a new report [90] supplementing the evidence adduced in the 1982 Haig and Shultz Reports. It summarized the results of new analyses for the trichothecene mycotoxins which Washington believes have been used as CBW agents alongside other poisons as yet unidentified. The analyses had been performed on blood samples that had been drawn from purported victims of toxic agent attacks during November 1981, January 1982 and February 1982 in Laos and during March 1983 in Kampuchea. The report itemized positive findings for T2 mycotoxin and its metabolite HT2. In unofficial publications during the year new details emerged about the origins of the belief in mycotoxin involvement [123, 137]. At the end of the year it was being said that a further summary of the evidence had been prepared by the Administration for release early in 1984 as part of a study of possible Soviet violations of arms control agreements [249]. The Administration, in contrast to some sectors of US opinion, did not take the view that the Yellow Rain had killed arms control. As Under-Secretary Eagleburger put it: "We would contend that the Soviet actions lead to a different conclusion—real, equitable and fully verifiable arms control is an absolute necessity. It is not that arms control is pointless; it is that we have to do a better job of it" [83].

The Canadian government, which had issued four reports during 1982 generally supportive of the US position although contradictory on points of detail [172], in March issued a dismissive assessment of the Soviet critique [11]. It is said to have a further report in preparation for public release. The results of its analyses for trichothecenes of the many environmental and biomedical samples obtained from South-East Asia by Canadian investigators have yet to be disclosed publicly.

The French government did not, after all, issue the report expected during the spring, but in March the Foreign Minister said at a press conference in Bangkok: "We have no final proof that chemical armament has been used but the signs are multiple and converging. Therefore, although we French cannot prove that chemical arms had been used in Afghanistan and other places, we think that we have had enough to be convinced that it has been so" [16]. An official of the French Embassy in Bangkok had been reported in January as saying that "unnatural mycotoxins" had been found in a sample collected inside Kampuchea from the site of a February 1982 attack [195], and an unidentified source had been reported as saying that the French had tested about 20 samples, finding mycotoxins in seven of them [234]. Private reports of a French mycotoxin finding later being judged a false positive due to laboratory contamination have yet to be confirmed publicly.

The British government, in October, published a paper expressing its belief that "lethal chemical weapons, probably including mycotoxins, have been used" [45]. This was a form of words that had been used in response to a parliamentary question during the previous year [44], before the government had acquired its present capacity for conducting quantitative trichothecene analyses of the requisite sensitivity. It was reported unofficially in November that the Porton Down laboratory had found no trichothecenes in any of the purported Yellow Rain samples it had examined [139].

The Australian government in March released a report from its CW defence laboratories at Maribyrnong [8] which concluded that Yellow Rain samples from Laotian refugees, obtained via the Australian Embassy in Bangkok during April 1982 [210], were "fakes". At the same time, however, the Foreign Minister stated: "It does not necessarily follow that all so-called 'yellow rain' charges have been disproved by these findings" [10]. In August a further report was issued from Maribyrnong in which it was concluded that a Yellow Rain sample examined during the interim was actually "the excrement of bees (or other pollen eating insects)" [9]. It is unofficially reported that no trichothecenes have been found in any of the purported Yellow Rain samples examined in Australia [139].

In February a subcommittee of the US Senate Foreign Relations Committee received the following testimony from a freelance journalist:

"More than a dozen nations have confirmed the evidence privately. These include Norway, Sweden, Denmark, West Germany, France, England, Israel, South Africa, Australia, China, Thailand, Singapore and New Zealand" [178]. According to another freelance journalist later, "Military specialists and government scientists in the US, Canada, Great Britain, France, West Germany, Norway, Thailand, Israel and New Zealand have confirmed the current Soviet use of chemical warfare" [173].

The inquiries of the UN Secretary-General

The investigation by the UN Secretary-General of the Yellow Rain and Afghanistan CBW reports ended with the submission of the second report by his Expert Investigating Group in November 1982 [166]. In the following month the Secretary-General received a new mandate from the General Assembly [2] which, in effect, required him to do three things. First, he was to hold himself in readiness to investigate, with the assistance of qualified experts, any new CBW-use complaints that might be lodged with him. There were no such complaints during 1983 with regard to Afghanistan or South-East Asia (or Eritrea), and it remains to be seen whether he will in fact be able to respond to the Iranian complaint. Second, he was asked to compile a roster of experts and laboratories that might assist him in any future investigations. The governments of 19 Western and non-aligned countries[6] duly made nominations for the roster. Third, he was asked to devise, with the assistance of qualified consultant experts, appropriate fact-finding procedures. He submitted to the 38th General Assembly a report [3], subsequently taken as an interim one, prepared by the Group of Consultant Experts he had convened for the purpose. The report drew from the experience of the 1981–82 Expert Investigating Group, the chairman of which was a member of the new group. Its US member has published a review of the general problems with which CBW-use fact-finding machinery must contend [133, 134]. In December the General Assembly voted to remandate the Group of Consultant Experts for 1984.

The USSR and its allies voted against the empowering General Assembly resolution in December 1982, citing legal arguments, and did not support these activities of the Secretary-General. However, in a change of position at the CD in February, the USSR supported the view that an explicit prohibition of use of chemical weapons should be subsumed within the scope of the projected chemical weapons convention [37], meaning that the verification provisions of the convention, including its fact-finding procedures, would become applicable to CW-use allegations.

Non-governmental inquiries

In different parts of the world during 1983, the involvement of non-governmental groups with the CBW-use allegations, principally the Yellow Rain ones, increased markedly.

In retrospect, this can be seen as a reaction to the increasingly apparent limitations of the available governmental machinery. Neither governmental nor intergovernmental agencies seemed capable of responding adequately to the full gravity of what was at stake. The Yellow Rain, whether its origins lay in CBW or, as seemed increasingly plausible to some, in the natural environment itself, was still producing illness and death among inhabitants of afflicted areas—unless, that is, the stories related by the refugees and by those in Thailand who were bringing them relief were to be completely discounted. And the regime of international law on which hopes had been built, especially in its arms control application, for a future of increased international co-operation and diminished confrontation likewise remained in jeopardy. With good reason, therefore, all governments that had capacity for doing so came under increasing pressure to stop whatever was happening or to concert their actions in a search for remedies: the governments of the USSR, Viet Nam and Laos, as well as their accusers and onlookers. The apparent absence of any such governmental actions stimulated activities at the non-governmental level. Those involved inevitably included organizations that had seen in the Yellow Rain an opportunity to do new battle on one or the other side of the intensifying East–West propaganda war.[7] But they also included groups in several countries, east European ones among them, that were motivated by a genuine rather than an opportunistic concern for the different casualties of the affair.

A further stimulus of non-governmental involvement came from the behaviour of the US government specifically. The great publicity which Washington had given to its belief in a CBW causation of the Yellow Rain continued to stand in apparent contrast to the limited nature of the resources committed by Washington to actual fact-finding. It seems, not least from the reporting of the US newspaper that has been far the most supportive of the CBW charges, that the bulk of the field data has been provided by a private relief agency operating in Thailand and the part-time efforts of two Bangkok Embassy officials [186, 235, 237]; and there has now been resort by the US government [213], emulating *Soldier of Fortune* magazine [179], to bounty-hunters. In June 1982 broadly based machinery for assessing and evaluating the data was created by the US Administration in the form of an inter-agency CBW/Toxin Use Working Group under the Director of Central Intelligence [54]. But it is reported that, of the agencies represented, only the Army ones have assigned significant assets to Yellow Rain (as opposed to Afghanistan) data collection. These, it became apparent from the responses of the State Department to criticism of its evidence during 1983, were insufficient.[8]

When viewed against this background, three of the various non-governmental inquiries are especially noteworthy.

First, there were the efforts that began to gather momentum during 1983 under private US leadership to conduct a systematic epidemiological survey of the Kampuchean and Laotian refugee populations in Thailand. This survey has been mounted in the belief that the Yellow Rain phenomenon is indeed the product of CBW waged with mycotoxins; it seeks to learn more about the nature of the disease afflicting the victims, its extent and therefore the medical and other countermeasures that might be instituted [157, 177, 186]. The methods used in the survey, provided they are indeed soundly based on modern epidemiological principles, should yield new data uncoloured by the underlying, and otherwise potentially debilitating, assumption of the operation.

Second, there have been private US and Australian inquiries inside Laos in which there has been some cross-checking of accounts previously given by Laotian refugees interviewed in Thailand. Data from such interviews are, it will be recalled, the foundation of the US government's charges [166]. Findings from two of these inquiries—neither of which were, in the nature of things, as comprehensive or as systematic as subsequent field investigations in Laos could be—were published during 1983. The first [132] illustrated the misperception that can result when refugees are interviewed without due regard for the controls that anthropologists and sociologists have learned to apply. From the second [128] it emerged that reports of yellow substances causing illness could indeed be heard from people inside Laos, but the substances were known only as sporadic dew-like appearances uncorrelated with aircraft overflights or military activity. Both publications recorded Laotian experiences of Yellow Rain-like happenings prior to 1975.

Third, the scientific community at large began to pay serious professional attention to the data on Yellow Rain that had been published by the US and Canadian governments. At a private conference during April in Cambridge, Massachusetts, to discuss these data, academic scientists from most of the relevant disciplines met for two days with government scientists and officials [146, 147, 148]. No conclusion other than that more data were needed was reached, but, despite the strongly polarized nature of the surrounding public debate, it seemed as though a process of constructive dialogue was now commencing that would supplement the uneasy contractor–client relationship on Yellow Rain matters already linking government to isolated parts of the scientific community. The dialogue has since been an intermittent one only, for the traditions of scientific inquiry, which place the utmost value on peer review and on disclosure of sources and methods, do not fit comfortably into the hierarchical and secretive procedures of government. The potential benefit of the dialogue stemmed from the fact that the US Administration had become institutionally committed to one particular explanation of the Yellow Rain phenomenon, so that its investigations had inevitably been skewed towards data which supported that explanation. Since true scientists seek to understand phenomena by gathering data as much to disprove as to prove hypotheses, their involvement in Yellow Rain inquiries would necessarily widen the scope of future investigations, thereby providing the governmental evaluation process with the safety net of a broadened data base. When, in May, in order to demonstrate this elementary principle of scientific method, one such theory was put forward as an example of a hypothesis which, on the data available, could not yet be disproved, it initially provoked not the constructive criticism sought but a bizarre furor of ridicule to which the State Department, despite advance notice, made its own obtuse contribution [88]. The theory in question—that a particular set of samples of what had been taken to be residues of actual Yellow Rain agent might in fact be dried excrement of bees [122, 153, 159]—is taken seriously within the scientific community [9, 209, 224], but outside it there is still bewilderment [114, 248], largely because initial commentary mistakenly reported the theory as an explanation of the entire Yellow Rain phenomenon[9] [221]. The significance of this episode of course goes beyond the question of the involvement of bees. It is rather that the possibility of a natural causation of the Yellow Rain phenomenon now appears to be receiving a degree of governmental attention which had hitherto (effectively since September 1981) been impossible.

Is Yellow Rain natural?

Ever since it first announced its conclusion that trichothecene poisons found in certain moulds were being used as CBW agents the US government has consistently rejected the proposition that the trichothecenes which one of its analysts has found in environmental samples from Laos and Kampuchea, and in blood, urine and tissue samples taken from Yellow Rain victims, could have got there by natural processes, such as the eating of mouldy food. Yet in explaining its reasons for this belief it has been compelled to retreat through a succession of arguments discredited by recorded scientific observations of which it had apparently been unaware. This, however, is not to say that the arguments to which the US government is now reduced [77] are untenable. They are no longer disprovable from the data available, and their appeal remains substantial in view of, for example, the finding of trichothecenes on the outer surface of a Soviet gas mask purchased in Kabul.

But acceptance of the arguments requires, among other things, a satisfactory explanation of how it is that the human body can for long periods retain unmetabolized T2 trichothecene. Maybe the human body really can do this; but the weight of the available evidence, including data from animal studies, is against it to the extent that substantial experimentation would be needed in order to establish the fact. However, it is also the case that a substantial body of field observations is needed from Laos and Kampuchea if natural-causation hypotheses are to be established. In short, the present situation is one in which a dearth of pertinent data allows diametrically opposed hypotheses to coexist.

The relevant arguments and counter-arguments are too technical to review in any further detail here; they are available in the literature.[10] The uncertainties which they admit stand in striking contrast to the certainty which continues to characterize the public stance of the US government. "The levels of trichothecenes detected", it informed the United Nations in August, "cannot be attributed to any known natural phenomena" [90]. "The deaths of defenceless people in Southeast Asia are simply not the result of flukes of nature", wrote Under-Secretary Eagleburger in October [85]. "This possibility has in fact been studied, and rejected, by responsible scientists who have seriously studied the question", the State Department told journalists in May [86], later that month telling them that it was preparing a report on the matter that would be ready for distribution "in the next few months" [87].

That report has yet to appear. In the meantime a group of non-governmental scientists has published the following conclusions from a close study of all the information that has yet been released on the Yellow Rain sample analyses: "These results give no statistically significant evidence that the toxins are more common at the sites of alleged attack than outside"; and, "the toxin found in refugees could have originated from exposure long after the alleged attacks" [122]. At the time of writing, these conclusions—which, it should be noted, do not exclude the possibility of a CBW causation—have yet to receive public comment from Washington.

The implications for the inhabitants of the afflicted regions of South-East Asia would gain still more alarmingly in seriousness if the Yellow Rain were ultimately found to have a natural causation. It may be hoped that the highly politicized nature of the affair will not prevent agencies such as the World Health Organization (WHO) or the Food and Agriculture Organization (FAO) from contributing to its clarification.

Notes

[1] This is illustrated by the five-year forward-expenditure planning for US CW programmes that was current in February 1983 [52]. Of the $7 123 million total programmed for fiscal years 1984–1988 inclusive, protective measures were to account for $4 948 million (69 per cent; contrast the 78 per cent quoted in the *Fiscal Year 1984 Arms Control Impact Statement* [53]), as compared with $1 524 million (21 per cent) for CW weaponry, the balance to go towards further demilitarization of old chemical weapons. Moreover, research and development were to account for 41.4 per cent of the expenditure projected for protective measures, in contrast to 14.4 per cent of the weaponry expenditure. As to Soviet expenditure on CW programmes, the US Deputy Secretary of Defense spoke to the Congress in 1982 of this having been greater than US expenditure by a factor of "at least four or five"; but subsequently, for the record of the committee concerned, his staff wrote that "after checking with the CIA, we find that they have not yet placed one overall price on the Soviet chemical warfare program" [59].

[2] The following were the principal hearings held during 1982 during which Congressional committees received testimony from the Administration on CW programmes: House Military Construction Appropriations Subcommittee, 3 March [100]; House Armed Services Military Installations Subcommittee, 5 March [102]; House Armed Services Committee, 18 March [101b]; House Defense Appropriations Subcommittee, 23 June [99]; Senate Armed Services Subcommittee on Strategic and Theater Nuclear Forces, 15 March [98c] and 22 March [98d]; and Senate Appropriations Committee, 5 and 6 May [97]. Evidence was also taken during a House Foreign Affairs Committee staff study mission to Europe at the end of the year [103].

[3] Britain is the only European NATO member state that has displayed, in public, the slightest inclination to participate actively in CW rearmament, having held in June 1980 "bilateral CW technical talks" in Washington. But the follow-on talks scheduled for February 1981 were cancelled, and subsequent contacts—such as the March 1981 meeting between the Chief Scientific Adviser of the British Defence Ministry and the Chairman of the US Defense Department's CW Steering Group—have apparently all been "informal" [65].

[4] In the Panel's subsequent report of October 1983, there were these comments on the likely condition of the stockpile in 1990:

> We have insufficient evidence, either qualitative or quantitative, to predict this with any reliability. Currently it would appear that by 1990 decomposition of the agent could be as little as an additional five percent, or so great as to render the munitions almost useless. It is our best estimate that at least 50 percent, plus or minus 10 percent, of the agent should still be present in 1990, and at least half of the 155 mm and 8-inch artillery munitions should meet the Army standards for being fully usable with respect to agent. However, it is within the range of possibility that catastrophic decomposition could occur, due to stabilizer disappearance or other factors, yet unknown. Based on available information we do not expect metallurgical degradation to be a serious problem . . . ultimately metal parts could be attacked when sufficient decomposition [of agent fill] does occur. [64]

[5] "Now there are three basic questions", said the Chairman of the Senate Foreign Relations Committee in February, "which must be resolved: How can remaining skeptics be convinced? When will chemical warfare be ended? And what is the implication for arms control of this continuing chemical warfare?" [108]

[6] Australia, Austria, Belgium, Canada, Denmark, Ecuador, Egypt, France, FR Germany, Greece, Italy (pending), Netherlands, New Zealand, Norway, Spain, Sweden, Thailand, UK and USA [4].

[7] Or, indeed, in other campaigns. Note, for example, the following advice recently offered by the National Center for Public Policy Research in Washington:

> Individuals/organizations interested in expressing sentiment against an immediate nuclear freeze can often find the chemical warfare issue to be a very useful one. This is because (1) the chemical issue points out the fact that the Soviet Union cannot be trusted to adhere to treaties and thus another treaty with them without definite on-site inspection would be folly, and (2) protesting chemical weapons is an assertive, or positive, action which puts the Soviet Union in the defensive position whereas opposing the nuclear freeze puts the individual in the defensive position. . . .

[8] In October 1983 the US Embassy in Bangkok announced that a three-man team had been formed to evaluate CW reports [194].

[9] Witness Congressman Jim Leach's ludicrous rendering: "a bee-borne plague may have spread through parts of Asia where Soviet and Soviet surrogate troops operate" [113]. That Asian bees may indeed defaecate to spatter broad areas with comparatively dense patterns of small yellowish droplets having a high pollen count is suggested by observations in China of a phenomenon which local people called "yellow rain", and which were reported in the Chinese scientific literature in 1977 [12].

[10] The main features of the scientific debate during 1983 are to be found in the publications cited in the bibliography at 122, 126, 155, 156, 170, 175, 176, 197, 209, 215, 217, 223, 224, 225 and 236. Related publications during 1982, in particular the Canadian Reports to the UN, material appended to the Haig and Shultz Reports, and the Congressional testimony and occasional papers of Dr Chester Mirocha and Dr Sharon Watson, are cited in *SIPRI Yearbook 1983* [166].

Bibliography of recent CBW publications

Listed here are the published sources of information cited in the preceding sections, together with other noteworthy publications on CBW that have appeared since the time of the review published in *SIPRI Yearbook 1983* [166]. This bibliography leans heavily towards English-language publications. Readers are cordially invited to inform the author of any omissions. For its future work, SIPRI would also greatly appreciate receiving advance notice of forthcoming publications on the subject or copies of publications it might otherwise miss.

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2. **United Nations.** 37th General Assembly. 'Provisional procedures to uphold the authority of the 1925 Geneva Protocol'. Resolution 37/98D of 13 December 1982.
3. —. 'Report of the Group of Consultant Experts established in pursuance of General Assembly resolution 37/98D'. 2 September 1983. In UN document A/38/435 of 19 October 1983 [4].
4. —. 38th General Assembly. Agenda item 61, Chemical and Bacteriological (Biological) Weapons. Report of the Secretary-General. Document A/38/435 of 19 October 1983.

5. **Warsaw Treaty Organization.** Political Consultative Committee. Declaration from Prague, 5 January 1983. In Committee on Disarmament document CD/338 of 1 February 1983.
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11. **Canada.** Permanent Mission to the United Nations. 'Assessment of the Soviet Critique (UN Document A/38/86 of 7 February 1983) as it pertains to the Schiefer Report (UN Document A/37/308 of 25 June 1982)'. Submitted to the UN Secretary-General on 18 March 1983.

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14. **Ethiopia.** Representative to the United Nations. Statement in the First Committee of the General Assembly, 9 December 1982.
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16. **France.** Minister for Foreign Relations (C. Cheysson). Statement at a press conference in Bangkok, 26 March 1983.
17. —. Delegation to the Committee on Disarmament. 'Monitoring the destruction of stocks of chemical weapons'. Document CD/316 of 19 August 1982.

18. **Federal Republic of Germany.** Foreign Ministry. Minister of State Alois Mertes, as interviewed on ARD television, 19 April 1983.
19. —. Representative to the Committee on Disarmament (H. Wegener). Statement to the Committee in plenary session, 7 September 1982. Document CD/PV.185, p. 16.
20. —. —. Statements to the Committee in plenary session, 24 February and 3 March 1983. Document CD/PV. 197, pp. 14–15 and document CD/PV.200, p. 31.
21. —. Ministry of Defence. Statement by spokesman J. Reichardt to DPA, 15 December 1982, confirming a report in *Stern* magazine [226].
22. —. —. *White Paper 1983, The Security of the Federal Republic of Germany.* October 1983.

23. **German Democratic Republic.** Politbureau of the Central Committee, and Council of Ministers. Joint statement on the results of the 4–5 January 1983 Berlin session of the Political Consultative Committee of States parties to the Warsaw Treaty. 11 January 1983.
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Addenda: The following citations are of notable publications during 1983 which became available too late for review:

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251. **USSR.** Tass Agency. Petrov, A. ['Chemical weapons and the Washington alchemists'], *Pravda*, 10 June 1983 (in Russian).

252. **USA.** Department of the Army. Strategic Studies Institute. Weinstein, J. and Cole, Lt-Col H. G., 'Chemical weapons rearmament and the security of Europe: can support be mustered?' Strategic Issues Research Memorandum ACN 83003 of 20 January 1983, 56 pp.
253. —. —. Johnson, Lt-Col D. E. 'The medic on the chemical battlefield', *Infantry*, March–April 1983, pp. 24–26.
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10. The military use of outer space

BHUPENDRA JASANI

Superscript numbers refer to the list of notes and references at the end of the chapter.

I. Introduction

During the 25 years of the space age, outer space has remained free from the deployment of any weapons of mass destruction. Militarization of the outer space environment has continued nonetheless (see tables 10.1–10.8). Earth-orbiting satellites are used by the military as integral support components of Earth-based armed forces, and weapons which can be aimed at satellites—anti-satellite (ASAT) weapons—have been introduced. From 1958 to 1983, 2 114 military-oriented satellites have been launched. This constitutes at least 75 per cent of all the satellites orbited.

The functions of military satellites range from navigation, communications, meteorology and geodesy to reconnaissance and anti-satellite activities. The main function of reconnaissance satellites (photographic, electronic and ocean-surveillance spacecraft) has been to obtain information on military targets. However, since 1972 reconnaissance spacecraft, together with early-warning satellites, have officially been recognized as an integral part of the national technical means of verification which monitor compliance with the terms of the SALT agreements. Since 1973 it has become apparent that some of these types of satellite also monitor crisis areas of the world, and both the USA and the USSR can today observe each other's military manoeuvres.

With the increasing role of spacecraft for improving the fighting efficiency of military forces on Earth and even influencing military doctrines, it is not surprising that the two superpowers have come to regard satellites as vital military targets. ASAT weapons have been developed, tested and even deployed. They range from ground- or air-based anti-satellite missiles and orbiting hunter–killer satellites to more futuristic ground- or space-based high-energy lasers. Attempts to stop the spread of the arms race to outer space were made by the USSR and the USA in bilateral negotiations in 1978 and 1979. No progress was made, but in 1981 the Soviet Union broadened the basis for negotiations by moving the discussions from a bilateral forum to a multilateral one. In August 1981 the USSR submitted to the United Nations a new draft treaty banning the placement of any kind of weapon into orbit round the Earth.[1] One of the main deficiencies of the proposal was that, while it banned the deployment of ASAT weapons in orbit, it did not ban ASAT weapons on Earth, in the atmosphere or above it.

A second Soviet draft treaty, presented to the UN in August 1983, banned the use of force in outer space and from outer space directed at targets on Earth.[2] It appears to cover not only all types of ASAT weapons but also ballistic missile defence (BMD) systems. Article 2.1 contains a provision to ban testing and deploying in orbit "any space based weapon designed to hit targets on the Earth, in the air and outer space".

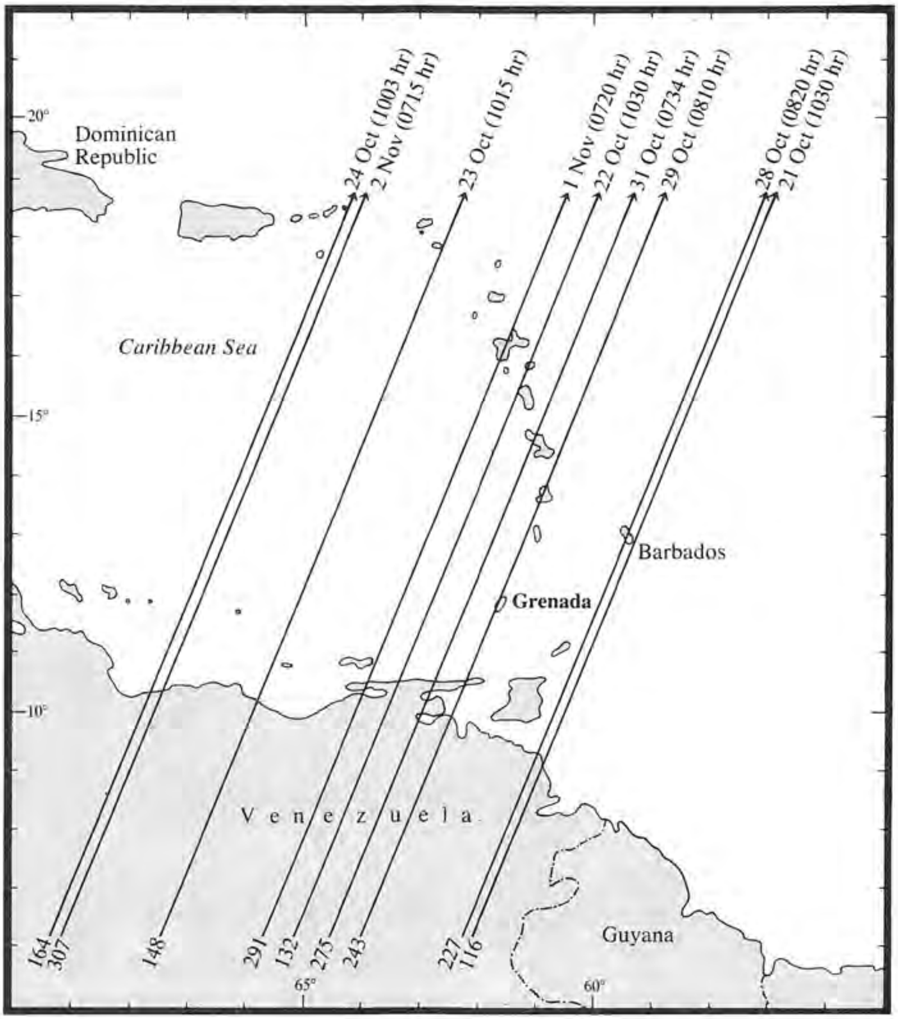
In view of shortcomings in the 1972 ABM Treaty, such a provision would be a step forward since some ASAT weapons are envisaged not only for space warfare but also for BMD systems based in outer space. This became apparent when on 23 March 1983 President Reagan called on US scientists and engineers to find "the means of rendering nuclear weapons impotent and obsolete".[3] In January 1984 the President in fact gave the go-ahead to research and development of space-based BMD systems. This dual ASAT role is not a new one. The early US ground-based ASAT system using the US Army's Nike-Zeus missiles, for example, was a slightly modified version of an anti-ballistic missile (ABM) system. Even the present US non-nuclear kill (NNK) ASAT interceptor was originally conceived in the 1960s as an ABM warhead.[4] Some of the technical and arms-control aspects of developments in the field of ASAT and BMD as well as observations from space of conflict areas and military manoeuvres are briefly examined in this chapter.

II. Observation of conflict areas

The USA and the USSR have monitored many conflict areas of the world by means of their artificial Earth satellites.[5] A recent illustration was the invasion of Grenada at the end of October 1983 by a multinational force from the member states of the Organization of Eastern Caribbean States, led by the USA. Concern in the United States about developments in Grenada was raised on about 20 October, and the decision was taken to divert the aircraft carrier *Independence* (which was on its way to Lebanon) to Grenada. The invasion began in the early hours of 25 October, with the landing of US marines and paratroopers on Grenada. A Soviet Cosmos 1504 satellite, carrying high-resolution cameras, was already in orbit at an altitude of just under 200 km. The fact that the satellite was launched on 14 October and recovered on 6 December (see table 10.1) would suggest not only that it could have accomplished the mission of observing the Grenada conflict, but also that this was not necessarily its only mission. The conflict lasted for nine days; the USA announced on 2 November that hostilities had ended and that the withdrawal of US forces had begun.

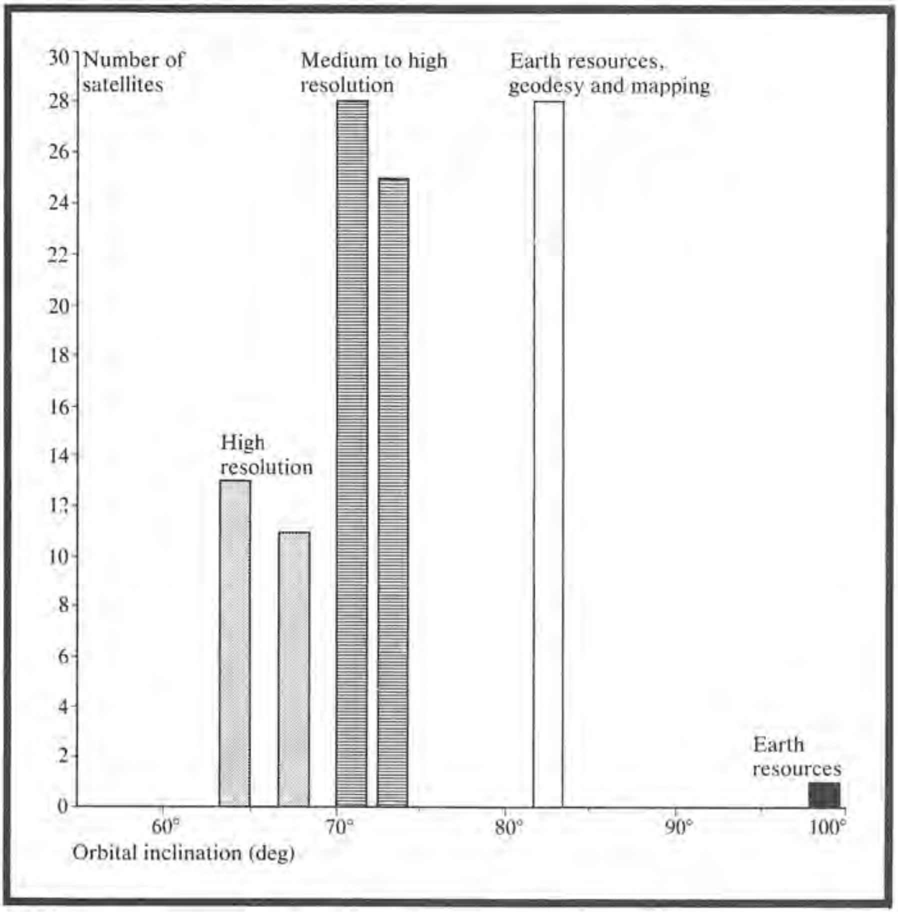
The ground tracks of Cosmos 1504 are shown in figure 10.1. The satellite passed over the region on several occasions between 25 October and 2 November at about 0800 hours and 1030 hours, probably to observe the change of course of the naval task force, naval movements led by the assault ship *Guam*, and even the progress of the conflict on the island. While it is true that such satellites also pass over regions of the Earth other than those of particular interest, during such crisis observations they are often manoeuvred more frequently than is necessary simply to prolong their lifetime.

Figure 10.1. Ground tracks of Soviet Cosmos 1504 over the Caribbean Sea and the island of Grenada in October–November 1983 (number, date and time of each orbit indicated on ground track)



It is now apparent that, at least since 1981, Soviet photographic reconnaissance satellites fall into three groups. The first (the fourth generation), launched at orbital angles of 65° and 67° (and a few at 70°), carry high-resolution cameras; they are both manoeuvrable and have relatively long lifetimes. The second group of satellites carry cameras of medium to high resolution and are orbited at inclinations of 70° and 73°. The third group are orbited at an angle of 82° and perform area-surveillance, geodesy, mapping and Earth resources missions (see figure 10.2). Cosmos 1504 falls into the first group and had a lifetime of 53 days, the longest of any Soviet photographic reconnaissance satellite. With regard to the third group, it is interesting to note that information useful for both civilian and military applications is often obtained by the same satellite. The US civilian Landsat 4 satellite is being used in direct support of the programme of the US Defense Mapping Agency (DMA) for obtaining accurate

Figure 10.2. Number of Soviet photographic reconnaissance satellites launched in 1981–83



geodetic measurements to enhance the performance of US ICBMs and SLBMs. A satellite receiver, GPSPAC (Global Positioning System Package), designed by the DMA, has been orbited on board Landsat 4.

With the detail that is observable from satellites and the extent to which reconnaissance satellites are now being used, it would be reasonable to assume that they are being used for missions other than simply obtaining targeting information and verifying arms control agreements or managing conflicts. One other possible mission—observation of military manoeuvres—is discussed in the section below.

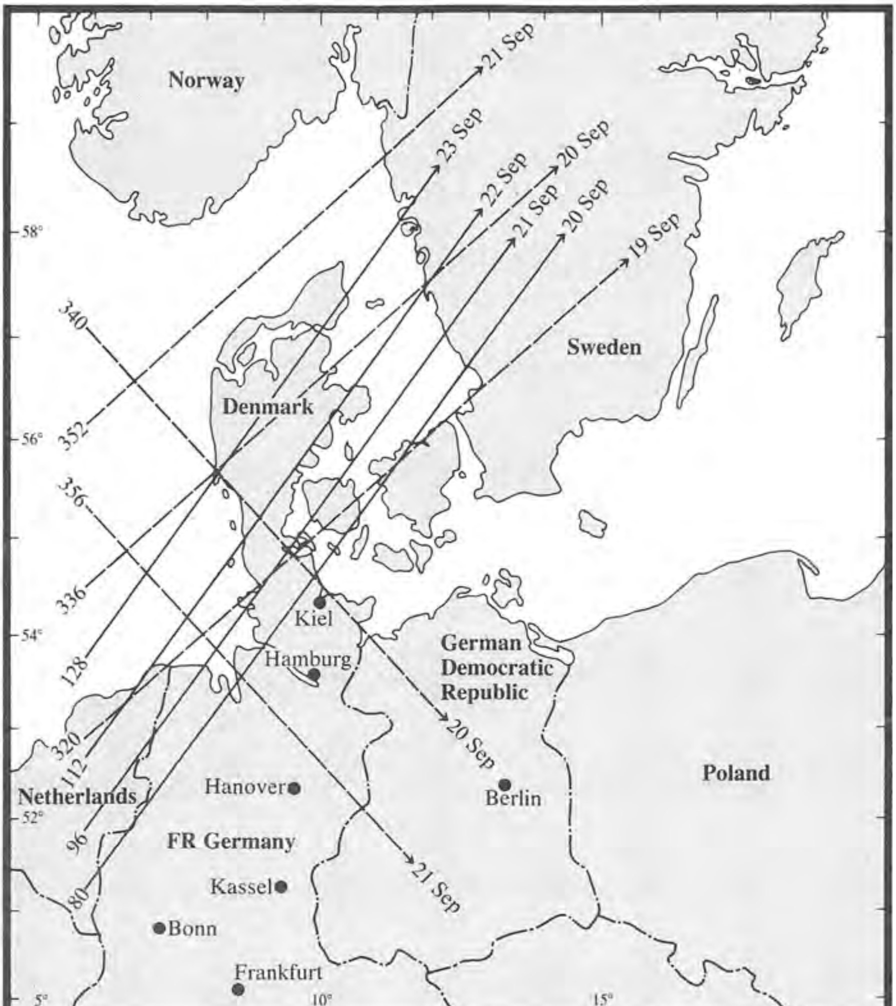
III. Possible observations of military manoeuvres

The 1975 Helsinki Final Act of the Conference on Security and Co-operation in Europe deals with, among other things, security issues in Europe. In order "to contribute to reducing the dangers of armed conflict and of misunderstanding or miscalculation of military activities which could give rise to apprehension", the Final Act includes, as a confidence-building measure, agreement on such issues as prior notification of major and other military manoeuvres and exchange of observers.[6] While notifications are given, the numerical strength of participating forces is sometimes not supplied. Moreover, even when foreign observers are present, their observations can only be limited, particularly in the case of a large manoeuvre spread out over a great area. It is therefore reasonable to assume that observations from outer space are being made during certain manoeuvres. One example is the *Bold Guard* combat exercise held by the 6th FRG Armoured Infantry Division, the Territorial Defence Command Schleswig-Holstein, the Danish Jutland Division (Danish Eastern Land Command), and US, British and Dutch units. The areas of manoeuvre were Jutland, the Danish Isles and Schleswig-Holstein.

The *Bold Guard* manoeuvre was announced on 24 August 1982, and the manoeuvre took place between 20 and 24 September 1982. During this period, the Soviet Union had two reconnaissance satellites in orbit: Cosmos 1407, a high-resolution photographic reconnaissance spacecraft, and Cosmos 1402, an ocean-surveillance satellite. The latter satellite carried a radar, powered by a small nuclear reactor, with all-weather day and night observation capability. It was with this satellite that attempts to manoeuvre the reactor into a higher orbit—a common practice after the completion of a mission—failed, and the reactor entered the Earth's atmosphere on 7 February 1983.[7]

The ground tracks of Cosmos 1407 and Cosmos 1402 are plotted in figure 10.3. It can be seen that both satellites were over the region of interest during the period of the manoeuvre. Cosmos 1407 was at an altitude of about 180 km and passed over the region at 1550 hours local time. For most days of the manoeuvre and during the time Cosmos 1407 was over the region of interest, over 60 per cent of the sky was covered with cloud. On the last day of the manoeuvre, visibility improved

Figure 10.3. Ground tracks of the Soviet satellites Cosmos 1407 (———) and Cosmos 1402 (– – –), launched on 15 September 1982 and 30 August 1982 respectively. The dates of passes over the *Bold Guard* manoeuvre area and the orbital numbers of the satellites are indicated



somewhat so Cosmos 1407 may have made some limited observations. Weather conditions were not a visibility constraint for Cosmos 1402, however, since its radar has all-weather day and night capabilities.

IV. Ballistic missile defence

The 1972 bilateral ABM Treaty limits land-based ABM systems and bans the development, testing or deployment of ABM systems or components which are sea-based, air-based, space-based or mobile land-based. However, there is a certain amount of ambiguity introduced in the Agreed Interpretations and Unilateral Statements regarding the ABM Treaty. For example, in Paragraph D of the Agreed Interpretations it is stated that "the Parties agree that in the event ABM systems based on other physical principles and including components capable of substituting for ABM interceptor missiles, ABM launchers, or ABM radars are created in the future, specific limitations on such systems and their components would be subject to discussion". Moreover, in Article II of the Treaty it is stated, "For the purpose of this Treaty an ABM system is a system to counter strategic ballistic missiles or their elements in flight trajectory, currently consisting of . . .". This could be interpreted as a ban on ABM systems that existed in 1972 and before. This article and paragraph D of the Agreed Interpretations would allow the development, testing and deployment of high-energy beam systems as well as some conventional ones which use optical sensors instead of radars together with non-nuclear interceptors.

In the early 1970s the significance of the Treaty was seen to lie in the fact that both sides had in effect agreed to maintain mutual vulnerability. The current interest in BMD is thus of special concern because it reflects a change of doctrine away from deterrence. Furthermore, developments in high-energy laser BMD would give impetus to its applications as an ASAT weapon since many of the key problems in both the applications are identical. In fact, for ASAT applications some of the problems are less severe. Thus, future arms control measures in outer space would be difficult to negotiate and some existing arms limitation measures could be undermined. This section will briefly examine some of the technical and arms-control aspects of these developments.

Conventional BMD systems

The essential elements of any BMD system are target-detection, -recognition, -tracking and -destruction systems. At present these tasks are being performed by ground-based radar sensors and by target interceptors armed with nuclear warheads. However, considerable efforts have been devoted to R&D on new concepts of a BMD system. While much can be learnt from the open literature about US thinking on BMD, an equal amount of information is not available from the Soviet Union. Thus, the following discussion is confined to the US programmes.

Since the de-commissioning of the US Safeguard ABM system in 1975, research and development funding has continued under two BMD programmes known as the Advanced Technology Program (ATP) and the Systems Technology Program (STP). Funding for these R&D programmes prior to fiscal year 1981 was nearly $2.5 billion while for fiscal years 1982, 1983 and 1984 (requested) it was just over $462 million, $519 million and $709 million, respectively.[8] The near doubling of funding in the figures of the past two years reflects the increased importance attached to these programmes.

Under the ATP, considerable emphasis has been placed on the development of non-nuclear kill warhead technology. In fact, of the total 1984 budget of $709 million, $170 million is for the ATP. Some 60 per cent of this is for development of the NNK warhead and optical sensor.[9] The technology is being developed for both endo- and exo-atmospheric applications using a long-wavelength infra-red optical sensor (mounted either on an aircraft or on board a missile), NNK warheads and micro-data processing of target-acquisition and -tracking information. Advanced radars are also being investigated. This investigation includes shorter wavelength (millimetre-range) radars to increase resistance to blackouts owing to nuclear explosions. Such radars may also increase the resolution and accuracy of measurements of the range, angle and speed of targets.

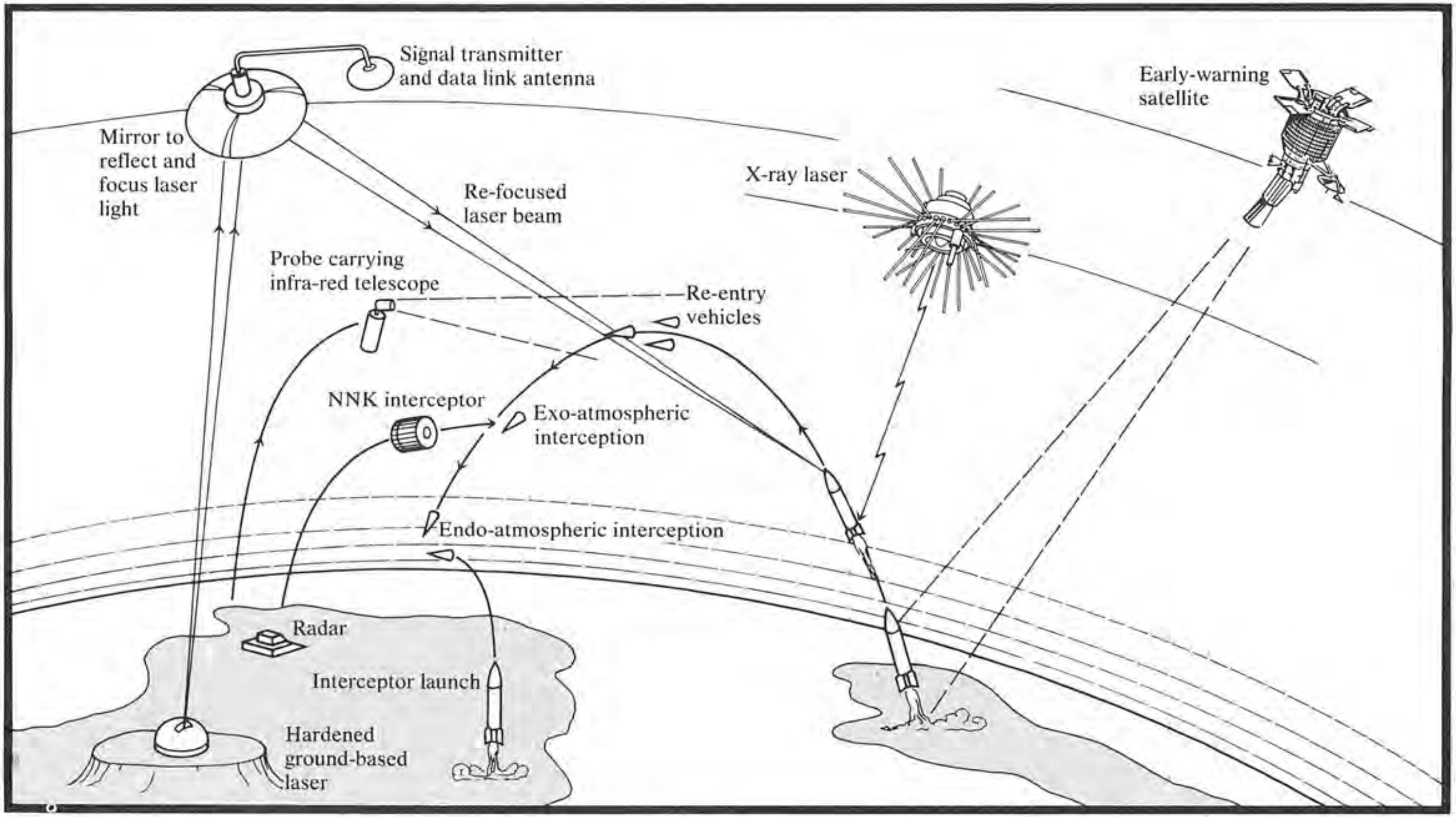
Passive optical sensors using long-range infra-red signals to detect and discriminate large numbers of objects in space are being investigated under the Designating Optical Tracker (DOT) programme. The device would be launched by a sounding rocket and would be operated when above the atmosphere. A DOT device has been tested on four occasions: in December 1978, February and September 1979, and June 1981.

Another development under way within the ATP is the so-called Forward Acquisition Sensor System (FASS). The purpose of FASS is to demonstrate the use of a long-range missile-borne target acquisition sensor which might be used in a BMD and in an early-warning system.

The STP is concerned with the integration of systems developed under the ATP and other programmes in a workable BMD system. At present, under the STP two BMD concepts are being considered: Low Altitude Defense (LoAD, designed for defence—below 9 km—of missiles in fixed silos); and Overlay Defense. The use of these two concepts either individually or combined in a layered defence is being considered (see figure 10.4).

At the lowest level, layered defence envisages low-altitude defence at heights of up to 9 km and terminal defence at an altitude of between 9 and 45 km using radar sensors, data processors and interceptor technology being developed under the LoAD programme. The mid-course defence ranges from altitudes of about 45 km to 90 km, and exo-atmospheric

Figure 10.4. Drawing of a concept of the layered BMD system



defence is envisaged above 90 km. At high altitudes the defence would consist of long-range interceptors with NNK warheads and optical, terminal-homing guidance systems to intercept incoming warheads above the atmosphere.

Once warning of an attack is received either from an early-warning satellite or from forward acquisition systems such as ground-based early-warning radars, a sounding rocket would be launched. Optical sensors on board such a rocket would locate and track the warheads and transmit their trajectory data to interceptors.

Under the layered defence programme, the Homing Overlay Experiment (HOE) has been designed to investigate the NNK system and optical guidance. One of the aims of HOE is to demonstrate the intercept capability of a single NNK warhead using a long-wavelength infra-red terminal guidance system. A Minuteman I ICBM is launched, followed by the launch of an infra-red telescope to detect and track the target and then the NNK interceptor to kill the target (see figure 10.4). The infra-red telescope and its onboard data processor are planned eventually to replace large ground-based radars and computers for acquisition, assessment, tracking and discrimination of the target.

In another system, the NNK interceptor, instead of destroying the target by collision, ejects metal pellets in a controlled sequence so as to place them in concentric circles in the path of the incoming target warheads. These pellets would then destroy them on impact.[10]

Some four tests were planned under the HOE programme.[11] Two of these were completed on 7 February and 28 May 1983.[12] In both tests, the missiles failed to intercept their targets. It is interesting to note that such activities are permitted, even with the 1972 ABM Treaty. This is because, for example, the Treaty bans the use of radars in the ABM mode while an ABM optical sensor, which is based on a "different physical principle" but performs the task of a radar, is allowed according to the Agreed Statements of the Treaty.

It is also interesting to note that even as early as the late 1960s and early 1970s, the concept of layered defence was evident in US thinking on ABM systems. A further dimension seems to have been added now, as suggested by President Reagan's 23 March 1983 speech.

The BMD concepts described above do not include methods of early-trajectory or boost-phase interception of offensive missiles. High-energy laser devices or other directed-energy weapons are thought to be particularly applicable as BMD non-nuclear interceptors of ICBMs during their boost phase (see figure 10.4).[13]

Space-based BMD systems

There are three concepts under consideration as space-based BMD systems. The first is that in which high-energy lasers are orbited. High-energy lasers are those which have an average power output of more than 20 kilowatts (kW) or a single pulse energy of at least 30 kilojoules (kJ). For beam weapon applications laser energies range from a few hundred kilowatts to a few megawatts.

In the laboratory environment, a 10-kW laser can easily penetrate a few centimetres of steel in a fraction of a minute while, theoretically, a 5-MW hydrogen fluoride laser (power density about 2 kJ/cm^2) can make a hole through steel 0.2 cm thick in less than 10 seconds from a distance of 1 000 km.[14] In the latter case it is assumed that the target surface is non-reflective and has not been hardened in any way and that the laser beam has been focused to a minimum radius of about 1 metre.

For industrial use 20-kW lasers are available, while the military has plans for lasers with a power output of between 2.5 MW and 5 MW.[15] The US Air Force has an Airborne Laser Laboratory (ALL) equipped with a 400-kW carbon dioxide gas dynamic laser. The laser emits light at an infra-red wavelength of 10.6 micrometres (μm). In early February 1981, the US Air Force tested its ALL system at full power on the ground.[16] On 1 June, the ALL was tested against an air-launched AIM-9L Sidewinder air-to-air missile. The beam hit the target, but it did not destroy it.[17] Two days later a second test was carried out against an AIM-9L missile. It was able to lock on to the target for a long period.[18] More recently, it was reported that in July 1983 the laser beam engaged five Sidewinder missiles and managed to change their course.[19]

The US Navy, under a programme called Sea Lite, is investigating a more powerful chemical laser. The Defense Advance Research Project Agency (DARPA), under the DARPA Triad programme, is investigating the use of a ground-based chemical laser device to demonstrate the feasibility of a laser suitable for deployment in outer space.[20]

The Triad consists of three elements, code-named Alpha, under which the feasibility of generating a 5-MW infra-red chemical high-energy laser is being investigated; LODE (Large Optics Demonstration Experiment) under which a large mirror, 4 metres in diameter, is being developed to steer and centre the laser beam; and Talon Gold under which the target-acquisition, -tracking and precision-pointing technologies are being investigated.[21]

Prior to 1983, the USA had already spent nearly \$2 billion on high-energy lasers.[22] For fiscal year 1984, the final budget for the space weapons amounts to \$1 195 million. Of this amount, \$467.9 million is for directed energy weapons, $501.9 million for BMD and $225.5 million for ASAT weapons.[23]

Several types of high-energy lasers have been proposed for weapon applications. However, in order to keep the beam divergence and the size of the optics to a minimum, short-wavelength lasers are preferable. Moreover, since beam–target coupling strongly increases with decreasing wavelength, the need for short-wavelength lasers is further emphasized. Nonetheless, considerable effort has been devoted to research on long-wavelength laser devices. For example, the US Air Force ALL is equipped with a gas dynamic laser (GDL) which uses carbon dioxide. The laser radiates at 10.6 μm. In a GDL, the rapid expansion of a gas provides the inverted distribution of excited molecular energy states necessary for laser beam emission, while in a chemical laser, the corresponding conditions are obtained by means of chemical reactions. The most commonly used chemical reactions for the latter type of laser are between hydrogen and fluorine emitting radiation at 2.7 μm or deuterium and fluorine radiating at 3.8 μm. The main characteristics of these and other high-energy lasers are summarized in table 10.9. It is useful to note here that, over a 10-km path, a high-power hydrogen/fluorine laser beam is very poorly transmitted through the atmosphere while deuterium/fluorine, carbon dioxide and some short-wavelength laser beams (operating in the range between 0.3 and 2 μm) have transmittance approaching 100 per cent.

In the electric discharge laser (EDL) the lasing material is excited by collisions with the electrons of an electric discharge. Another type of EDL is called the excimer laser which uses noble gases (such as xenon or argon) and operates in the visible and near ultraviolet wavelengths. This latter laser type has produced high-power bursts at short wavelengths in the laboratory.

A relatively new and, in principle, different and tunable laser type is the free-electron laser (FEL). It might be developed to exhibit very high efficiency in converting electrical energy to laser energy. Theoretical predictions suggest that power in the megawatt range could be produced from such a laser.[24] In an FEL, an alternating magnetic field interacts with a beam of relativistic electrons causing emission of coherent radiation. The wavelength can, in principle, be selected from a range between microwave and the ultraviolet. While theoretically with the existing accelerator technology, 10–20 kW (or 10–20 kJ/s) laser light in the visible wavelength could be produced, a room-sized electron accelerator costing up to about $1 million could produce a laser light of 10–100 W (10–100 J/s) power in the infra-red wavelength range.[24]

Other potential devices which have entered the high-energy laser weapon debate are the gamma-ray laser or 'graser' and the X-ray laser. These have been the subject of theoretical analyses both in the USA and the USSR for more than a decade.[25] In contrast to optical lasers which derive their beam energy from the stimulated release of energy stored in excited atoms or molecules, the radiative energy emitted by a graser or X-ray laser originates from excited states in the shell structure of the nuclei of atoms or excited states in the high-energy *K* and *L* shells of atoms. The pumping of X-ray lasers requires very intense radiation, like that emitted in a nuclear explosion.[26]

An X-ray laser can in principle be pumped by a high-intensity flash of X-rays from a conventional X-ray source. However, these are generally not intense enough to achieve the required gain, except for the possibility of optical resonances existing in the nuclei of some isotopes.[27]

X-rays can be neither reflected by mirrors nor refracted in prisms. The normal laser technique to create and sustain an inverted population of energy states in the lasing material by repeated reflections between mirrors can, therefore, not be used in X-ray lasers. Moreover, the X-ray laser radiation cannot be focused using mirrors and lenses as is done in other types of lasers. In addition, the lifetime of a high-energy excited state is very short compared with normal excited atomic states. All these factors necessitate the use of copious radiation from a nuclear explosion as the pumping source of the X-ray laser. This means that such an X-ray laser operates as a single laser pulse device. Its beam properties, particularly the beam divergence, are therefore determined by the geometry of the lasing medium, normally taken as long rods (see figure 10.4) pumped end-on by the nuclear explosion. It was reported in 1981 that the Lawrence Livermore Laboratory tested the concept of the X-ray pumped laser during an underground nuclear explosion.[28]

Thus, while the US Department of Defense has so far concentrated on the chemical laser for a possible space-based system, owing to the limitations of such a laser (see table 10.9), the emphasis seems to be shifting towards free-electron, excimer, graser and X-rays lasers. The chemical lasers have a chemical to laser energy efficiency of at most a few hundred kilojoules per kilogram of fuel.[29] This means that a very large amount of fuel is needed which must be transported to the orbital laser platform. Moreover, the wavelength of such lasers tends to be too long for them to be efficient weapons.

There are two other important questions of a technological nature which remain to be solved. One is the need for a compact power source to supply input energy for a laser. The Soviet Union has been orbiting small 10-kW(e) nuclear power reactors for the past decade or so and the USA has a plan to orbit a 100-kW(e) reactor in the very near future.[30] In any case, if graser and X-ray lasers are made to work, they may derive their energy from small nuclear explosions. The other problem is that of acquisition of, aiming at and tracking a target. Some of these problems are common to other areas as well—for example, the NASA space telescope and space-surveillance and anti-satellite activities. Once these problems are solved the techniques will, no doubt, be applied to laser weapons as well.

The second concept in the space-based BMD scheme is that proposed by the High Frontier Group. In this concept, it is envisaged that 432 satellites, each armed with 40–45 missile interceptors, be permanently placed in orbit round the Earth.[31] The interceptors, each capable of obtaining a velocity of about 90 km/s relative to the carrier satellite, would be guided by infra-red sensors to home in on enemy missile boosters and destroy them by colliding with them at high speed. Owing to the vulnerability of the above space-based systems, a third concept has been put forward.

The third BMD concept, which is partly space-based, is that supported by US presidential science adviser George A. Keyworth. This system would consist of several hundred lasers each operating at or near the visible light spectrum. The lasers would be dispersed throughout the US land mass and would be fired at large Earth-orbiting mirrors launched in great numbers on warning of an attack by enemy missiles. The laser light would be reflected off and refocused by these mirrors on targets. While this scheme is at a conceptual stage, it is difficult to see how problems such as launching and placing the mirrors in their correct orbital positions could be solved in time for enemy missiles to be intercepted by the reflected laser beam. The total time taken by a missile to reach its target is not much longer than 30 minutes and in many instances even shorter. Thus, the mirrors have to be in placed in orbit in a considerably shorter time than 30 minutes. Moreover, the laser beam must strike the ICBMs during their boost phase, which lasts at most 300 seconds.[32]

Another method which could be classified under the third BMD concept is known as the 'pop-up' system. Anti-missile rockets would be kept ready for immediate launching carrying either conventional or nuclear explosives or X-ray laser devices. The latter would have to be a nuclear explosive laser since the pop-up rocket has to be launched with high acceleration, which could be achieved only if a relatively light payload is used. For boost-phase interception, such a pop-up system would suffer from the same objection as mentioned above (i.e., the time factor). The interception of the warheads could be made once they are released after the boost-phase but a laser may be ineffective against hardened warheads.

The technological problems involved in the sum total of the systems required for an adequate BMD are very large indeed. Many outside experts regard them as virtually insoluble, even if funds were available. An active group of leading scientists in the United States have declared their opposition to the programme. For example, Professor Hans Bethe, Chief of the Theoretical Physics Division of the Manhattan Project during World War II and a Nobel Prize Winner in physics in 1967, has stated:

> ... the technologies required for a defense of our population against nuclear-armed ballistic missiles are far beyond the state of the art, and in most instances are unlikely ever to work effectively. In contrast to this, countermeasures that are cheap and already known to work exist in abundance.... If it is really our objective to reduce the exposure of our population to nuclear weapons, we must avoid a commitment to global BMD, for that will produce precisely the opposite result: a large expansion of nuclear forces aimed against us, combined with a vastly complex defensive system whose performance will remain a deep mystery until the tragic moment when it will be called into action. It is difficult to imagine a more unstable and hazardous confrontation. And it is also puzzling why anyone should believe that that is the road to a less dangerous world, for a direct, cheap, and safe road is known to exist: negotiated and verifiable deep, deep cuts in strategic offensive forces, and non-nuclear alternatives to our excessive reliance on nuclear weapons.[33]

Even within the Administration there is clearly some scepticism. Richard D. De Lauer, Under-Secretary of Defense for Research, has testified that the directed-energy weapons for the proposed BMD system posed several serious technical problems and would involve "staggering costs". Each problem, he said, would require a mobilization of science and engineering as great or greater than that required to land men on the Moon.[34]

V. Implications of BMD

Even though the technological problems relating to a space-based BMD laser weapon system may not be solved in the foreseeable future, the proposed application of high-energy laser beams raises considerable difficulties from the point of view of arms control. For example, the possible use of high-energy beam weapons as a ballistic missile defence system may have a destabilizing effect on the relationship between the two superpowers. If one side acquired such a weapon, it might then be tempted to strike first against the other, probably using tactical nuclear weapons, believing that it could still defend itself against the opponent's ICBMs, the release of which might result in escalation from tactical to strategic nuclear weapons. This is to be viewed particularly in the light of the availability of such small-yield, highly accurate nuclear weapons.

Moreover, a very important consequence would be for both the USA and the USSR to embark on yet another round of arms competition. Not only may there be a laser BMD race, but the two sides would multiply manyfold their offensive nuclear arsenals to ensure that despite the opponent's BMD systems some nuclear weapons would reach their targets. This would accelerate the nuclear arms race rather than check it.

Perhaps a more serious implication of such a development lies in the fact that it violates the spirit of the 1972 ABM Treaty. The two parties should begin discussion of the limitation of these new systems. The Treaty provides for such discussions.

The second difficulty the new technology raises—and which has been discussed very little so far—is that if X-ray or gamma-ray lasers are deployed, this may jeopardize the 1963 Partial Test Ban Treaty (PTBT), which bans nuclear weapon tests in the atmosphere, in outer space and under water. As mentioned above, an X-ray and gamma-ray laser can be produced using small thermonuclear explosions or small fission or neutron bombs. X-ray lasers will not be deployed before considerable testing, thus violating the PTBT. Certainly the deployment of such systems will violate the 1967 Outer Space Treaty, which prohibits orbiting nuclear weapons and other weapons of mass destruction. In any case, the Outer Space Treaty will be violated in spirit since orbiting any BMD system cannot be regarded as a peaceful activity (it can also be used as an ASAT weapon) and the Treaty requires parties to use outer space for peaceful purposes only.

However, perhaps a very important problem raised by the development and possible eventual deployment of beam weapons is that relating to a possible anti-satellite treaty. Both the United States and the Soviet Union began talks on the control of their anti-satellite activities during 1978 and 1979. These did not progress very far, and, in fact, the discussions ceased in 1979. As a result of the first Soviet draft treaty proposal, in 1981, the discussion has been referred to the Committee on Disarmament in Geneva. However, the CD is finding it difficult even to establish a working group to consider the issue of the arms race in space. The possible deployment of a ballistic missile defence system which can also be used as an anti-satellite weapon will complicate discussions at the CD even more.

VI. Conclusions

It can be seen not only that outer space is being used to enhance the performance of Earth-based weapons with the aid of artificial Earth satellites but also that the arms race is on the verge of being extended into this environment. In addition, this may well jeopardize a number of past arms control agreements. It may also make an ASAT treaty difficult to achieve. In view of this, the UN General Assembly, during its 38th session, in 1983 adopted overwhelmingly a resolution on the prevention of an arms race in outer space.[35] The USA voted against the resolution while the UK abstained. In the resolution, the CD is requested "to consider as a matter of priority the question of preventing an arms race in outer space" and to this end "to establish an *ad hoc* working group on the subject at the beginning of its session in 1984, with a view to undertaking negotiations for the conclusion of an agreement or agreements, as appropriate, to prevent an arms race in all its aspects in outer space". Moreover, in view of the dual nature of weapons of war in space, it is urgent that the two superpowers begin discussions on limiting new BMD systems, as stipulated in the 1972 ABM Treaty. In this context a limit on testing such systems, either as BMD or ASAT weapons, may be a useful step.[36]

There is no doubt that observations from outer space have been and are being usefully employed in verifying compliance with bilateral arms control agreements between the USA and the USSR. Both powers have also monitored from space many conflict areas of the world. Moreover, they may also be observing military manoeuvres in Europe as a confidence-building measure. It may be possible to check the militarization of outer space if such activities are emphasized more. Moreover, if many nations were to become involved in such activities under either international or regional control, then observations from space could contribute to stable relationships among nations and also build confidence between them.

It is useful to emphasize here that a regional satellite monitoring agency (RSMA) may be relevant in Europe, particularly because the infrastructure needed for an RSMA already exists. For example, in western Europe there is the European Space Agency (ESA),[37] and the Interkosmos Council[38] has been established in eastern Europe. Both these organizations have very active space programmes, especially in the field of remote sensing, an essential technology for use in verification of arms control treaties. Moreover, the necessary links between the two organizations also exist. For example, France has actively participated in the Interkosmos programmes by orbiting scientific experiments on board many Soviet Cosmos satellites. Also, French astronauts have flown on Salyut–Soyuz spacecraft and France is the most active member of ESA. Moreover, a civilian scientist from FR Germany, an important member of ESA, has recently flown on a US space shuttle. Thus, with such infrastructures already in existence and with a strong link between the two organizations, it is not unreasonable to suggest that the basis for an RSMA exists.

The problems raised for an international satellite monitoring agency (ISMA) by the availability and spread of sensitive data may be less intense in the case of an RSMA. When astronauts from one political bloc can orbit on board the other's satellites, the question of sensitive data cannot remain a great problem. Moreover, the USA, and probably the USSR also, appear to be sharing among their allies some data obtained from their military photographic reconnaissance satellites. On the other hand, it is recognized that although the infrastructure in Europe and the essential links both exist, only Interkosmos is led by a superpower; the United States does not lead the ESA. Therefore, should an RSMA come about, this may be regarded as lacking balance in the involvement of the two superpowers.

The concepts of an ISMA and an RSMA are based on an assumption that there will be some co-operation between nations. International co-operation concerning activities in outer space is not a new concept. Many west European states are co-operating under the umbrella of the European Space Agency. The Interkosmos Council, embodying several east European states, was established in order to further co-operation in space technology among the member nations. In addition to these, among a number of the most successful international ventures in the field of communications and navigation are INTELSAT and INMARSAT, and in the field of meteorology those by the World Meteorological Organization. The latter has introduced a global programme, the World Weather Watch, which is actively supported by the European meteorological satellite programme (METEOSAT), the meteorological satellite programmes of Japan and the USSR, and the environmental satellite programme of the USA. A more recent important co-operative venture is COSPAS/SARSAT, an international search-and-rescue satellite project programme. The Canadian Defence and Communications Departments, the French space agency (CNES), NASA of the USA and the Soviet Union signed an agreement in 1979 to initiate this programme. The Department of Trade (Marine Division) of the UK and the Norwegian Council for Scientific and Industrial Research are also associated with the COSPAS/SARSAT project. Japan and Finland are negotiating to join the programme. Three satellites, Soviet Cosmos 1383, Cosmos 1447 and US NOAA-8, have been launched and several lives have already been saved—for example, through pinpointing the position of crashed aircraft using Cosmos 1383.

This and other international ventures have been highly successful. Even rivals in arms co-operate (for example, the COSPAS/SARSAT programme) when natural disasters occur; surely they will in the end co-operate in averting man-made disasters.

VII. Tables

Table 10.1. Photographic reconnaissance satellites launched during 1983[a]

Country, satellite name and designation	Launch date and time (GMT)	Orbital inclination (deg) and period (min)	Perigee and apogee heights (km)	Comments
USA				
USAF (1983-32A)	15 Apr 1843	97 89	136 297	Lifetime 128 days; high resolution; manoeuvrable; film recovery type
USAF (1983-60A)	20 Jun 1843	97 89	169 229	In orbit at the end of December 1983; Big Bird satellite; manoeuvrable
USSR				
Cosmos 1438 (1983-05A)	27 Jan 0838	70 89	209 230	Lifetime 11 days; high resolution
Cosmos 1439 (1983-07A)	6 Feb 1131	70 89	170 251	Lifetime 16 days; high resolution; fourth generation
Cosmos 1440 (1983-09A)	10 Feb 0712	82 90	260 275	Lifetime 14 days; Earth resources; high resolution
Cosmos 1442 (1983-12A)	25 Feb 1243	67 90	170 367	Lifetime 45 days; high resolution; fourth generation
Cosmos 1444 (1983-14A)	2 Mar 1048	73 92	358 416	Lifetime 14 days; medium resolution
Cosmos 1446 (1983-18A)	16 Mar 0853	70 89	222 242	Lifetime 14 days; high resolution
Cosmos 1449 (1983-24A)	31 Mar 1048	73 92	357 416	Lifetime 15 days; medium resolution
Cosmos 1451 (1983-29A)	8 Apr 0838	82 90	227 323	Lifetime 14 days; only one that was not announced as Earth resources
Cosmos 1454 (1983-36A)	22 Apr 1438	67 90	171 343	Lifetime 30 days; high resolution; fourth generation
Cosmos 1457 (1983-39A)	26 Apr 1005	70 90	171 349	Lifetime 43 days; high resolution; fourth generation
Cosmos 1458 (1983-40A)	28 Apr 0824	82 89	212 240	Lifetime 13 days; Earth resources; data received by Priroda Nature Station; high resolution
Cosmos 1460 (1983-43A)	6 May 0907	70 92	351 417	Lifetime 14 days; TF; medium resolution
Cosmos 1462 (1983-45A)	17 May 0810	82 90	259 275	Lifetime 14 days; Earth resources; data received by Priroda Nature Station; high resolution
Cosmos 1466 (1983-50A)	26 May 1200	65 90	174 345	Lifetime 41 days; high resolution; fourth generation
Cosmos 1467 (1983-52A)	31 May 1146	73 92	357 417	Lifetime 12 days; medium resolution
Cosmos 1468 (1983-55A)	7 Jun 0755	82 90	255 280	Lifetime 14 days; Earth resources; TF; data received by Priroda Nature Station; high resolution
Cosmos 1469 (1983-57A)	14 Jun 1214	73 90	232 344	Lifetime 10 days; high resolution
Cosmos 1471 (1983-64A)	28 Jun 1507	67 90	185 344	Lifetime 30 days; high resolution; fourth generation

Country, satellite name and designation	Launch date and time (GMT)	Orbital inclination (deg) and period (min)	Perigee and apogee heights (km)	Comments
Cosmos 1472 (1983-68A)	5 Jul 0755	82 92	338 362	Lifetime 14 days; Earth resources; TF; high perigee flight; medium resolution
Cosmos 1482 (1983-71A)	13 Jul 0936	70 92	352 413	Lifetime 14 days; TF; announced as Earth resources; only one at 70°; high perigee flight; medium resolution
Cosmos 1483 (1983-74A)	20 Jul 0755	82 90	260 275	Lifetime 14 days; TF; Earth resources; high resolution
Cosmos 1485 (1983-76A)	26 Jul 1200	73 92	358 416	Lifetime 14 days; TF; medium resolution
Cosmos 1487 (1983-80A)	5 Aug 0922	82 90	261 275	Lifetime 14 days; TF; Earth resources; data received by Priroda Nature Station; high resolution
Cosmos 1488 (1983-82A)	9 Aug 1131	73 92	358 416	Lifetime 14 days; medium resolution
Cosmos 1489 (1983-83A)	10 Aug 1258	65 90	171 365	Lifetime 44 days; high resolution; fourth generation
Cosmos 1493 (1983-87A)	23 Aug 1102	73 92	360 414	Lifetime 14 days; medium resolution
Cosmos 1495 (1983-92A)	3 Sep 1019	82 89	215 236	Lifetime 13 days; TK; Earth resources; high resolution
Cosmos 1496 (1983-93A)	7 Sep 1326	67 90	170 341	Lifetime 42 days; high resolution; fourth generation
Cosmos 1497 (1983-95A)	9 Sep 1102	73 92	357 416	Lifetime 14 days; medium resolution
Cosmos 1498 (1983-96A)	14 Sep 1033	82 90	261 275	Lifetime 14 days; Earth resources; high resolution
Cosmos 1499 (1983-97A)	17 Sep 1117	73 92	357 416	Lifetime 14 days; medium resolution
Cosmos 1504 (1983-104A)	14 Oct 1005	65 89	173 305	Lifetime 53 days; high resolution; fourth generation
Cosmos 1505 (1983-107A)	21 Oct 1214	75 92	358 415	Lifetime 14 days; medium resolution
Cosmos 1509 (1983-112A)	17 Nov 1214	73 90	227 292	Lifetime 14 days; high resolution
Cosmos 1511 (1983-117A)	30 Nov 1341	67 90	172 343	Lifetime 44 days; high resolution; fourth generation
Cosmos 1512 (1983-119A)	7 Dec 1241	73 92	356 418	Lifetime 14 days; medium resolution
Cosmos 1516 (1983-124A)	27 Dec 0936	65 89	197 275	In orbit at the end of December 1983; high resolution; fourth generation; no signals received by the Kettering Group; probably similar to Cosmos 1426 launched in 1982; manoeuvred[b]
People's Republic of China				
China 13 (1983-86A)	19 Aug 0600	63 90	173 382	Lifetime 15 days

[a] Morse code recovery beacon data supplied by the Kettering Group.
[b] G. E. Perry, private communication.

Table 10.2. Possible electronic reconnaissance satellites launched during 1983

Country, satellite name and designation	Launch date and time (GMT)	Orbital inclination (deg) and period (min)	Perigee and apogee heights (km)	Comments
USA				
USAF (1983-60C)	20 Jun 1843	97 111	1 289 1 291	Satellite was ejected from the Big Bird spacecraft (1983-60A)
USSR				
Cosmos 1437 (1983-03A)	20 Jan 1731	81 98	628 658	Lifetime 60 years
Cosmos 1441 (1983-10A)	16 Feb 1005	81 98	631 642	Lifetime 60 years
Cosmos 1453 (1983-34A)	19 Apr 1200	74 95	471 517	Lifetime 4 years; orbital period lower than usual
Cosmos 1455 (1983-37A)	23 Apr 1424	83 98	637 665	Lifetime 60 years
Cosmos 1470 (1983-61A)	23 Jun 0000	83 98	635 670	Lifetime 60 years
Cosmos 1500 (1983-99A)	28 Sep 0755	83 98	635 667	Lifetime 60 years
Cosmos 1515 (1983-122A)	15 Dec 1229	83 98	638 665	Lifetime 60 years; scientific oceanographic mission announced; TCE survey possibly with side-looking radar

Table 10.3. Ocean-surveillance and oceanographic satellites launched during 1983

Country, satellite name and designation	Launch date and time (GMT)	Orbital inclination (deg) and period (min)	Perigee and apogee heights (km)	Comments
USA				
NOSS-4 (1983-08A)	9 Feb 1355	63 108	1 063 1 186	
SSU-D (1983-08B)	9 Feb 1355	63 108	1 047 1 184	
SSU-A (1983-08E)	9 Feb 1355	63 108	1 052 1 168	Navy ocean-surveillance satellites; five sub-satellites and SSU satellites
SSU-B (1983-08F)	9 Feb 1355	63 108	1 052 1 168	
SSU-C (1983-08H)	9 Feb 1355	63 108	1 052 1 167	
NOSS-5 (1983-56A)	10 Jun 0307	63 107	1 048 1 168	
GB 1 (1983-56C)	10 Jun 0307	63 108	1 051 1 171	Navy ocean-surveillance satellites; only three payloads launched
GB 2 (1983-56D)	10 Jun 0307	63 108	1 051 1 170	
USSR				
Cosmos 1461 (1983-44A)	7 May 1033	65 93	429 445	Passive satellite with ion thruster
Cosmos 1507 (1983-110A)	29 Oct 0824	65 93	435 443	Passive satellite with ion thruster

Table 10.4. Possible early-warning satellites launched during 1983

Country, satellite name and designation	Launch date and time (GMT)	Orbital inclination (deg) and period (min)	Perigee and apogee heights (km)	Comments
USSR				
Cosmos 1456	25 Apr	63	622	Replaced Cosmos 1191
(1983-38A)	1938	717	39 716	
Cosmos 1481	8 Jul	63	643	Replaced Cosmos 1285
(1983-70A)	1926	707	39 200	
Cosmos 1518	28 Dec	63	585	Replaced Cosmos 1341
(1983-126A)	0350	709	39 348	

Table 10.5. Meteorological satellites launched during 1983

Country, satellite name and designation	Launch date and time (GMT)	Orbital inclination (deg) and period (min)	Perigee and apogee heights (km)	Comments
USA				
NASA/NOAA 8	28 Mar	99	808	National Oceanographic and Atmospheric Administration satellite; includes SARSAT (Search and Rescue Satellite-Aided Tracking) of the joint Cospas project
(1983-22A)	1550	101	830	
NASA/GOES 6	28 Apr	15	33 367	Geostationary Operational Environmental Satellite
(1983-41A)	2219	1 704	48 390	
DMSP 2-02	18 Nov	99	816	Defense Meteorological Satellite Program; last of the DMSP 1 series was launched on 22 December 1982 (1982-118A)
(1983-113A)	0629	101	833	
USSR				
Meteor 2-10	28 Oct	81	754	Only ones in operation are Meteors 2-7, 2-8 and 2-10
(1983-109A)	0907	101	890	

Table 10.6. Communications satellites launched during 1983

Country, satellite name and designation	Launch date and time (GMT)	Orbital inclination (deg) and period (min)	Perigee and apogee heights (km)	Comments
USA				
TDRS 1 (1983-26B)	4 Apr 1829	2 1 436	35 763 35 805	Tracking and Data Relay Satellite launched from space shuttle STS 6 to provide spacecraft to ground communications; located about 40° W longitude
USAF SDS 8 (1983-78A)	31 Jul	-	-	Satellite Data System; orbit similar to 1980-100A
USSR				
Cosmos 1429–Cosmos 1436 (1983-02A–H)	19 Jan 0224	74 116	1 401 1 521	Octuple launch
Molniya 1-56 (1983-19A)	16 Mar 1814	63 737	453 40 825	Replaced Molniya 1-50
Molniya 1-57 (1983-25A)	2 Apr 0210	63 700	470 39 006	Replaced Molniya 1-52
Cosmos 1452 (1983-31A)	12 Apr 1814	74 101	785 810	Possibly store-dump communications satellite; replaced Cosmos 1317?[a]
Cosmos 1473–Cosmos 1480 (1983-69A–H)	6 Jul 0029	74 116	1 397 1 484	Octuple launch
Molniya 1-58 (1983-73A)	19 Jul 1522	63 700	459 39 014	Replaced Molniya 1-49
Cosmos 1486 (1983-79A)	3 Aug 1243	74 101	784 806	Possibly store-dump communications satellite; replaced Cosmos 1354
Cosmos 1503 (1983-103A)	12 Oct 0014	74 101	790 810	Possibly store-dump communications satellite; replaced Cosmos 1486
Molniya 1-59 (1983-114A)	23 Nov 1648	63 702	442 39 145	Replaced Molniya 1-48 and Cosmos 1423, 11 months after failure to replace Molniya 1-48 with Cosmos 1423 which exploded[b]

[a] Not in exactly the same orbital planes (G. E. Perry, private communication).
[b] G. E. Perry, private communication.

Table 10.7. Navigation satellites launched during 1983[a]

Country, satellite name and designation	Launch date and time (GMT)	Orbital inclination (deg) and period (min)	Perigee and apogee heights (km)	Comments
USA				
USAF/Navstar 8 (1983-72A)	14 Jul 1019	63 726	19 952 20 798	Eight in a network of 18 satellites; Navstar 7 launched on 18 December 1981 failed
USSR				
Cosmos 1428 (1983-01A)	12 Jan 1355	83 105	957 1 006	Replaced Cosmos 1333; No. 3; Cosmos 1333 became No. 7 transmitting at the end of 1983
Cosmos 1448 (1983-23A)	30 Mar 0112	83 105	963 1 006	Replaced Cosmos 1344; No. 1; Cosmos 1344 not transmitting
Cosmos 1459 (1983-42A)	6 May 0253	83 105	947 1 019	Replaced Cosmos 1349; No. 4
Cosmos 1464 (1983-48A)	24 May 0253	83 105	968 1 011	Replaced Cosmos 1295; No. 5
Cosmos 1513 (1983-120A)	8 Dec 0614	83 105	963 1019	Replaced Cosmos 1417; No. 6; Cosmos 1417 no longer in operation

[a] In Table 15.7 in *SIPRI Yearbook 1983* (p. 453) the GLONASS (Global Navigation Satellite System) satellites were listed. In 1983 two more sets of triple GLONASS satellites, Cosmos 1490–1492 and Cosmos 1519–1521, were launched. These are 120° out of phase with the previous launches signifying operational capability. These and Cosmos 1506 are, however, from the civil navigation system (G. E. Perry, private communication). They are therefore omitted from this table.

Table 10.8. Reusable space launcher flights during 1983

Country, satellite name and designation	Launch date and time (GMT)	Orbital inclination (deg) and period (min)	Perigee and apogee heights (km)	Comments
USA				
STS 6 (1983-26A)	4 Apr 1829	29 90	278 289	Lifetime 5.02 days; launched TDRS (1983-26B) and Inertial Upper Stage (IUS) (1983-26C & D); FRG IRCCD sensor (MOMS—Multispectral Optical Modular System)
STS 7 (1983-59A)	18 Jun 1131	29 91	295 320	Lifetime 6.1 days; launched FRG Shuttle Pallet Satellite (SPAS-01) and retrieved it using shuttle arm; STS 7 also launched Canadian Anik C2 and Indonesian Palapa 3 communications satellites
STS 8 (1983-89A)	30 Aug 0629	29 90	294 301	Lifetime 6.05 days; night launch and landing; launched INSAT 1B, an Indian weather satellite; cargo bay carried PFTA which was not separated
STS 9 (1983-116A)	28 Nov 1605	57 89	239 252	Lifetime 10.32 days; cargo bay carried European Spacelab 1; crew—5 from USA and 1 from FRG
USSR				
Cosmos 1445 (1983-17A)	15 Mar 2243	51 88	176 217	Test of a delta-winged re-entry vehicle; similar to Cosmos 1374 (1982-54A) test carried out on 3 June 1982; Cosmos 1374 was recovered after 109 min and Cosmos 1445 after less than two hours; both recovered in the Indian Ocean
Cosmos 1517 (1983-125A)	27 Dec 1005	51 88	180 221	Test of a delta-winged re-entry vehicle; recovered after about 86 min in the Black Sea

Table 10.9. Summary of some of the main characteristics of high-energy lasers proposed for space-based BMD, ASAT and anti-aircraft applications

Range of wavelengths	Target damage mechanism	Type of laser	Lasing material	Comments
Long wavelengths, 2–11 micrometres	Mainly by heating target surface	Chemical Laser (CL)	Hydrogen–fluorine or deuterium–fluorine	Power output in the multi-megawatt range has been demonstrated but need for large amount of fuel and poor beam quality make it impractical as a space-based system
		Gas Dynamic Laser (GDL)	Carbon monoxide or dioxide	Potential for high power and acceptable beam quality have been demonstrated but limitations are its long wavelengths and maximum available power output
		Electric Discharge Laser (EDL)	Carbon monoxide or dioxide	Potential for high power and excellent beam quality but, like all long-wavelength lasers, gives inefficient target coupling; its beam propagation properties also limit its usefulness
Short wavelengths, 0.2–2 micrometres	By heating target surface or by shock waves imparted by short pulses	Excimer Laser (EL)	Fluoride compounds, noble gases, halogens	Overall efficiencies of only a few per cent; the multi-megawatt power for weapon application would require very large power input; severe corrosion problems and maintenance of the purity of the lasing material make ELs unsuitable as space-based system
		Free-Electron Laser (FEL)		Wide range of frequencies may be available together with tunability; high potential efficiency; needs a particle beam source
Very short wavelengths, 0.01–0.1 micrometres	Mainly by shock waves	Graser		Non-monochromatic and atmospheric absorption total
		X-ray Laser		Like a graser it would require considerably greater optical precision compared with the long-wavelength lasers; both of these types could in principle produce peak power in the terawatt range using nuclear explosions; the use of nuclear explosives raises considerable arms control difficulties; there are problems of electro-magnetic pulse associated with nuclear explosives

Notes and references

[1] UN document A/36/192, 20 August 1981.
[2] UN document A/38/194, 22 August 1983.
[3] 'Text of Reagan address on defense policy', *Congressional Quarterly Weekly Reports*, Vol. 41, No. 12, 26 March 1983, pp. 629–33.
[4] 'Anti-satellite missile flight test nears', *Defense Electronics*, Vol. 12, No. 12, December 1980, pp. 22–24; Pike, J., 'Anti-satellite weapons', *Journal of the Federation of American Scientists (FAS)*, Vol. 36, No. 9, November 1983, p. 4.
[5] SIPRI, *World Armaments and Disarmament, SIPRI Yearbook 1974* (Almqvist & Wiksell, Stockholm, 1974), pp. 287–302; Jasani, B., *Outer Space—Battlefield of the Future?* (Taylor & Francis, London, 1978), pp. 18–21; SIPRI, *World Armaments and Disarmament, SIPRI Yearbook 1981* (Taylor & Francis, London, 1981), pp. 279–93; and SIPRI, *World Armaments and Disarmament, SIPRI Yearbook 1983* (Taylor & Francis, London, 1983), pp. 427–63.
[6] See also chapter 15 and *SIPRI Yearbook 1981* (note 5), chapter 17.
[7] See note 5.
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11. The operational characteristics of ballistic missiles

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Superscript numbers refer to the list of notes and references at the end of the chapter.

I. Introduction

Since the inception of nuclear weapons, strategic planners in the United States, and probably also in the Soviet Union, have been concerned about the vulnerability of their nuclear arsenals to a disarming first strike by the other side.

In the early post-war years, each side's nuclear weapons were carried by intercontinental bombers, which were vulnerable to pre-emptive strikes if caught on the ground. To relieve this vulnerability, US bombers were kept in a high state of alert, a fraction of them always airborne.

By the early 1960s, the United States, while maintaining its bomber force, was moving a substantial portion of its nuclear force into submarine-launched ballistic missiles (SLBMs) and land-based intercontinental ballistic missiles (ICBMs). The latter were placed in concrete structures known as silos, which were hardened to resist the effects of nearby nuclear detonations. Thus the US strategic nuclear forces were distributed among bombers, submarines and ICBMs (the 'triad'), and the potential importance of a Soviet technical advance threatening any one of the three systems was reduced.

The Soviet Union initiated similar efforts, but its early ICBMs were not based in hardened silos and its early submarine-launched missiles had extremely short ranges, making them much less effective weapons. It was not until the mid- to late-1960s that the Soviet Union developed a truly survivable nuclear force, but not a triad. Even today, the Soviet Union has 75 per cent of its nuclear force in ICBMs, though it has expanded its submarine force considerably in recent years. By comparison, roughly 25 per cent of the US strategic force is housed in land-based silos. The Soviet Union does not have an operationally significant strategic bomber force; the 150 aircraft are not on alert and are used mostly for reconnaissance.

Making nuclear weapons invulnerable to surprise attack permitted the development of the theory of deterrence, that is, the avoidance of nuclear war between the USA and the USSR by the threat of mutual assured destruction of each other's cities, industrial infrastructures and populations. Although deterrence provided a measure of stability and predictability to the nuclear confrontation, it remained unsatisfactory to many political and military leaders on two counts. It provided, in principle at least, for a retaliatory attack against civilian populations, a distastefully inhumane strategy; and it foreclosed any potential political utility for nuclear weapons, since neither country could use them or threaten to use them in such a way as to extract accommodating political behaviour from the other side.

Thus, at least in the United States and most probably in the Soviet Union, strategic thinkers attempted to devise scenarios for the use of nuclear weapons other than in massive retaliation. As a result, since the earliest days of US nuclear planning, most of the nuclear weapons of the United States were aimed against military targets: industrial facilities of military significance, military bases, and communications and transport centres. This in principle was a 'counterforce' targeting doctrine, but its implementation was so massive that it would be difficult to distinguish it from an all-out attack.

As the nuclear arsenal of the Soviet Union achieved comparable capabilities to that of the USA, US strategic thinkers became increasingly interested in strategies that would limit the extent of a nuclear exchange if deterrence ever failed, and thereby limit the damage to both countries. Thus the doctrine of flexible response emerged. The practical effect of that, in the USA at least, was a move away from the notion of a single massive, almost spasmodic nuclear attack on the Soviet Union as a response to a first attack and the adoption of a targeting doctrine that permitted selected, limited but escalating attacks better tailored to meet hypothetical Soviet provocation. Within the doctrine of flexible response, counter-military attacks became even more prominent, and the original (that is, the pre-1980) counterforce doctrine was implemented in the targeting menu of the US strategic nuclear arsenal.

The apparent stability of 'mutually assured destruction' was further upset by two technological developments: the introduction of multiple independently targetable re-entry vehicles (MIRVs) by the USA in 1969 and by the Soviet Union in 1975, and the gradual improvement of the nominal accuracy of long-range nuclear weapons. The combined effect has been the perception, in both countries, that their land-based ICBMs are vulnerable to surprise attack.

The US development of missiles that carry several warheads, each capable of striking a separate target, changed the situation dramatically; if both powers had several warheads on each of their land-based missiles, an attack with perfect missiles could theoretically destroy several times more warheads than were expended. This would have the destabilizing effect of appearing to give a large advantage to the side that struck first.

It became clear to strategic planners in the United States that the Soviet Union had many more large missiles each capable of carrying numerous warheads, should the decision be taken to deploy a large number of warheads. If those warheads were accurate, powerful and reliable, they could theoretically destroy most of the US land-based missile force in its silos in a pre-emptive surprise attack. Some claimed that such an attack would force the President to capitulate to Soviet political demands. While these claims were not well-founded they were espoused by the past and current US Administrations. Thus was born the 'window of vulnerability'. In fact the Scowcroft Commission report has repudiated such claims by pointing out that the US strategic triad provides robust deterrence against any Soviet attack and that the window of vulnerability consequently does not exist.

In 1977–78, the worst fears of US strategic planners were realized: the Soviet Union began testing a new guidance system that made its ICBMs much more accurate than previous systems. This guidance system was tested on two missile systems, the SS-18 Mod ('modification') 4, and the SS-19 Mod 3. Simplified calculations indicated that by the early 1980s, when the Soviet Union was predicted to have deployed these systems extensively, they would be able to destroy nearly 90 per cent of the US ICBMs in a first strike. This premise has dominated US strategic thinking for several years and has been the primary public justification for the development of a new generation of US nuclear missiles, including the MX and the D5 Trident II missiles.

Such an attack against missile silos is in effect a new and different type of counterforce attack that places an entirely different set of requirements on the predictable performance of ICBMs. While for the pre-1980 type of counterforce attack against militarily significant—*but not hardened*—targets, accuracy and reliability requirements for the attacking ICBMs were within the operational capabilities of ICBMs on both sides, a counter-silo attack (or an attack against hardened command posts) requires, as will be shown in this chapter, an extraordinary degree of accuracy, reliability and co-ordination. Since an attack of this kind has as its aim to *win* rather than limit a nuclear war, it requires a very high degree of predictability. Anything but a completely successful counter-silo attack would leave the attacked nation with land-based nuclear weapons with which it could retaliate—and the large force of SLBMs would not have been affected. Confidence in the successful outcome of such an attack would need to be high for it to be even remotely politically and militarily conceivable, to say nothing of 'attractive'.

There are, however, considerable technical uncertainties involved in planning such a strike which are not usually considered in the simplified calculations often quoted by the Pentagon. Because tests of operational missiles are not very frequent, there is some uncertainty as to the precision of any weapon (usually measured by the Circular Error Probable, or CEP: the radius from the average point of impact within which half of the incoming warheads will fall). This is especially true in the Soviet case, as most of their tests take place on a range substantially shorter than that necessary for a strike on US silos. Since the accuracy of a weapon varies with distance, the observed accuracies during tests of Soviet ICBMs over these shorter ranges would not be equalled during operational launches, and calculating the appropriate adjustment factors is a complex and uncertain business.

Moreover, these calculations assume that there will be no systematic error, that is, that the average point of impact, from which the CEP is measured, will be coincident with the target; in fact, it is often the case that the average point of impact is offset by a systematic bias. If the bias is large, it can have a significant effect on the outcome of a counter-silo attack. Unpredictable changes in both the CEP and the bias sometimes occur when new missiles are tested, or old systems are tested over a different range, and can affect the flight path of any ballistic missile. These changes are caused by a variety of factors, including variations in the Earth's atmosphere and gravitational field, as well as errors in the guidance systems themselves.

Other uncertain factors that would affect the outcome of a counter-silo attack include the yield of the warhead, the reliability of the missile, the response of silos to nuclear effects, the co-ordination and timing of the attack, and the interference between the many warheads used in the attack, referred to as 'fratricide'. Many of these factors have never been, and can never be, tested. Thus, the level of destruction the planner of an attack could *have confidence* in achieving is much lower than that which ideal calculations would predict. Since *any* use of nuclear weapons represents an enormous gamble, such uncertainty will serve as a powerful deterrent to an attack.

This chapter examines quantitatively these uncertainties: those inherent in the performance of a complex electro-mechanical system such as that of a ballistic missile, the uncertainties in the conditions a nuclear weapon approaching a silo will encounter (conditions that have a decisive influence on the ultimate performance of the weapon), and the uncertainties in the behaviour of a silo subjected to a nuclear attack. The chapter also examines the practices employed by the military in their efforts to minimize these operational uncertainties and concludes with an evaluation of the combined effect of all these uncertainties on the predictability of the outcome of a massive, surprise counter-silo attack.[1] The conclusions are summarized in section VII, and the uncertainties are presented in tables 11.1 to 11.4.

II. The importance of uncertainty

The uncertainty of the outcome of a counter-silo attack is essentially of a technical nature. As will be argued in the next section, the majority of the current generation of nuclear weapons barely possess the combination of accuracy and explosive yield necessary to destroy a silo with high probability. Therefore any departure from their expected optimal performance introduces large uncertainties as to the outcome of the attack.

Considering the tremendous military, ecological, economic and political ramifications of such a counter-silo strike, a military planner must not only consider what the best or even the most probable *expected* outcome of an attack could be, but also what the *worst plausible* outcome is. The higher the stakes involved in any one operation, the greater the need for confidence in its success. Therefore, prudent Soviet and US planners must pay careful attention to the possibility of failure. They must consider all possible sources of uncertainty in such an attack, including unexpected but significant and systematic departures from the expected performance of the missile owing to technical failure. Former Secretary of Defense James Schlesinger stressed this point in recent Senate testimony: "perhaps the dominant element in measuring nuclear forces against each other is the unknown and immeasurable element of the possibility of major technical failure. It would tend to dominate any outcome".[2]

Despite their crucial significance in assessing the probability of a successful counter-silo attack, the uncertainties inherent in such operations and the resulting plausible worst outcomes are never discussed. In most public assessments of the vulnerability of US ICBMs, for example, offered by officials of the present and past US Administrations, no mention of these very important uncertainties is ever made. Instead, the results of an ideal attack are presented while the certain degradation of the performance of Soviet weapons, and the large uncertainties inherent in simple analytical predictive models, are ignored.

In this chapter, it will be seen that calculated outcomes of counter-silo attacks in which only 30 per cent of the attacked silos are destroyed by all-out attack are at least as probable as the calculated outcomes, usually quoted by US officials in congressional testimony,[3] that anticipate 90 per cent destruction of US silos in an all-out Soviet attack. In addition, the chapter describes the types of observable characteristic of an adversary's missile tests that can be monitored and the confidence level with which one can predict, based on the data from such observations, the most probable outcome of a potential hostile attack on one's own missile silos.

III. Physical quantities that enter calculations

The general effects of the detonation of a nuclear weapon are relevant to the calculation of the outcome of a nuclear attack against the ICBM force of a country. Modern ICBMs are stored in underground reinforced concrete silos, constructed to withstand the effects of a nearby nuclear detonation and preserve the operational readiness of the missile inside.

The most important 'kill mechanism' is considered to be the rupturing of the silo cover by the high overpressures in the shock wave. Second on the list, perhaps, is cratering: for nearly all conceivable silo designs, if the silo is within the radius of the crater excavated by the explosion, the missile will be destroyed. In addition, burial by the ejecta of the crater may prevent the missile from being launched; strong ground shock may damage or destroy sensitive equipment within the silo or the missile.

Thus the calculation of the vulnerability of a silo to a nuclear detonation is based primarily on the expected response of the silo to the blast shock wave generated by the nuclear explosion. This response in turn depends on the amount of energy released in the nuclear detonation, that is, the yield of the weapon, the distance between ground zero—the epicentre—and the silo, and the hardness of the silo. While the nominal hardness of the silo (designated H and measured in pounds per square inch, or p.s.i.) and the yield of the weapon (designated Y and measured in megatons of TNT equivalent) are determined largely by their respective design and construction, the distance of the detonation from the silo varies. One can *never predict* this distance. At best one can estimate the distance, and then calculate the possible outcome of an attack against a silo by a specific missile, for example an SS-19 or an MM III. For one's own missiles the probable distance of detonation from the silo can be calculated on the basis of both results of tests of individual components of the missile and actual flight tests of the missile. To determine the probable behaviour of an opponent's missiles in a counter-silo attack, observations of his missile tests are needed. Clearly, since such observations do not yield nearly as much information as one's own tests, a nation's predictions about an opponent's missile performance necessarily contain large uncertainties. Thus quotations of Soviet missile accuracies by the US Defense Department, for example, must command much less confidence than their quotations of the performance characteristics of US missiles.

A missile is called *precise* if all the impact points are bunched close together. A convenient quantitative expression of this precision is the CEP. This assumes that the impact points will tend to fall in a circular Gaussian (bell-shaped or 'normal') distribution. In fact this is not so; the actual pattern is more like an ellipse with its long axis along the line that joins the launch point with the target. This simplifying assumption, however, changes the calculated probability that a given weapon will destroy a given silo by only a few percentage points, and therefore it is not significant.

The distance between the centre of the distribution of impact points and the target is known as the *bias*, that is, the cumulative effect of systematic errors on the trajectory of the missile. A missile is *accurate* if both CEP and bias are small. The conventional analytical formulation used by most analysts assumes that the bias is zero, that is, that the missiles attacking a group of silos are expected not to suffer any systematic degradation of performance. This is highly unlikely in real situations. In this chapter the effects of bias will be quantified explicitly to display their importance in the expected outcome of a counter-silo attack.

With these assumptions in mind, we can now write the idealized formulae with which one can predict the probability P_k that a weapon with no bias, a given CEP (in nautical miles), yield Y in megatons and perfect reliability ($\rho = 1$) will destroy a silo of given hardness H (in p.s.i.):[4]

$$P_k(\rho = 1, n = 1) = 1 - \exp\left(-\frac{Y^{2/3}}{0.22H^{2/3}(\mathrm{CEP})^2}\right)$$

If the reliability of the missile (ρ) is less than perfect, then

$$P_k(\rho \neq 1, n = 1) = \rho\left[1 - \exp\left(-\frac{Y^{2/3}}{0.22H^{2/3}(\mathrm{CEP})^2}\right)\right]$$
$$= \rho P_k(\rho = 1, n = 1)$$

If more than one warhead, say n of them from the same missile, are aimed against the same silo, then

$$P_k(\rho, n) = \rho[1 - (1 - P_k(\rho = 1))^n]$$

while if n statistically independent warheads, each from a different missile, are aimed at the same silo:

$$P_k(\rho, n) = 1 - [1 - \rho P_k(\rho = 1)]^n$$

Therefore, in order to predict the outcome of an attack against a silo of an opponent using these formulae, a military planner must know: (*a*) the yield of the weapon to be used, (*b*) the CEP of the weapon, (*c*) the reliability, (*d*) the hardness of the silo of the opponent, and (*e*) the value of physical variables, such as gravity along the missile's entire trajectory or atmospheric density over the target, that may affect in a systematic manner the trajectory of the warhead to its target. He must further assume that if more than one warhead is used against the same silo, the conditions created over the target by the detonation of the first one will not affect the efficacy of subsequent ones.

This is usually an unwarranted assumption. Since most of the energy of the nuclear reaction is released in the first few nanoseconds (billionths of a second), the heated air does not have time to expand and initial pressures reach millions of pounds per square inch. This extremely hot, pressurized air then expands rapidly in a blast wave, radiating energy and cooling as it does so. The shock wave will cause extreme air turbulence and winds of hundreds or thousands of miles per hour. The expanding sphere of radiating gas is called the 'fireball'; it will begin to rise since it is hotter than the surrounding air, creating the characteristic mushroom cloud.

The nature of the electromagnetic radiation emitted by the air changes as the air cools. Following the initial pulse of X-rays and gamma rays, there will be ultraviolet light and then, as the fireball expands outwards, the radiation will fall into the visible range, and finally into the infra-red part of the spectrum.

If the explosion occurs on or near the ground, it will excavate a substantial crater, sucking dust and debris into the rising cloud. In addition, if the blast occurs near the ground, the blast wave will propagate into the earth, creating 'ground shock'.

The initial burst of X-rays will create a large body of ionized gas; if the spherical symmetry of this ionization is disturbed (as, for instance, if the explosion takes place on the ground, making the ionization distribution hemispherical rather than spherical), it will constitute an effective current flow that creates strong electric and magnetic fields, in a phenomenon known as the electromagnetic pulse (EMP). Since the X-rays are given off mainly in the first few nanoseconds, the rise time of the pulse is extremely short, making it difficult to protect electronic circuits from its effects.

These effects (the air turbulence, flying debris, EMP) can seriously damage, or at the very least deflect, subsequent re-entry vehicles approaching the silo over which the first detonation has occurred. This phenomenon, known as 'fratricide', is generally not taken into account in calculating the outcome of a counter-silo attack in which more than one weapon is targeted against each silo.

It has been common practice until now to ignore both fratricide and bias in calculations of the outcome of counter-silo attacks, and to assume that the values of CEP, H, Y and ρ are confidently known and stable with respect to the circumstances of use of the weapon. This is unrealistic and leads to an exaggerated view of silo vulnerability. For example, this formulation gives a probability of 60 per cent that a single warhead from a Soviet SS-18 Mod 4—having a yield of 0.5 Mt, an accuracy of 0.14 nautical miles and perfect reliability—would destroy a Minuteman silo hardened to 2 000 p.s.i. For a warhead from the SS-19 Mod 3—with a yield of 0.55 Mt and the same accuracy and reliability—the figure is 63 per cent. It should be borne in mind that this formula overestimates the probability of damage both by assuming a circular impact distribution rather than an elliptical one and by assuming that the area of damage is clearly delineated by a lethal radius that neglects the effect of pulse duration. Thus the kill probabilities for given parameters that would result from using a slightly more realistic model of the situation would be several per cent lower than those cited.

These equations give a probability of 86 per cent that two statistically independent SS-19 warheads would destroy a Minuteman silo, assuming that both warheads are 100 per cent reliable. This is the sort of alarming figure that has been given wide circulation. However, assuming a more realistic reliability of 75 per cent[5] lowers the probability of destruction to 72 per cent. This, then, is the result of the 'standard' calculations, as applied to the current situation; the next sections examine some of the uncertainties which they ignore.

Uncertainties in missile performance

Characteristic of the great inherent uncertainty of any calculation aimed at predicting the outcome of a counter-silo attack is the fact that the most important quantity, that is, the accuracy of the missile, can never be known *a priori*. From the formula $P_k(\rho=1, n=1)$ it is seen that while the kill probability is a function of the 2/3 power of the hardness and the yield, it varies with the square of the CEP. A twofold improvement in the CEP (in other words halving it) can be neutralized by an eightfold improvement in the hardness of the silo; also, it would take a yield eight times greater to match the improvement achieved by a halving of the CEP. Yet, given the factors that affect the accuracy of a missile navigated to its target by an inertial guidance system, the CEP value can be estimated only as the combined effect of a number of statistically independent errors caused by imperfections in the guidance equipment and by possible errors in the input data it receives before launching. This section examines these imperfections in instrument performance and input data, and offers some quantitative estimates of the errors that they cause in the missile trajectory.

All modern ICBMs are guided and navigated to their target by inertial guidance, a completely self-contained system that does not require any inputs from the outside once the missile is launched.[6]

Inertial guidance systems rely on Newton's law that relates the acceleration a imparted on a body of mass m by a force F, $F=ma$, to determine the path of the missile. In essence, what an inertial guidance system does is to measure the acceleration of the missile in order to determine its position and velocity; it then calculates the velocity the missile will need to reach its target, using a model of the forces the missile will experience after thrust termination, and directs the rocket thrust to match that velocity. When the current velocity of the missile is equal to that required to hit the target, the rocket is shut off and the missile enters the free-flight phase of its trajectory.

The acceleration of a missile in the Earth's gravitational field can be described by the following equation:

$$a = \frac{f_a}{m} + g$$

where a is the acceleration of the missile, f_a is the specific force acting on the missile and m is a test mass on which the force is acting. In order for this equation to hold, the reference frame of the guidance system must be non-rotating and inertial. Often, the co-ordinate frame that is used is a non-rotating frame with its origin at the centre of the Earth. The first term on the right-hand side of the function is the specific force per unit mass acting on the missile, and g is the acceleration of gravity. The specific force is the vector sum of all forces acting on the missile except the force of gravity; it includes such forces as rocket thrust and aerodynamic drag. It can be measured directly by instruments known as accelerometers.

In each accelerometer, there is a test mass, and the specific force is measured from the forces required to support the test mass. A common configuration for the measurement of the acceleration experienced by a ballistic missile during the boost phase of its trajectory is the pendulous integrating gyroscopic accelerometer, in which a single-degree-of-freedom integrating gyroscope is arranged so that a force along the measurement axis will cause a precession proportional to that force; the measurement of the gyro precession then becomes the output of the accelerometer.

Since the missile will be accelerating in three dimensions, three accelerometers, mounted orthogonally, are required to measure the three components of the specific force. In order to maintain the initial orientation of the accelerometers' co-ordinate frame, the accelerometers are mounted on a gimballed platform stabilized by three orthogonal gyroscopes. Each gyroscope is a self-contained rapidly spinning wheel; the conservation of angular momentum causes it to resist change in its angular orientation. This resistance can be translated into angular error signals; these signals are then used to control electronic servo-mechanisms, which apply torques to maintain the initial orientation of the guidance system. In this way the inertial guidance system can measure the specific forces applied to the missile in a non-rotating inertial frame and then calculate the acceleration of the missile caused by the thruster rocket. It should be noted that accelerometers do not measure the force of gravity. An accelerometer in a free-falling elevator would register zero, as its real acceleration would be cancelled by the effects of the Earth's gravitational field. While the missile is in free-fall, therefore, the accelerometers read zero, even though the missile is accelerating under the force of gravity. Thus, in order for the guidance system to calculate the actual acceleration of the missile, the gravity vector, as a function of position, must be programmed into the missile's guidance computer before launching. By combining the instantaneous value of the specific force provided by the accelerometers and gyroscopes with the information concerning the gravitational field provided by the missile's guidance program, the guidance computer calculates the true three-dimensional acceleration of the missile. The computer then integrates once to find the missile's instantaneous velocity and a second time to find the missile's position at any instant during the boosting portion of its flight.

A ballistic missile is guided only during the few minutes that its rocket is burning. In a solid-fuel missile, the only variable that can be controlled in order to navigate it to its target is the *direction* of the thrust generated by the booster rocket. Once the guidance computer has calculated the missile's instantaneous current position and velocity, it calculates the velocity *needed* to reach its target from that position. The motion of the warhead after thrust termination, or 'burn out', is predicted using a detailed mathematical model of the forces that will act on it during the rest of its flight, such as gravity and aerodynamic forces. Clearly, the accuracy of this model is as important as that of the accelerometers and gyroscopes themselves. The guidance computer then takes the vector difference between the instantaneous current velocity and the required velocity, and steers the rocket thrust parallel to that difference. If the rocket thrust is controlled properly, all three components of the velocity difference should then go smoothly and simultaneously towards zero. While the control of the rocket is a difficult problem in itself, the inertial guidance system can sense and compensate for any errors that build up as a result of the rocket not responding perfectly to guidance signals. When the three components of the missile's actual velocity are each equal to the corresponding components of the velocity needed for the missile to reach the target, the guidance computer shuts off the booster rocket and the payloads—the re-entry vehicles that contain the nuclear warheads—are separated from the missile and each is sent in a slightly different trajectory towards the targets.

From the above discussion of inertial guidance, it can be seen that there are two broad types of possible error in a ballistic missile system. First, errors can build up during the boost phase, as a result of pre-launch conditions, guidance system errors, thrust termination errors or inadequate modelling of the Earth's gravitational field. These types of problem result in an erroneous calculation of the missile's position and velocity at thrust termination: while the guidance computer has calculated that the instantaneous velocity of the missile is equal to the required velocity, the *actual* velocity of the missile may not correspond to this value. The other broad class of error arises from the need to predict the forces that a missile will encounter *after* thrust termination. The most prominent errors in this class are those due to atmospheric variations and those that arise from anomalies in the Earth's gravitational field.

From a rigorous mathematical formulation of the missile's trajectory it is possible to predict the size of the target miss that each of the errors during the launch and boost phase will cause because *the target miss is always proportional to the size of the guidance error*: the bigger the error, the bigger the miss. The same proportionality relationships between guidance errors and target miss allow an estimation of the magnitude of the uncertainty of the expected target miss. Guidance error can be subsumed under four categories, each corresponding to a different part of the missile's trajectory: (*a*) pre-launch errors, (*b*) boost-phase errors, (*c*) free-fall trajectory errors, and (*d*) re-entry and warhead fusing errors.

In order to function, the guidance system requires information about the position, velocity and orientation of the missile before launch. In addition, the position of the target in the same reference frame must be part of the input information. While there is no difficulty in determining the initial velocity of the missile—it is the speed of rotation of the surface of the Earth at the location of the silo—some error is unavoidable in determining the relative distance between target and silo. It is necessary to utilize satellite ranging techniques to develop targeting maps. A satellite passing over the target can measure the direction of the target with respect to the satellite. Estimating the position of the satellite at the time the measurement was taken requires accurate clocks on board the satellite and an accurate model of its orbit. Orbit models are developed by long observation of satellites, utilizing models of the gravitational, drag and other forces acting on them. Minimum and maximum targeting errors of 20 and less than 100 metres respectively about each axis are assumed. The original orientation of the guidance system in the missile is potentially a source of significant errors. Finding the true vertical at the silo is complicated first by the fact that the local vertical at a point on the Earth is defined as the direction of the gravity vector at that point. Because of local anomalies of the gravitational field, however, the gravity vector may not be pointing to the centre of the Earth. A second source of potential error in defining the true vertical comes from the imperfection of the accelerometers. Each of these sources can contribute angular errors from a microradian (10^{-6} radians) to at most a few microradians. These translate to target miss errors from 60 m in range and 10 m in track to errors of about double these figures. Aligning the guidance system precisely with the line that points from the silo to the target can cause errors of 10 to 20 microradians or more. These in turn do not cause substantial range errors at the target, but the track error can be anywhere from 70 to 150 metres.

Once powered flight begins, errors can arise from several sources. Both gyroscopes and accelerometers have a wide variety of error modes, some time-dependent, some dependent on acceleration and vibration, some dependent on the square of acceleration, some essentially random. An accelerometer produces an output signal by measuring the forces required to support a test mass within the instrument. It will measure incorrectly if forces other than those of the calibrated support structure act on the test mass or if the calibration of the measurement of the support forces is incorrect. This will create accelerometer biases; their characteristics will depend on the behaviour of the extraneous force involved.

A time-dependent accelerometer bias might result from any constant extraneous force acting on the test mass; an example might be an electrostatic field arising from a charged object in the vicinity of the accelerometer. Many other types of bias arise from sources that behave in a way that is nearly random; as an example, the DC magnetic torques on the gimbals of the platform inevitably create electromagnetic fields around the inertial instruments. Since the current is typically changing through time, and the torque vectors are moving with respect to the inertial instruments, the extraneous forces on the accelerometers vary unpredictably with time and can be an important source of error. These biases can cause target miss errors of 40 to 100 m in range and 10–20 m in track. If the output of the accelerometer is improperly calibrated, it will result in an error in the sensed acceleration which is proportional to the actual acceleration. A calibration error of one part per million will cause a range error of 40 m and no track error at the target. It is not uncommon for modern instruments to achieve such precision in calibration.

One last accelerometer-caused error (which has contributions both to the pre-launch and to the boost phase error budgets) is the possible improper alignment of the accelerometers. It is possible that the accelerometers are not exactly orthogonal to each other. A misalignment of one microradian will cause a range error of 20 m and track error of 5 m. It is possible, however, that the misalignment would be more severe, and errors of 50 m in range and 10–15 m in track cannot be excluded.

Like accelerometer errors, spurious precessions or 'drift' of gyroscopes can arise from a number of sources. Such drifts will cause the platform on which the accelerometers are mounted to rotate, degrading the alignment of the system and hence introducing error in the accelerometer's measurements of the three components of the specific force. One type of gyroscope drift is constant with time and is called 'bias drift'. It arises from a constant extraneous torque on the gyro support gimbals. Electrostatic gyroscopes for inertial navigation are reported to have remarkably low drift rates, of the order of 2×10^{-8} radians/h. But gyroscope performance in the very demanding acceleration environment of a boosting ballistic missile is considerably worse. The errors caused by gyroscope drift will depend on the specific boost-phase trajectory, if it is assumed that each gyroscope has an uncorrelated bias drift of 5×10^{-5} radians/h, corresponding to a range miss of 45 m and a cross-range miss of 15 m. It is possible, of course, that the drift errors are larger or that the trajectory is such that the boost phase lasts longer than the 180 seconds assumed here for the sake of calculating the values of target misses. Therefore, track and range misses twice as large cannot be excluded.

There are many sources of torque in a typical gyroscope that depend on acceleration. As an example, if the centre of mass is not exactly centred on the support, a torque will develop proportional to the sensed acceleration. In a typical gyroscope, a centre of mass offset by no more than a few angstroms could cause substantial errors. Such offsets can be constant with time, as in the case of error in the fundamental manufacture of the gyroscope and its support gimbal, or they can change in complex ways, as in the case of imbalances caused by temperature gradients causing non-symmetric expansion or contraction of the instrument. The latter is a significant source of error in many systems of this type.

Another source of accelerator-dependent gyroscope error is the compliance of the instrument under acceleration. Under high accelerations, the structure will typically deflect somewhat, moving the centre of mass. Theoretically this movement of the centre of mass should be parallel to the acceleration, resulting in no torque, but asymmetries in the support structure or in the properties of the wheel bearings will often cause the motion of the centre of mass to be not exactly along the acceleration axis, causing an extraneous torque to develop. Since both the motion of the centre of mass and the torque caused by a given imbalance are proportional to the acceleration, the resulting precession will be proportional to the square of the acceleration.

The gyroscopes can be arranged to minimize the effect of the actual thrust, but since the effect is proportional to the square of the acceleration, the effect of vibratory accelerations will not be nullified by their constant changes of direction, and this can cause significant errors. Errors of this sort are difficult to predict, since they depend not only on the properties of the gyroscope but also on the types of vibration caused by the rocket, which are more difficult to account for using most calibration techniques.

Depending on the boost-history of the missile, these gyroscope imperfections can result in target misses between 75 and 150 m in range and

25 to 50 m in track. The accuracy with which the guidance computer can decipher the outputs of the guidance instruments, calculate the anticipated post-boost trajectory and direct the thrust of the rocket accordingly is limited primarily by the speed and complexity of the computer.

In the guidance formulation used by US missiles (explicit guidance) the computer is given only the co-ordinates of the target and a single parameter (such as the angle of travel at thrust termination) which specifies the trajectory to be flown. It then performs all the calculations necessary and continuously recalculates the optimal way to reach the appropriate end-conditions, given the trajectory flown up to that time. The advantages of this method are improved accuracy, in some cases, and improved retargeting capability.

There is no fundamental limit on the accuracy with which the programme can execute the appropriate calculations; given the capabilities of current digital computers, this error source should by now be comparatively small. Errors of 15 m in range and 5 m in track seem sensible for the case of US ballistic missiles. Soviet missiles may have computation-derived errors twice as large or larger.

As the missile approaches burn-out, the rocket generates thousands of pounds of thrust, which must go to zero essentially instantaneously when the guidance computer determines that the missile has reached the required velocity. However, the thrust of any real rocket takes some time to decay, and does so rather unpredictably. Given the target miss caused by relatively small velocity errors at thrust termination, this would be a major error source if it were not given special attention.

Errors due to thrust termination are reduced to a minimum by the addition of a low-thrust 'vernier stage', often called the 'post-boost vehicle'. This stage will make final trajectory corrections using extremely low thrust, so that the unpredictable elements of thrust decay will be less of a problem. In MIRVed missiles, this stage is responsible for setting each warhead on its separate trajectory. The accuracy of the delivery of each consecutive warhead will be marginally worse than the accuracy of the first one, since the guidance errors will continue to build up throughout the time it takes to disperse all warheads. However, there is no reason to believe that MIRVed weapons will be fundamentally less accurate than single-warhead weapons.

It should be noted that the choice of targets for the MIRVs on a given weapon is not completely open. The distance by which the targets may be separated is limited by the extra velocities the post-boost vehicle can impart to the warheads; so typically, a post-boost vehicle might have a 'footprint' of 500 km by 150 km. Under these circumstances thrust termination errors may cause a range miss of 40 m, but perhaps not more than twice that.

For the computer to send the signal to terminate thrust, all three components of the sensed velocity must have reached their correct values simultaneously; this usually means that the entire system has functioned without major failure up to that point. The only possible failures that can have occurred are a major failure in the computer or an *undetected* failure in one or more of the guidance components. Thus, the thrust termination signal is often used for other purposes as well. It might be used to arm the warhead with reasonable assurance that the missile would not go significantly awry from the intended target. It could also cause a simple signal to be sent to command centres on the ground; they would then recognize those missiles that did not send such a signal as failures reasonably early in the flight, and could retarget other missiles for those targets. Since about 80 per cent of failures will occur by the time of thrust termination, this ability to retarget for those missiles could be quite significant in some attack senarios.

The numbers used to give a quantitative measure of errors one can expect to be generated from the imperfections of the guidance system of a missile are based on several assumptions regarding the trajectory of the hypothetical missile: that the range is 10 000 km, that the trajectory is a 'minimum energy' one (that is, that at thrust termination the velocity vector makes a 22° angle with the horizontal), and that all the error-causing effects are both linear and constant with time. Furthermore, the assumed performance characteristics of the guidance system may be rather inflated for currently deployed systems, but may be surpassed in the case of the guidance system of the MX missile.

Uncertainties in gravitational anomalies

The inability of the accelerometers of the missile's inertial navigation system to measure the force of gravity leads to a potential source of errors that will cause a ballistic missile to miss its target. The guidance computer must therefore be provided with a model for calculating the gravity vector as a function of position, so that it can then calculate the missile's real acceleration during the boost phase. In addition, the guidance system must be provided with accurate information about the gravitational field the missile will encounter after rocket burn-out, in order to calculate the appropriate burn-out velocity needed to reach the target. The variation of the gravitational field a missile would encounter over different trajectories has been repeatedly invoked in public as an obvious source of degradation of missile accuracy in operational trajectories. There seems to be considerable confusion surrounding this matter, so special attention is devoted to it in this chapter.

If the Earth were a perfect sphere of uniform density, there would be no difficulty in predicting exactly the magnitude and direction of gravity from simple Newtonian mechanics. But the Earth is a somewhat irregularly shaped ellipsoid of varying density. This gives rise to a gravity vector that varies from place to place, in both magnitude and direction. Thus, the gravity a missile experiences over one trajectory will be different from the gravity it experiences over another. If these variations are not predicted sufficiently accurately, they can cause significant impact errors at the target. In absolute terms, gravity variations are generally quite small. The root-mean-square value of the gravity anomaly in the continental United States is approximately 17 milligals (one milligal is roughly one millionth of the average acceleration of gravity). In mountainous regions, the anomalies can reach some hundreds of milligals. Typical deflections of the vertical are correspondingly small.

Since the force of gravity on a missile varies with the inverse square of its distance from the source of the force (in this case the Earth and the density anomalies in it), gravitational anomalies have the greatest effect on the missile when it is close to the Earth, that is, during the boost phase and when approaching the target. Since the re-entry vehicle travels for a very brief time near the surface of the Earth before reaching the target, errors in its trajectory due to gravitational anomalies do not have time to affect the velocity vector. Thus unpredicted gravitational anomalies near the target do not contribute significantly to any target miss errors. Since gravitational anomalies tend to even out with distance, and since the gravitational field strength at 200 to 1 500 km above the Earth—the usual apogee for a ballistic missile—can be sampled in detail by orbiting satellites, gravitational anomalies will introduce small unexpected variations in the trajectory of the re-entry vehicle during the free-fall portion of its trajectory. The gravity anomalies near the launch sites of missiles can be mapped and modelled in a manner that allows the guidance computer of the missile to calculate the effects of the gravitational field on the missile's acceleration. The accuracy is such that the errors in the missile's trajectory caused by gravitational anomalies are comparable in size to the error caused by the imperfection of the guidance system. Thus gravity errors do not dominate the error budget that makes up for the CEP of the missile. In the United States at least, reduction of the magnitude of gravity-introduced errors has kept pace with improvements in the rest of the performance of guidance systems (otherwise gravitational uncertainties would completely obscure the results of flight tests performed to measure the effects of improved guidance and control components on the accuracy of the missile). Given the performance of modern guidance systems, it is difficult to imagine that gravity anomaly errors would be allowed to contribute more than 50–75 m in range error and 15–25 m in track error. Therefore one must conclude that even if these errors were systematic—since they would be the same for a group of missiles housed in silos of the same silo-field—the bias caused by gravitational anomalies is small compared to the most probable CEP of modern ICBMs.

Re-entry errors and uncertainties

The same cannot be said about the uncertainties in a missile's performance introduced by errors during the re-entry of the weapon into the atmosphere. Because the re-entry vehicle (RV) enters the atmosphere with a velocity of several kilometres per second, aerodynamic forces will create the most severe environment the warhead experiences during its flight, heating the surface of the RV to temperatures of thousands of degrees Celsius, and subjecting it to forces tens of times stronger than the force of gravity. As a result, for most of its entry, the RV is surrounded by a flow-field of incandescent, ionized plasma that wears out the protective shield of the RV.

In order to protect the warhead and related electronics inside the vehicle from these extreme conditions, the re-entry vehicle is protected by an ablating thermal shield. Rather than absorbing the heat in a heat shield, the RV is coated with material that burns away, or ablates, during the course of re-entry, carrying the accumulated heat with it as it peels off. With this method much lighter RVs, with greater accuracy, can be produced. Currently, the thrust of re-entry technology is not so much on mere survival through the re-entry environment as on the design of ablative materials, especially for the nose-tip of the vehicle, which will ablate symmetrically and predictably at extremely high re-entry speeds and under a variety of re-entry conditions, such as passage through a rain storm or a layer of dust.

The forces acting on the re-entry vehicle during its passage through the atmosphere are so large compared with the dynamic loads during the boost and coasting section of the trajectory that it is reasonable to anticipate that it would be difficult to control the motion of the RV and avoid unexpected departures from the correct trajectory. Indeed, re-entry errors are large and unpredictable by comparison with other sources of target miss.

Three main forces operate on the RV during re-entry. The largest of these is the aerodynamic drag; second is the force of the Earth's gravity and, if the RV is not absolutely symmetrical with respect to its line of flight, it will also experience some lift.

The deceleration caused by the aerodynamic drag on a re-entry vehicle is given by the simple relationship

$$a_D = \rho v^2 / 2\beta$$

where ρ is the density of the medium the RV traverses, v its velocity with respect to the medium and β the weight-to-drag ratio of the re-entry vehicle or 'the ballistic coefficient of the vehicle'.

Prediction of the forces that will act on the RV needed for determining *a priori* its exact trajectory through the atmosphere that ends at the target requires exact knowledge of ρ, β and v. Clearly the effective ρ, the density of the air, over the target that will be experienced by the RV will be very different depending on the barometric pressure, humidity and weather conditions (rain and snow in the air, for example, will increase ρ). Therefore, unpredicted weather changes over a target during an attack can cause substantial target misses. Winds over the target can also influence the flight path of the RV. Therefore the RV can suffer considerable departure from its intended trajectory if weather conditions over the target are not somehow assessed and factored into the computation of the RV's trajectory following boost termination.

Although β is a design parameter of the RV, its effective value can be changed by unexpected or asymmetrical ablation of the nose-tip and ablative shield of the RV. For example, a higher effective density, or the presence of rain or snow in the air above the target, can cause unexpected changes in the rate of ablation and therefore of the effective β of the vehicle that changes continuously as the RV approaches its target.

Worst of all, asymmetrical ablation can cause effective lift or bending forces that, unpredicted (and unpredictable) as they are, can increase target-miss by hundreds of metres. In order to avoid effects caused by asymmetrical erosion of the nose-tip or shield of the RV and the resulting lift force, the RV is made to spin during its passage through the atmosphere. This averages out any lift forces and tends to keep the RV on its intended trajectory. It is possible, however, that the spinning could be reversed or stopped, in which case large errors in the detonation point of the weapon are unavoidable.

Many of the adverse effects of re-entry are minimized as the angle at which the RV enters the atmosphere with respect to the horizon becomes larger. Steep angles of descent require higher β and imply more rigorous re-entry conditions. Yet if an RV can be manufactured that can withstand the extra thermal and mechanical loads of steep descent, it will be intrinsically more accurate.

In tests, only a very small number of warheads are tested at any one time, so that the effect of atmospheric variations will appear as *random* error in a typical series of tests conducted over a long period of time. However, in a large-scale counterforce attack, all the RVs in the first attack wave against a given missile field will be re-entering the same area of the atmosphere at the same time, and so their errors due to atmospheric variations will be strongly correlated, appearing as a *systematic bias*; if one RV is blown off target, it is quite likely that other RVs targeted on the same area will experience similar effects.

It is extremely difficult to estimate the variations in range and track errors caused by the rigours of re-entry. Under placid weather conditions, the error can be as small as 100 m in range and 50 m in track. But unexpected conditions or circumstances can easily multiply these figures several times. The 100–200 m range error and 50–75 m track error that are listed in the error budget in this chapter are hypothetical postulates rather than actual data derived from tests. The reader must use them as examples of the magnitude of re-entry errors and not as definitive figures.

Uncertainties in the fusing of the warhead

Once the re-entry vehicle reaches the target it must be made to explode by triggering its fuse.

For ground-burst weapons, fusing can be accomplished simply and reliably with either a contact fuse in the nose or, if there is some probability that the warhead will hit an object (such as a low wall or stake) without touching it with the nose, shock fuses can be used that perform reliably and well.

A more difficult problem arises in the case of air bursts. Here, the fusing requirements for different missions are quite different. The radius at which relatively soft targets will be destroyed is very closely dependent on the height of burst; accuracy in the determination of the RV's distance from the ground is thus very important in counter-city attacks, even though the accuracy of its horizontal position over the ground is usually not crucial. In the case of hardened missile silos, however, the situation is just the opposite; the dependence of the radius of destruction on the height of burst is weak but the requirement for horizontal accuracy is tight.

The two preferred methods are path-length fusing, which relies on an accelerometer in the RV integrating over the entire path and setting off the fuse when the appropriate path length has been traversed, and radar altimetry, which relies on radars mounted within the RV sensing the distance between the RV and the ground. This is more difficult than it might seem, both because of the environments the radars must withstand and because the RV is spinning so that any single radar will be looking directly down only for a small fraction of the time.

The accuracy of these fusing methods depends, of course, on the quality and the design of the fuse. The radar altimeter fuse of the current MK 12A warhead was said to be inaccurate enough to noticeably reduce its kill probability against hardened targets, implying an inaccuracy of several tens of metres.

The interaction of errors caused by re-entry conditions described above and the uncertainty inherent both in the path length and radar altimeter fusing methods can cause substantial departure of the point at which the weapon detonates from its intended point of detonation. Departures of 40–80 m along the flight path of the RV caused by fusing errors cannot be safely excluded.

Other errors

Public references have been made to other potential sources of error in the delivery of nuclear weapons by ballistic missiles: the interaction of electrostatically accumulated electric charges on an RV with the geomagnetic field and the effects of the Sun's and the Moon's gravitational fields have been mentioned in particular. Simple calculations indicate, however, that these effects contribute possible errors that are insignificant in magnitude compared with the quantities listed in the error budget. Since CEP = 0.59 (error in range plus error in track), the errors postulated in this chapter result in a lower CEP of 0.08 nm and an upper one of 0.16 nm —figures that are close to the expected performance of the US MX missile and the best of the deployed Soviet missiles, respectively.

Table 11.1. Error budget for the delivery of nuclear weapons by ballistic missiles

	Range error (m)		Track error (m)	
Source of error	Lower	Upper	Lower	Upper
Initial position	20	100	20	100
Initial alignment				
vertical	60	120	6	15
azimuth	0	0	75	150
Accelerometer non-orthogonality	15	50	0	10
Accelerometer bias	45	100	5	20
Accelerometer scale factor	40	40	0	0
Gyroscope bias drift	45	100	15	30
Gyroscope vibration-caused drift	75	150	25	50
Guidance computation	15	30	5	10
Thrust termination	40	80	0	0
Gravitational anomaly	50	75	15	25
Re-entry	100	200	60	75
Fusing	40	80	0	0
Root-mean-square	180	360	105	207

CEP = 0.59 ($\epsilon_T + \epsilon_R$) = 0.59 (360 + 207) = 335 (ϵ = error, T = track, R = range)
= Lower 166 m or 0.08 nm
= Upper 335 m or 0.18 nm

IV. The role of bias

In the above treatment of the possible errors and uncertainty of errors in delivering a nuclear weapon against a silo, it has been assumed that all the contributions are statistically uncorrelated and, by implication, that the centre of the distribution of impact points of a larger number of missiles (or warheads) aimed at the same target would be collocated with this target. Although this is in line with the common practice according to which public calculations of silo vulnerability have been made in the past, there is little reason to expect that it corresponds to what one can realistically expect to happen in an actual nuclear attack against the silos of the USA or the USSR. As is the case with most complex electro-mechanical systems, the possible error sources of an ICBM are a complex combination of random errors reflected in the size of the CEP and systematic errors that would manifest themselves as a displacement of the centre of the impact distribution from the target, that is, as a bias.

There has been considerable public debate regarding the significance of bias, but much of it has been somewhat confused; part of the problem is that there are two competing definitions of CEP and bias. The first is the definition generally used by the US Air Force: this defines the CEP as the radius of the circle, *centred on the target*, which contains half of the impact points, and the bias as the distance from the target to the average point of impact. The second definition defines the bias in the same way but uses the average impact point rather than the target as the centre of the CEP circle. The first definition of the CEP *includes* the bias, in some sense providing a real measure of the *accuracy* of the system, that is to say, how far from the target the warheads will land. The second definition of the CEP, on the other hand, measures only the *precision* of the weapon system, or how far the warheads are scattered from the average point of impact. With this definition, both the bias and the CEP are required to determine how close to the target the warheads would land. In the first definition, the CEP no longer uniquely describes a normal circular distribution, so the relationship between CEP and the standard deviation of the distribution no longer holds; without knowing the bias, it is impossible to calculate the standard deviation from this definition of the CEP, so it is impossible to perform the necessary integrations to calculate the probability of kill. The second definition of the CEP retains the same relationship between the CEP and the impact distribution described in the last section, and so it can be used more easily to calculate the kill probability for a given value of the bias.

Although both these definitions refer to a single target with a very large number of warheads landing around it, this will not be the case in a real attack; instead, there will be a large number of similar targets, with perhaps two warheads falling near each one. If the targets are assumed to be essentially the same, then the situation is statistically identical: the CEP and the bias are then defined by taking a large number of targets together. For example, if in an attack on 1 000 targets the warheads on the average fall 50 m short of their target, then the weapons are said to have a bias of 50 m, just as would be the case with an attack on one target. Most of the error sources of modern ballistic missiles contribute both systematic and random components. For example, a given accelerometer error might vary randomly from one missile to another, or all of the accelerometers of that type might give similar errors. By vigorous calibration and testing, it should be possible to eliminate or at least reduce to tolerable levels this type of systematic error, since it arises from sources within the missile itself (such as the guidance components and program). Small systematic errors, however, may be expected to remain uncorrected even after a missile has been tested repeatedly.

Systematic errors that arise outside the missile present a greater problem. As was shown above, gravitational anomaly errors, errors due to atmospheric variations and targeting errors will all act largely as systematic errors in a counter-silo strike, and their effect will change from one trajectory to another, making them difficult to eliminate by testing over a small number of trajectories. Former US Secretary of Defense James Schlesinger has commented on exactly this problem:

I believe there is some misunderstanding about the degree of reliability and accuracy of missiles. As this chart explains, it is impossible for either side to acquire the degree of accuracy that would give them a high confidence first strike because we will not know what the actual accuracy will be like in a real-world context.

As you know, we have acquired from the western test range a fairly precise accuracy, but in the real world we would have to fly from operational bases to targets in the Soviet Union. The parameters of the flight from the western test range are not really very helpful in determining those accuracies to the Soviet Union. We can never know what degrees of accuracy would be achieved in the real world. I think that that is probably advantageous. . . .

The effect of this is that there will always be degradation in accuracy as one shifts from R&D testing, which is essentially what we have at the western test range, to operational silos. . . .

We know that and the Soviets know it, and that is one of the reasons that I can publicly state that neither side can aquire a high-confidence first-strike capability. I want the President of the United States to know that for all the future years, and I want the Soviet leadership to know that for all the future years.[7]

In that testimony, Schlesinger cited 0.1 and 0.2 nautical miles as possible 'operational degradations' of accuracy. He has repeated his comments quite recently, again in Congressional testimony:

Happily, no one has ever fought a nuclear war. Not only have ICBMs never been tested in flying operational trajectories, they have not been tested flying north, and this may or may not introduce certain areas of bias in the estimates of accuracy. . . . Consequently, neither the Soviet Union nor ourselves has appropriate test data to buttress the estimates regularly made about either nation's strategic forces. . . . For these reasons, perhaps the dominant element in measuring nuclear forces against each other is the unknown and immeasurable element of the possibility of major technical failure. It would tend to dominate any outcome. Given the spotty Soviet history in dealing with modern technologies, one would hypothesize that this must be a constant worry of the Soviet leaders. . . .[2]

J. B. Walsh, who had a more direct role in the development of testing of ballistic missiles than Secretary Schlesinger (he was then Deputy Director of Strategic and Space Systems, Defense Research and Engineering), made some similar observations in 1976 testimony:

The problem with increased accuracy is your confidence in that accuracy. . . . I have concern about uncertainties and factors that might have been left out, biases in the system for example, I might be able to fire 10 RVs from 10 separate missiles and land in exactly the same spot, except that the spot is removed by a fraction of a mile from the target. And it is very difficult to find that kind of error or to know it exists. And that, of course, is the purpose of many of our flight test programs, to be sure such errors do not exist. So there is a problem . . . of acquiring confidence that you really have achieved the accuracy.[8]

The limited nature of the testing process that will be described below and the fact that no weapons have ever been tested over the trajectories between the United States and the Soviet Union make some systematic errors inevitable in any counter-silo attack. Given that errors resulting from targeting, gravity anomalies and the effects of atmospheric variations on re-entry will all act largely as systematic errors in the context of a large counter-silo strike, systematic biases are unlikely to be negligible. Given that guidance errors, thrust termination errors, initial alignment errors and re-entry ablation errors will act largely randomly, it would be surprising if, on the average, the bias were not somewhat smaller than the CEP.

However, the task of predicting upper bounds for such errors is complicated by the fact that, unlike random errors of the sort described by the CEP, the 'law of large numbers' would not apply to systematic errors in a counter-silo attack. In a major counter-silo attack involving some 2 000 warheads, the probability of a significant random variation from the mean CEP is very small, as the number of trials is very large; the only significant uncertainty would be in extrapolating the mean CEP itself from a limited number of tests. In the case of systematic errors, however, the number of 'trials' in the statistical sense will be quite small; for example, if there are six ICBM fields being targeted, there will be essentially only six 'trials' for atmospheric errors, and the possibility of significant random variation from the 'expected' outcome is quite large. Indeed, a much larger than expected bias at even one field could enable a significant percentage of the silos in that field to survive; even if the 'expected' bias could be determined, it would be imprudent to discount the possibility of large random departures from this value over one field.

In summary, the bias in a counterforce attack may be smaller than the CEP but of the same order of magnitude. However, it will be difficult for the planner to ensure that this will be the case in a specific strike. Consider as an example the double-shot kill probability for an SS-19 warhead against a Minuteman silo, for four possible values of the bias. While one may believe that a bias of the order of 0.05 nautical miles or less will be more likely than one of 0.15 nautical miles, it is very difficult to place upper bounds on systematic error.

Bias	0.00	0.05	0.10	0.15
$P_k(\rho=0.75, n=2)$	0.72	0.70	0.62	0.50

Thus even without considering uncertainties in the other two relevant variables that determine P_k, namely variation in Y, the expected amount of energy released by the weapon (and the overpressure it would generate), and H, the effective hardness of the silo, it is evident that the attacker would be faced with considerable uncertainty regarding the outcome of a counter-silo attack. He would have no rational grounds for assigning a higher probability of occurrence to the $P_k=0.70$ prediction rather than to the $P_k=0.50$ outcome.

The testing of ICBMs

Both the USA and the USSR have attempted over the years to obtain enough experimental information about the performance of their ballistic missiles by testing both new and existing ICBMs in order to minimize the uncertainties discussed so far.

Before proceeding to a description of test practices and what one can learn from them, it is important to make a clear distinction between the amount of information (and the confidence one can have in it) that a country can glean from tests of its own missiles as opposed to what observation of the tests of another country can provide in terms of reliable information. For example, while one can confidently expect that the CEP of US missiles as quoted by US authorities contains inherent uncertainties of the size discussed here, one *cannot* be as confident about US statements regarding Soviet missile CEPs and vice versa. These latter numbers must necessarily incorporate much larger uncertainties that result from the nature of the information one can gather by observing an unco-operative opponent's missile tests from a distance. The degree of confidence which may be placed in such public statements can best be established by an examination of the testing procedures of the USA and the USSR, and the manner in which each nation observes the testing of missiles by the other. It is through this testing that the values of the errors listed in the error budget are established. The reader will have to judge with what degree of reliability these tests endow the CEP values for US and Soviet missiles quoted in public. Estimates of a missile's precision, accuracy and reliability are derived from detailed testing both of individual components and of the entire weapon system.

A modern ballistic missile is an extremely complex electromechanical device, comprising hundreds of smaller subsystems. The rigorous testing of each of these components is an integral part of their development: typically, detailed specifications of the total allowable error and failure rate are included in the contract to develop the component, and each component undergoes very extensive testing to verify that the basic physical principles on which the new design is based have been successfully incorporated into an operational device that performs in accordance with the specifications of the designer.

Full-system testing of these missiles follows, since it is impossible to develop a new system as complex as an ICBM without an extensive series of full-system tests.

Modern ICBMs generally undergo fewer pre-deployment flight tests than did earlier systems; currently, both the USA and the USSR typically perform about 20–30 tests of a new system before full-scale production begins.

Once a new ICBM has been produced and deployed, the first task is to perform enough operational tests to provide statistical confidence in estimates of the accuracy and reliability of the deployed weapons. In the case of the US Minuteman II and Minuteman III missiles, roughly 40 such tests were conducted in the initial years of deployment. The guidance system of a deployed ICBM is constantly tested non-destructively, since it has a variety of performance characteristics that have been known to change unpredictably after prolonged operation. In order to keep the missile on constant alert, the guidance system must be kept running continuously; thus, for example, the high-speed gyroscopes that make up the core of the inertial measurement unit must be kept spinning for tens of thousands of hours, creating the possibility of degradation in the instrument's performance, or of actual failure.

Despite extensive subsystem tests, continued full-system flight testing remains necessary throughout the life-cycle of an ICBM, to monitor any changes in the accuracy or reliability of the full system that may result from prolonged operation and storage and to maintain confidence in initial estimates of system accuracy and reliability. The USA typically conducts 5–10 such tests of a given type of ICBM each year. The USSR conducts a substantially larger number of total operational tests.

An effort is made to maximize the amount of information available from any one test: for this reason, most of the ICBM flight tests conducted by both the USA and the USSR take place over heavily instrumented test ranges. The US ICBM flight tests are launched from Vandenberg Air Force Base in California, and are targeted on the lagoon of Kwajalein Atoll in the Pacific Ocean; both Vandenberg and Kwajalein have telemetry equipment, radar, and other instrumentation with which to monitor the progress of the test. Since essentially the entire flight is over the ocean, the safety hazards are minimized.

The Soviet Union conducts the majority of its ICBM flight tests from two major test sites. The first of these, although usually referred to in Soviet literature as the 'Baikonur Cosmodrome', is in fact 370 km southwest of Baikonur, near Tyuratam (45° 6′ North, 63° 4′ East). From there, ICBMs are fired into a heavily instrumented range on the Kamchatka peninsula and occasionally at longer range into the Pacific Ocean. The second ICBM test centre is at Plesetsk (62° 8′ North, 40° 1′ East), and serves mainly for testing intermediate-range ballistic missiles.

While both nations have tested ICBMs over several other ranges (the USA, for example has flown ICBMs from Cape Canaveral in Florida to Ascension Island in the Atlantic), both the number of tests over other ranges and the number of different trajectories flown have been quite limited. This is not true of SLBM testing, but the differences in error budgets and the specifics of operational launches between SLBMs and ICBMs are so large as to make it difficult to usefully compare data between the two types of testing.

The testing sequence in the United States is as follows:

1. A missile is selected at random, from the operational ICBMs in the silo fields.

2. While still in its original silo, with its original crew, the missile is brought to alert status, ready for immediate firing. This procedure is intended to test the condition of the silo, the crew and auxiliary electronics. If the missile fails to come to alert properly, it is listed as a failure and not tested further.

3. The operational re-entry vehicles are removed from the missile. The re-entry vehicles are then shipped to a special facility in Texas, where the weapon is removed from each one and replaced with telemetry equipment to monitor the missile flight.

4. The missile is taken from its silo and shipped to Vandenberg Air Force Base in California, where it is placed in a test silo. The only major

differences between this silo and an operational one are the design of the silo cover, which on the test silo is reusable, and the fact that the test silo is covered with a protective substance so that it will not be severely damaged by engine firing and can be made ready for further tests with reasonable speed. The test silo is manned by randomly selected crews from the operational missile fields who are transported to the test site for this purpose.

Air Force spokesmen insist that no extraordinary maintenance or 'gold-plating' of the missile takes place. There are two changes to aid the testing process: first, the re-entry vehicles contain only telemetry equipment; and second, for safety reasons, the missile is 'wired' so that it can be destroyed should it go awry. Neither of these changes should have any effect on the missile's flight path or reliability.

5. The missile's guidance system is aligned and calibrated, as described in a previous section. (This is done every 30 days at the operational silos; in test, the missile is aligned and calibrated soon after its arrival at the test silo and then launched 15 days later in order to get an average result. This assumes, of course, that the decay of calibration and alignment with time will be reasonably linear.)

6. The missile is again brought to alert. If it fails to come to alert, having succeeded in its original silo, the problem is investigated. If the failure is clearly attributable to a problem within the test silo, it is listed as a failure. If no such error can be found, the problem is attributed to damage incurred during transportation of the missile, and the event is not listed as a test failure.

7. The missile is then fired from Vandenberg to Kwajalein lagoon, a distance of about 8 000 km. The ranges missiles would be required to fly in wartime would be more of the order of 9–10 000 km. The maximum range of the Minuteman III missile is reported to be of the order of 13 000 km. The main Soviet ICBM test range is shorter still, some 6 500 km.

Telemetry equipment installed aboard the missile monitors the performance of each sub-system throughout the flight, measuring the rate of fuel consumption, vibration, performance of the guidance system components, etc. This information is then broadcast to ground stations, where it is collected and stored for analysis. The missile's course is carefully monitored by ground-based radars and sometimes by satellites as well. Performance of the RV is monitored by large radars and optical telescopes based on Kwajalein, as well as by instruments on board the RV itself.

Even though the number of tests any one version of a missile undergoes is relatively small, perhaps no more than six or eight, the confidence in the data derived from such tests is enhanced by the availability of all the detailed performance information obtained from the telemetry data. These tests do not offer just 'success or failure' statistics but a much richer set of data that can make up for the poor statistics available.

Concerns about the realism of operational tests can be divided into two general categories: first, questions of possible changes in accuracy in shifting from the test trajectory to operational trajectories, and second, questions concerning the realism of the test sequence itself.

Gravitational uncertainties—discussed above—are likely to be small. Other geophysical factors that have been suggested as possible sources of error are likely to be negligible. However, there are some significant variables which would be likely to be quite different in the case of an actual attack than in test conditions. For example, RVs in most US tests re-enter over Kwajalein lagoon, an area where atmospheric conditions are very different from those that would most probably prevail over Soviet silos during an attack. Another difference is that test trajectories are considerably shorter than operational trajectories. In the case of Soviet missiles, test ranges are as much as 40 per cent shorter than the operational ranges necessary to attack Minuteman silos in the USA. Since many of the target miss distances from several error sources are proportional to the distance the missile travels, Soviet CEPs calculated on the basis of information gleaned by observing and monitoring their tests could be considerably smaller than the actual operational CEP of Soviet missiles. Attempts to extrapolate these results to full-range trajectories would introduce additional uncertainties to US estimates of Soviet missile performance.

Common practices during tests further exacerbate the difference between test and operational firing of missiles and therefore the difference between the performance of the missile in each of the two situations. For example, US tests not only use a target located in an area with a naturally calm atmosphere but are skewed towards days with good weather in the target area. Since atmospheric errors are one of the most significant errors in the system, this could have a noticeable effect on CEP estimates.

Perhaps more importantly, there remains the fact that no full-scale test from an operational silo has ever been conducted by the United States. The only four ICBM tests that were ever conducted in the USA from operational silos (in the mid-1960s) all ended in failure: three of the four missiles did not even leave their silos.

It is often pointed out that the Soviet Union, in contrast to the United States, frequently conducts tests from operational silos. However, many of these tests involve launches of older missiles with little or no telemetry; such tests provide much less information than fully instrumented tests. For example, when a silo holding an old-model missile is to be rebuilt for a new type of ICBM, the old missile will generally be fired from the silo; in 1974, when SS-11 silos were to be rebuilt to hold the first SS-19s, the Soviet Union conducted more than 70 such operational 'disposals' of the SS-11.

Uncertainty as to the size of the CEP arises primarily from two limits on the testing of ICBMs. First, the small number of full flight tests would leave some uncertainty even under ideal conditions. Second, because the main test ranges of each country are significantly different from the ICBM flight paths between the United States and the Soviet Union, a variation of 10 per cent between the CEP estimated from shots over test ranges and the actual CEP in a large-scale counter-silo strike cannot be ruled out; indeed, this may be a conservative estimate.

The monitoring of the opponent's ICBM flight tests is an essential source of intelligence information, providing details concerning the capabilities and design of the opponent's weapons. The USA utilizes a wide variety of techniques to monitor Soviet flight tests, including radars, telemetry interception, and optical and infra-red tracking.

The first stage of a missile's flight, and the stage which provides the greatest wealth of information concerning its design characteristics, is the boost phase. During this phase of flight, Soviet ICBMs broadcast telemetry information to the ground on 50 separate channels: this telemetry includes detailed reports of the performances of all guidance components, thrust and fuel consumption of the rocket engine, rotation and vibration of the rocket, and so on. The interception of this information is perhaps the single most crucial phase of the monitoring of Soviet tests; successful telemetry interception could provide accurate information concerning all of the sources of error up to thrust termination, with the possible exception of pre-launch errors.

Until 1979, the primary radars and electronic intelligence equipment used to intercept telemetry were stationed in northern Iran, only 1 000 km from the Soviet launch sites at Tyuratam. These stations ceased operating as a result of the Iranian revolution. Monitoring of Soviet tests continued from a station in north-east Turkey and from aircraft, but less detail about the early part of the boost phase of Soviet missiles could be gathered.

In addition to ground stations and aircraft, some telemetry information can be picked up by satellites. Two general classes of satellites are used for this purpose: low-flying 'ferret' satellites, and satellites stationed in geosynchronous orbit. Ferret satellites have the advantages of being high enough to be able to monitor telemetry all the way to the ground, yet operate at a low enough altitude to ensure that most telemetry information can be intercepted. However, since they operate in low orbits, they cannot remain stationary over the launch site, and a large number of satellites would be required to provide continuous coverage.

Geosynchronous satellites, by contrast, remain stationary over their target of observation, but their orbital position is so far away (more than 36 000 km from the launch site) that it is extremely difficult for them to pick up telemetry signals, especially if these are broadcast at low power. The US Rhyolite intelligence satellites are geosynchronous platforms, intended both to provide notice of Soviet launches using infra-red sensors to detect the rocket exhaust and to monitor telemetry from Soviet ICBMs. The first such satellite was launched in 1973; two of these satellites are reported to be stationed over the Horn of Africa to monitor ICBM tests from Tyuratam, while two more are stationed further east to monitor intermediate-range tests from the launch site at Plesetsk. The latter are also monitored by ground stations in Norway.

All forms of telemetry interception are subject to the encryption of the telemetry information. The unratified SALT II treaty contains limits on telemetry encryption, but it only prohibits encryption that would inhibit verification of the treaty provisions; this leaves considerable ambiguity as to what is and is not permitted. In 1979, the USSR began extensive encryption of telemetry information; US officials protested, and the encryption was discontinued. In more recent tests, large fractions of the telemetry information have been encoded, again raising questions concerning compliance with the treaty, as well as US ability to monitor design changes in the absence of this important source of information.

Immediately after the initial tests of the Soviet SS-18 Mod 4 and SS-19 Mod 3 missiles, the USA found it much more difficult to monitor the telemetry during the boost phase of Soviet missiles. This decrease was caused by the loss of Iranian bases, the reduction of the strength of Soviet telemetry signals and the encryption of those signals.

As a result, the uncertainties in US estimates of the accuracy of those systems were larger than usual during this period: for example, for several years the *Military Balance* published by the International Institute for Strategic Studies, London, listed the CEP of the SS-18 as being 200 m; in the past several years, this has been revised upward by 50 per cent, to 300 m.

The next stage in monitoring a Soviet ICBM test is the tracking of the missile by radar. This monitors primarily the post-boost portion of the trajectory, providing valuable information concerning the design and performance of the post-boost vehicle which puts each of the re-entry vehicles on its separate trajectory. The radars of the US Ballistic Missile Early Warning System (BMEWS) are used to track some portions of the missile's flight, but the most important radars in this respect are the Cobra Dane radar based on Shemya Island in the Aleutians and ABM testing radars on Kwajalein Atoll, each of which was designed specifically to track RVs.

Cobra Dane is a very large phased-array radar system which became operational in 1977. It is reportedly capable of tracking a basketball-sized object at ranges of 3 000 km, and of simultaneously tracking up to 100 such objects. However, for the majority of Soviet ICBM tests, which impact on the Kamchatka peninsula more than 720 km away, Cobra Dane cannot monitor the re-entry process. Full-range Soviet tests to the Pacific can be monitored by radars on Kwajalein capable of tracking up to 14 separate objects at ranges of more than 2 000 km and which can determine the position and velocity of an RV to within 5 m in range, 250 microradians in angle, and 0.1 m/s in velocity, or better.

With this degree of precision in measuring the RV's velocity, it is possible to make very accurate estimates of the ballistic coefficient of Soviet RVs. In addition to the radars, the Kwajalein facility includes optical telescopes, which are also used to track and record the re-entry process.

Spectroscopic analysis of optical and infra-red images of the RV's trail can provide valuable information concerning the materials of the RV's heat shield. In addition, atmospheric variables such as wind and density, in the region through which the RV passes, can be measured by aircraft.

Thus, as long as telemetry information can be intercepted and other monitoring techniques are not interfered with, it should be possible to acquire a considerable quantity of accurate information concerning the range, throw-weight and fuel consumption of the missile, the detailed performance of the guidance system during the boost phase, the technical characteristics of the MIRV bus, the number of RVs, and the ballistic coefficient and material composition of the RV shield. From this information, estimates of the reliability, accuracy and other technical characteristics of Soviet ICBMs are made. However, the uncertainty in this process will be substantially higher than the uncertainties in either country's estimates concerning its own ICBMs; if the Soviet Union continues its current practice of encoding large portions of the telemetry from its test flights, these uncertainties are likely to increase.

V. Uncertainties in other relevant parameters

In addition to the uncertainties inherent in predicting the point of detonation of a nuclear weapon aimed against a given target, the outcome of an attack against a silo depends on three more variables: the yield of the warhead, the effective hardness of the silo, and the reliability of the missile. The range, and sources, of uncertainty in the magnitude of these variables under operational conditions are examined in this section.

The reliability of a missile can be simply calculated by dividing the number of successful tests the missile has had by the total number of tests it has undergone. For example, of the first 29 tests of the SS-18 missile, 22 were successful; therefore it can be said that its reliability is 22/29 = 75 per cent. That result could be viewed as a pessimistic or an optimistic assessment: pessimistic, because in addition to the actual early tests the various components of a missile undergo constant testing and that establishes the 'mean time between failures', perhaps an equally valid measure of reliability; optimistic, because in an actual operational firing of a large number of missiles in an atmosphere of crisis and tension, the human operators will not be 100 per cent reliable in carrying out the launching procedures correctly and in a timely fashion. It is quite possible then that the actual reliability of the entire force of missiles in a country is lower than the nominal expected reliability of one missile. In addition, the frequent and numerous technical difficulties encountered during launches of space vehicles tend to indicate that even well-tested and carefully engineered systems fail to perform on command. It is not injudicious then to expect a modest deterioration of the nominal reliability of a missile system by 10–20 per cent under operational conditions. Thus a missile that has been calculated to have a 75 per cent reliability may prove to be less reliable in an operational situation. To what extent one may be more confident of the upper or lower figure must to some extent depend on the training and practice of crews in launching missiles during tests and on the frequent exercising of the launch electronics and launch computer.

There are two interrelated sources of uncertainty in determining the effects of a given warhead: first, the effects of warheads of given yields are known only within fairly wide confidence intervals; second, there is some uncertainty in calculating the mean yield of a given type of warhead. These problems have a familiar source: they essentially result from the limited nature of the testing these weapons have undergone. Measurement of weapon effects in the range necessary to destroy a modern hardened silo has been especially limited both because of the instrumentation difficulties associated with attempting to accurately measure transient overpressures of more than 100 atmospheres, and by lack of pressing interest. At the time when atmospheric nuclear tests were being conducted, the hardest targets of interest were roughly one order of magnitude 'softer' than current missile silos. As a result, estimates of overpressure effects greater than 100 p.s.i. are based on extremely limited data, usually scaled from blasts of completely different size. Often, much of the available data is simply scaled from tests of conventional explosives.

The US Defense Intelligence Agency reports estimate the uncertainty in overpressure at a given range as plus or minus 20 per cent, and the uncertainty in yield of a given warhead as plus or minus 10 per cent.

Indeed, the situation contains greater uncertainty than even these data would indicate; the probability that a missile silo will fail is in fact more closely related to the *impulse* (overpressure integrated over time) than to the peak overpressure, and the impulse data are even more fragmentary. According to a US expert "there are fewer data for impulse than for overpressure [and] there is more scatter in the data. Impulse measurements are more demanding of the instrumentation . . . Impulse data are inadequate at 4 p.s.i./s (about 500 p.s.i.) and completely lacking at higher levels".[9] It should be pointed out in this connection that the Soviet Union has conducted far fewer atmospheric nuclear tests than has the United States.

Thus, the relevant data for high overpressures are limited in a number of points and show a wide spread among these points, especially if the attacker chooses to burst high enough above the ground to avoid lifting a lot of debris in the air. Therefore the uncertainty in the yield of a weapon and the concomitant uncertainty in the overpressure it will generate are conservatively 20 per cent of the nominal value of the yield. Any error in the fusing of the weapon that would cause it to detonate at a higher than expected altitude above the ground can cause rapid diminution of the overpressure at the intended target.

In addition to these uncertainties of the effects of a nuclear explosion there are some uncertainties in estimating the mean yield of a given weapon design. These uncertainties may be larger for extremely recent designs since neither side has conducted full-scale tests of large warheads for several years as a result of the still unratified Threshold Test Ban Treaty. As mentioned above, uncertainties in warhead yield are commonly given as plus or minus 10 per cent, although given the uncertainties with regard to measurement described above, it is possible that the uncertainty may be higher. One can conservatively assume that the combination of these two types of uncertainty results in an overall uncertainty in the mean destructiveness of the warhead of between 25 and 30 per cent.

Consider finally the uncertainty in the value of the hardness of a missile silo. This is perhaps the most difficult parameter for a potential attacker to estimate. While intelligence regarding ballistic missiles and nuclear warheads can be gathered by monitoring tests of the opponent's weapons, this is not possible with hardened missile silos; they are inanimate objects with comparatively few easily observable features. The overpressure at which a silo will fail is related in a complex way to the mass, the thickness, the strength and the ductility of the silo cover, and it would be extremely difficult for an attacker to have precise, high-confidence estimates of these parameters prior to an attack.

Indeed, it is difficult to precisely assess the hardness of one's own silos.

Although assessments such as this one commonly concentrate on the blast wave overpressure as the primary kill mechanism, a wide range of nuclear effects can inflict damage on a hardened missile silo, and the magnitude of many of these effects is impossible to predict beforehand. As an example, the propagation of the ground shock, one of the more important damage mechanisms, is crucially dependent on the state of the local water-table. In a nuclear detonation, these effects would act synergistically; it is thus quite possible that the vulnerability of silo-based missiles is greater than calculations based on the overpressure alone would indicate. However, it would be impossible for an attacker to have reasonable confidence that this would be the case.

The fact is that *no silo has ever been exposed to a nuclear detonation in any test*. Some tests have been carried out involving shaped-charge conventional explosives and scale models of silos, but the uncertainties involved are great. The available data for assessing the capabilities of hardened structures are extremely limited, and the uncertainties in such assessments remain high. Conservatively, then, it would seem improbable that the attacker could rule out the possibility that his opponent's silos will be 20 per cent harder than expected. On the other hand it is perhaps equally impossible to exclude the possibility that a missile inside a silo will suffer effects from a nearby nuclear detonation as if the silo that housed it were 20 per cent less resistant to these effects. While the conservative attacker cannot count on such a variation, the defender must not ignore it.

VI. Fratricide

The effects of an endoatmospheric nuclear detonation can destroy a re-entry vehicle. For the first few milliseconds after the detonation a re-entry vehicle anywhere within 800–1 000 m of an exploding 0.5-Mt weapon will be damaged or destroyed by the intense flux of gamma rays, X-rays and neutrons generated by the explosion.[10] During the next several tens of seconds the rapidly expanding fireball, the shock wave overpressure and the accompanying winds will destroy or deflect a re-entry vehicle from its trajectory if it is within 2–3 km of the detonation. Finally, the nuclear detonation, if intended to destroy a silo, will raise very substantial amounts of dust that will form a stem and cloud (the characteristic mushroom cloud of a nuclear explosion) about 12 km in diameter with its top about 18 km above the ground. In a counter-silo attack a 0.5-Mt weapon will have to be detonated at an altitude less than 250 m above the surface of the ground in order to generate overpressures of 2 000 p.s.i. below the surface. Since the fireball from such a weapon will expand to about 1 km before it starts lifting, a considerable area of the ground below the detonation will be bathed in the intense heat and overpressures inside the fireball which in turn lift large amounts of dust and even larger particles into the atmosphere.

Particles and dust have an extremely destructive effect on incoming RVs because of the extremely high speed at which the RVs are re-entering the atmosphere; any collision will take place at speeds of several kilometres per second. Interaction with a heavy particle would destroy the RV outright, much like shooting it with a bullet. Smaller particles will erode the nose-tip of the RV quite rapidly and unpredictably; such unpredictable erosion will greatly reduce the accuracy of the RV, and in some cases can cause the RV to fail outright.

These clouds of dust persist for significant periods of time. The heavy particles fall back to the ground first; particles of seven grammes or more will have fallen out of the cloud completely within the first 20–25 minutes. Smaller particles take much longer to fall; while the cloud is no longer visible after about one hour, particles large enough to be visible will still be falling to the ground more than 24 hours after the detonation.

As a consequence a second warhead cannot be targeted at a silo already attacked unless it is timed to arrive many tens of minutes after the first detonation. But even then the second re-entry vehicle, even if it survives, will encounter a completely different re-entry environment from that of the RVs of the first wave. The near-ground detonations of the first wave will have completely altered the atmospheric density and wind profiles up to altitudes of tens of thousands of metres; these profiles will now be completely unpredictable and, indeed, unlike any that have ever been experienced or tested. In addition, at an altitude of some 18 000 m, the RV would enter the dust cloud, travelling at some 6 000 m/s. The RV would then travel a slant distance of roughly 20 km through the cloud: at such speeds, the effect would be similar to being exposed to an extraordinarily powerful sand-blaster for several seconds. Even when the RV has left the cloud, it will have a good chance of passing through one or more cloud stems, also laden with dust and particles.

Thus, it is clear that considerable fratricidal effects on the second wave would be unavoidable. The expected accuracy of the incoming RVs will be greatly reduced, both by the atmospheric disturbances and by the severe ablation uncertainties imposed by the dust; some warheads may be destroyed, either by a collision with a larger particle that has not yet fallen, or from a failure of their heat shielding resulting from the greater rate of ablation and higher thermal loads caused by the 20-km trip through the abrasive environment of the dust cloud.

As a result any two-wave attack will have intrinsically much more unpredictable results than the one indicated by either of the simple P_k

formulae with $n=2$ (see page 385). The attacker can certainly have no confidence that the outcome of the attack will approximate his 'best plausible' estimate. The most probable outcome of such an attack would include the incapacitation of at least a fraction of the warheads in the second wave and the deterioration of the accuracy of an even large fraction of them.

VII. Concluding remarks

It is now possible to combine the various effects of uncertainty that have been identified as potentially significant contributing factors to the outcome of a counter-silo attack, in order to assess the level of confidence with which a planner can predict the degree of success.

Table 11.2 lists the variations of P_k caused by changes in all the relevant variables on which P_k depends. Tables 11.3 and 11.4 list respectively the effects of fratricide and bias on the outcome of a counter-silo attack.

Table 11.2. Variations in kill-probability caused by changes in all the relevant parameters

Parameter	Kill probability (P_k) 1 warhead	2 warheads
Nominal CEP	0.46	0.72
10% worse	0.38	0.66
20% worse	0.36	0.58
Nominal reliability (ρ)	0.46	0.72
10% worse	0.42	0.67
20% worse	0.36	0.60
Nominal yield (Y)	0.46	0.72
20% worse	0.42	0.66
40% worse	0.38	0.60
Nominal hardness (H)	0.46	0.72
20% higher	0.44	0.66
40% higher	0.42	0.62
20% lower	0.50	0.76
40% lower than expected by attacker	0.56	0.80
All parameters:		
Nominal values	0.46	0.72
5% unfavourable	0.40	0.64
10% unfavourable	0.34	0.56
15% unfavourable	0.28	0.48
25% unfavourable for attacker	0.20	0.36

Nominal values are CEP = 0.14 nm
$Y=0.55$ Mt (no fratricide)
$\rho=0.75$ (no bias)
$H=2\,000$ p.s.i.

Finally, we can combine all the unfavourable variations in a single *plausible bad case* for the attacker, in order to determine what a prudent planner of a counter-silo attack must recognize as a *plausible outcome* of a two-warhead attack on a silo. The results are shown in table 11.5.

Table 11.3. The effect of fratricide on the outcome of a counter-silo attack

Level of fratricide	Kill probability
(1) No fratricide effects	0.72
(2) No second-wave RVs destroyed, second-wave re-entry errors multiplied by 1.3	0.70
(3) 5% destroyed, re-entry errors multiplied by 1.6	0.68
(4) 5% destroyed, re-entry errors multiplied by 2	0.65
(5) 10% destroyed, re-entry errors multiplied by 2.2	0.63
(6) 10% destroyed, re-entry errors multiplied by 2.5	0.61
(7) 20% of second-wave RVs destroyed; re-entry errors multiplied by 2.5	0.59
(8) 35% destroyed; re-entry errors multiplied by 3	0.56
(9) 50% destroyed; re-entry errors multiplied by 3.5	0.52
(10) 65% destroyed; re-entry errors multiplied by 4	0.50
(11) 80% destroyed; re-entry errors multiplied by 4.5	0.48
(12) 100% destruction	0.46

Table 11.4. The effect of bias on the outcome of a counter-silo attack

	Kill probability	
Size of bias	1 warhead	2 warheads
No bias	0.46	0.72
Bias=0.5 CEP	0.38	0.66
Bias=1 CEP		0.50
Bias=2 CEP		0.20

Table 11.5. Plausible outcome of a two-warhead attack on a silo

	Bias			
Reliability assumptions	0.0	0.3 CEP	0.6 CEP	1.0 CEP
$\rho=100$	0.86	0.84	0.76	0.63
$\rho=0.75$	0.72	0.70	0.62	0.50
plus light fratricide	0.65	0.62	0.56	0.45
plus unfavourable variations of parameters[a]	0.45	0.43	0.38	0.31

[a] The unfavourable variations assumed here are the same as those described individually in the last section: a 10 per cent degradation in CEP, silos 20 per cent harder than expected, a 25 per cent variation in yield and expected weapons effects, and a 10 per cent degradation of reliability. These variations result in a system with a CEP of 0.154 nautical miles, an effective yield of 0.41 Mt, and a reliability of 0.675, attacking silos hardened to 2 400 p.s.i. A two-RV per silo attack is assumed throughout this table.

The first row of table 11.5 shows the result of an idealized attack on US silos with perfectly reliable weapons. This is the assumption behind US claims that it is threatened by a 'window of vulnerability'. In the absence of bias, such an idealized attack would destroy nearly 90 per cent of the US ICBM force. The second row shows the result of an attack with 75 per cent reliable weapons; the result is considerably less favourable to the attacker, but the assumption is much more realistic. The third row shows the result of an attack with imperfectly reliable weapons that also encounter light fratricide. This further substantially degrades the probability that a silo will be destroyed. The fourth row shows the effect of combining light fratricide with unfavourable variations in all of the basic parameters of the attack, representing a plausible worse outcome which the attacker must consider. The result in this case is drastically less favourable to the attacker than that of the idealized attack represented by the first row; the number of surviving silos in the first column has nearly doubled between the two, since the percentage destroyed has dropped below 50 per cent. While it could be argued that a case involving large unfavourable variations in *all* of the attack parameters simultaneously is unlikely to occur, it should be noted that an unfavourable variation of any two of the four basic attack parameters, when combined with light fratricide, would lower the percentage of silos destroyed to 55 per cent or below, even in the absence of bias. In the presence of a bias effect no larger than the CEP of the missile, the proportion of surviving silos quickly rises to 70 per cent of those attacked.

There is one specific and one general conclusion to be drawn from this basic analysis of the circumstances that will most probably surround a counter-silo attack. The specific conclusion can be drawn from the fact that throughout this analysis the performance parameter of the most competent sort of missile has been used to illustrate the deterioration of P_k with the introduction of several realistic factors into the calculus of a silo destruction.

The results of this analysis then are readily applicable to the case of the US ICBM force: it is clear that the fear of the US Department of Defense that the US ICBMs are now vulnerable to a counterforce surprise attack are unfounded and unduly pessimistic, if not contrived. To achieve a 90 per cent kill probability a Soviet two-on-one attack must be performed with perfectly reliable missiles that experience zero bias, no fratricide and no unfavourable variation in any of the four important attack parameters. Even if each such assumption had a 50 per cent probability of being true (a grossly pessimistic case from the US point of view) the combined probability that all six assumptions would obtain at the same time is 1.5 per cent. So the probability that a Soviet attack would achieve the 90 per cent destruction of US silos claimed by the Pentagon is equal to 1.5 per cent. This is hardly a credible basis for claims that the USA has been faced by a window of vulnerability. In fact, President Reagan's Commission on Strategic Forces (the Scowcroft Commission) has now denied that such a window ever existed. Yet it did so basing its claim on the fact that the US possesses an invulnerable second-strike force rather than on the above considerations.

The more general and more valuable conclusion is that the over-confidence with which analytical formulae of silo kill probability and the results derived from them are used in the public debate in the West is unwarranted. While it is quite possible to predict with some confidence the results of a nuclear attack on cities—there are at any rate two instances to draw conclusions from and it is possible to compare the results of theoretical calculation with the destruction that actually took place—it is simply unwarranted and injudicious to make firm predictions about the outcome of a counter-silo attack. To base defence policy or weapon procurement and planning on such predictions approaches the irresponsible. The habit of ignoring many of the effects that, as has been shown here, have a high probability of influencing drastically the outcome of a counter-silo attack may mislead political elites and decision makers in both the United States and the Soviet Union to believe that the outcome of a nuclear counterforce attack is predictable. In fact, claims by some strategic thinkers and policy makers in the USA that a nuclear war is winnable implicitly assume that one can calculate the outcome of such a war with enough certainty to be able to predict the actual outcome of such a combat. The analysis offered in this chapter strongly suggests that nothing can be further from the truth.

Notes and references

[1] In writing this chapter I have drawn heavily on calculations, data and other materials originally presented in a research report of the Program in Science and Technology for International Security of the Physics Department at MIT (see note 11).

[2] Schlesinger, J., Testimony before the US Senate Foreign Relations Committee, 30 April 1982.

[3] See, for example, *Congressional Record*, 23 January 1978, pp. H99–H100.

[4] Tsipis, K., *Arsenal* (Simon and Schuster, New York, 1983).

[5] Reliability is one of the 'softest' numbers concerning Soviet capabilities; most discussions of the technical abilities of Soviet weapons ignore this issue entirely, and those estimates that are available in the unclassified domain range from 60 per cent to 98 per cent.

However, some basis for judgement is available. First, Soviet liquid-fuelled ICBMs are widely regarded as being less reliable than their US solid-fuelled counterparts; as an example, B. Schneider and S. Leader give figures of 75–80 per cent for US ICBMs, and 65–75 per cent for Soviet ICBMs ('The United States–Soviet Arms Race, SALT, and Nuclear Proliferation,' *Congressional Record*, 5 June 1975).

Second, an ICBM is an extremely complex technical system; when reliability is defined as the ability to launch at any moment over thousands of hours with the extreme accuracy needed for a counterforce attack, it is simply unrealistic to expect reliabilities close to 100 per cent. Albert C. Hall, one of the chief engineers for the Titan II, has indicated that it would be "extremely difficult" to engineer "a system as complex as an ICBM" with a reliability greater than 80 per cent ('The case for an improved ICBM,' *Astronautics and Aeronautics*, February 1977).

Other reasonably current estimates of Soviet ICBM reliabilities that fall in this same range include Edward Luttwak's, who uses roughly 73 per cent in *Strategic Power: Military Capabilities and Political Utility* (Center for Strategic and International Studies, Georgetown University, 1977), and that of the Congressional Budget Office, who give an estimate of 75 per cent in *Counterforce Issues for the U.S. Strategic Nuclear Forces*, January 1978, p. 16.

However, there are other estimates that are significantly higher: current estimates from the Rand Corporation use 85 per cent for both US and Soviet systems, while Rep. Thomas Downey gave 85 per cent for current Soviet weapons, and 90 per cent for early 1990 systems, in 'How to avoid monad—and disaster,' *Congressional Record*, 20 September 1976, pp. S16211–12.

[6] For an excellent treatment of inertial guidance see Hoag, D., 'Inertial guidance of ballistic missiles' in G. Rathjens *et al.*, *New Technologies and the Arms Race* (MIT Press, Cambridge 1972).

[7] Schlesinger, J., Testimony before the Arms Control Subcommittee of the Senate Foreign Relations Committee, 4 March 1974.

[8] Walsh, J. B., Testimony before the Senate Armed Services Committee, 5 March 1975.

[9] Brode, H. L., *Height of Burst Effects at High Overpressures*, Rand Corporation, 1970, prepared for the Defense Atomic Support Agency. A subsequent report by Brode and T. G. Lewis also reported substantial uncertainty in overpressures: see *Implications of Recent Airblast Studies to Damage of Hardened Structures*, 1975.

[10] Romm, J. and Tsipis, K., 'Dense Pack Vulnerability', *PSTIS Report No. 8*, December 1982.

[11] Bunn, M. and Tsipis, K., 'Ballistic missile guidance and technical uncertainties of countersilo attacks,' *PSTIS Report No. 9*, January 1983.

12. Implications of genetic engineering for chemical and biological warfare

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Superscript numbers refer to the list of notes and references at the end of the chapter. A glossary of scientific terms used in this chapter is given in appendix 12A.

I. Introduction

The early 1970s mark the birth of genetic engineering. It embraces a number of methods, including DNA recombinant technology, which make it possible to change precisely the genetic material of any organism almost at will.[1] Genetic engineering thus represents a true revolution in biology. Completely new insights into the basic biotic structures, functions and processes of higher organisms, including human beings, have been obtained. Numerous practical applications have already resulted, or will result, in medicine, agriculture and industry. Among the applications already achieved are the synthesis by bacteria of insulin, of growth hormone, of interferon and of other human gene products. Because of the emerging possibility to change the genetic material of organisms at will, fears have been expressed that genetic engineering might also lead to new developments in the field of chemical and biological warfare (CBW).

This chapter shows that genetic engineering might be very useful in the development of new agents for biological warfare and chemical warfare, including toxin warfare (TW). It is concluded here, however, that the 1925 Geneva Protocol and, to some extent the 1951 Genocide Convention, prohibit the use not only of existing CBW agents, including TW agents, but also of CBW agents which might be developed in the future by means of genetic engineering or other new biotechnological methods.

It is also concluded that the development, production and stockpiling of new BW agents are forbidden by the 1972 Biological Weapons Convention. This also holds true for agents which might be developed by means of genetic engineering. It is suggested, however, that genetic engineering might be misused to develop synthetic or modified TW agents which might be considered by some not to be covered by the Biological Weapons Convention. In addition, genetic engineering will provide deep insights into those basic structures or functions of organisms which might be targets of CW agents, thus allowing new and highly efficient agents to be tailored.

Therefore, greater efforts should be made to reach consensus on a chemical weapon convention which is at least comparable in scope to the provisions of the Biological Weapons Convention and which is without loopholes.

Definitions

BW agents, or *biological weapons*, are defined in a report of the UN Secretary-General as "living organisms, whatever their nature, or infective material derived from them, which are intended to cause disease or death in man, animals and plants, and which depend for their effects on their ability to multiply in the person, animal or plant attacked".[2] This definition corresponds to that used by the World Health Organization (WHO) in 1970, although WHO also emphasized that they are "intended for use in war".[3] However, BW agents might be used not only in wars, but by terrorists as well.[4] One should therefore refer to living organisms "used for hostile purposes".[5] In this connection the UN Secretary-General also makes clear that various organisms, including viruses and fungi, can be used as BW agents and emphasizes that "in the context of warfare all these are generally recognized as 'bacteriological weapons' ".[2] In his report, therefore, the phrase "bacteriological (biological) weapons" is used "to comprehend all forms of biological warfare" and to eliminate any possible ambiguity. This point is referred to again below in discussing problems of the coverage of the 1925 Geneva Protocol.

CW agents, or *chemical weapons*, are defined in the report of the UN Secretary-General as "chemical substances, whether gaseous, liquid, or solid, which might be employed because of their direct toxic effects on man, animals and plants",[2] a definition acceptable to most states. Because toxic chemicals could be used, for example, for weed control, and so on, the definition of CW agents should also include the intention to use them for hostile purposes. Inasmuch as the term 'toxic' is used in this definition, CW agents thus include not only the traditional toxic poisons of warfare (e.g., nerve gas), but also the more novel toxic poisons of warfare, such as toxins and chemical herbicides.[6] This seems logical also with respect to toxins produced by living organisms because they are not considered to be BW agents since they are inanimate and incapable of multiplying.

TW agents, or *toxic weapons*, are thus a type of CW agent, irrespective of whether they are produced by a living organism, or even of whether they are responsible for the qualification of that organism as a biological weapon, or whether they are produced by chemical synthesis.[7]

A brief history of developments

With respect to the development and possible use of BW and TW agents, three major stages can be distinguished whose boundaries correspond roughly to the development of modern genetics.

The classical stage of BW and TW is characterized by the direct use of biological agents and toxins and by efforts to develop their use as weapons. Lack of knowledge regarding the genetics of bacteria and viruses prevented the development of strains more convenient as BW agents. This stage dates from ancient times when primitive forms of biological weapon were used, as described in the early Persian, Greek and Roman literature, and extended through World War II. During World War II trials of *Bacillus anthracis* as a potential agent of BW were carried out on Gruinard Island off the west coast of Scotland. Small bombs containing spores of *B. anthracis* were suspended from a gantry and detonated, producing widespread contamination of the island's surface. The consequence was a heavy contamination of this island with persistent spores of a virulent micro-organism. A survey carried out by members of the British Chemical Defence Establishment, Porton Down, showed that viable spores of *B. anthracis* could still be detected in 1979 in at least a small area.[8] With this experience the director of Porton Down, Dr R. G. H. Watson, during a television interview, agreed that, had certain Allied contingency plans for BW been put into effect during World War II, the cities of Aachen, Berlin, Frankfurt, Hamburg, Stuttgart and Wilhelmshaven would probably still be uninhabitable because of anthrax contamination.[9] These plans were fortunately not put into effect.

At about the same time, however, the Japanese not only studied the possible effects of BW agents, but actually used them as weapons.[10] Between 1940 and 1944 at least 11 Chinese cities were subjected to Japanese BW attacks and the number of victims of artificially disseminated plague alone was placed at approximately 700.[11] In addition, at least 3 000 prisoners of war were misused by Japanese BW research workers for human experiments, and sacrificed in the process.[10] These experiments included infection with massive doses of plague, typhus, dysentery, gas gangrene, typhoid, haemorrhagic fever, cholera, anthrax, tularaemia, smallpox, tsutsugamushi and glanders.[12]

The second stage of BW and TW was a period of development dependent upon the introduction and development of microbial genetics and of other fields of molecular biology. It lasted for two to three decades following World War II. "Since bacteriological (biological) agents exist naturally", it was recognized in the report of the UN Secretary-General, "their increased potency as weapons has resulted from a process of selection rather than from the production of entirely new agents . . . Selection has been made possible by advances in our knowledge of the genetics of microbes, and through advances in experimental aerobiology".[2]

The identification of DNA as the major genetic material, the elucidation of its structure, as well as the discovery and use of different kinds of parasexual process in bacteria (e.g., DNA-mediated transformation, transduction and bacterial conjugation) and the detection and employment of physical and chemical mutagens allowed the induction of random genetic changes and the more or less random transfer of genes among related bacterial strains or species. In addition, methods were worked out which have allowed selection for microbes which express a new property. By these methods, which could also be applied at least in part to viruses, the virulence of existing pathogens could be increased, as could their resistance to antibiotics and chemotherapeutics. Moreover, research could be initiated on bacterial toxins and on their dissemination. However, all of the methods depended upon random genetic change. BW research workers therefore placed their hope on further genetic developments.

The present stage in the development of BW and TW agents began with the introduction of genetic engineering, an event which coincided with the introduction of the 1972 Biological Weapons Convention. From the very beginning of this turning point in biology, it was suspected that genetic engineering might contribute to the development of completely new types of BW agent. The following three statements are typical of the time:

> Further possibilities [to develop new BW agents] are presented by the growing battery of 'genetic engineering' techniques . . . Such methods might, in the distant future, lead to a strain of pathogen so different from its parent as to be classifiable as a new disease agent.[13]

> DNA hybridization must also look an attractive proposition for biological warfare researchers . . . The new technique offers the prospect of fabricating even nastier BW agents, facilitating the combination of 'desirable characteristics' that cannot be brought together by conventional microbial genetics.[14]

> With the increase of knowledge in the field of molecular biology, it will in the future be possible to perform genetic engineering in those genetic regions controlling virulence or toxicity of pathogens . . . Among other potential developments are the exploiting of chemical differences between races and ethnic groups . . . as well as the further development of already-developed plant diseases, such as rice virus, potato fungi or sugarcane bacteria, into entirely new plant diseases.[15]

In the following sections of this chapter the possible misuse of the methods of genetic engineering in the development of BW agents is discussed. The extent to which these developments are covered by the two major international laws dealing with CW, BW and TW agents—the 1925 Geneva Protocol and the 1972 Biological Weapons Convention—is then considered. Finally some conclusions are drawn regarding both unresolved questions and future actions.

II. Potential uses of biotechnology for CBW

This section discusses whether biotechnological methods might be used for the development or employment of BW, CW or TW agents. As no classified material could be used the importance of some methods might be overestimated whereas that of others might be underestimated.

In their background paper prepared for the states parties to the Biological Weapons Convention the three depositary governments (the UK, USA and USSR) emphasized that "modifying an organism by recombinant DNA techniques is similar in effect to modifying it by classical genetic techniques". Moreover, they pointed out that "genetic exchange involving DNA molecules occurs in nature and has been instrumental in evolution, as in the case of natural pathogens".[16]

The depositary governments refer to one important difference, however: "Recombinant DNA techniques . . . permit the transfer of genetic material between widely divergent species, [whereas] classical genetic techniques generally require considerable homology between the donor and recipient for genetic transfer to be possible". It should be added, moreover, that genetic engineering permits the replication of viral DNAs which do not replicate outside their natural host cells or which are too dangerous to be studied by standard microbiological techniques. Recombinant DNA techniques and other biotechnological methods also permit the semi-synthetic and even totally synthetic production of toxins. Finally, these techniques allow the molecular characterization of the target organs of CBW or of their functions, which would facilitate the development of new CBW agents.

Several authors mention that at least in the USA new military interests in biological research in general and in genetic engineering in particular have emerged in recent years.[17] For example, the US Army asked the US National Academy of Sciences whether it would be willing to co-operate in studies on BW and CW agents[18] and sought investigators interested in using genetic engineering to study human acetylchlorinesterase, the target of neurotoxins such as nerve gases.[19] Wright and Sinsheimer[17] noted that "[US] Defense Department support for biological research has increased significantly" and indicated that "the [US] Army, Navy, and Air Force are expected to have active recombinant DNA research programs by 1983". They listed some 15 projects involving recombinant DNA methods which have been initiated since 1980 in US Department of Defense (DoD) facilities or in universities and private laboratories funded by the US Army. Six groups were asked to introduce into bacteria the gene for the enzyme acetylcholinesterase (the main target of neurotoxins) in order to use these bacteria to synthesize the enzyme for study purposes. Six other projects sponsored by the DoD deal with cloning of various disease-causing agents. In a recent source-book[20] at least four further DoD-sponsored research projects are described that deal with the application of genetic engineering to pathogenic agents. This source-book also lists a great many research projects which might be relevant in the present context although they were studied in universities and private laboratories without obvious funding by the DoD.

Methods provided by genetic engineering clearly seem to fulfil some of the requirements which should be met by BW agents. "Requisites of Biological Agents", as given in a manual of the US Departments of the Army and Air Force, include the following:

Requirements. The agent should meet certain requirements for use against personnel, domestic food and draft animals, or plants. It should: (1) Consistently produce a given effect (death, disability, or plant damage). (2) Be manufacturable on a large scale. (3) Be stable under production and storage conditions, in munitions, and during transportation. (4) Be capable of efficient dissemination. (5) Be stable after dissemination.

Desirable characteristics. Additional agent characteristics that are desirable but not required are as follows: (1) Possible for the using forces to protect against. (2) Difficult for a potential enemy to detect or protect against. (3) A short and predictable incubation period. (4) A short and predictable persistency if the contaminated area is to be promptly occupied by friendly troops. (5) Capable of: (a) Infecting more than one kind of target (for example, man and animals) through more than one portal of entry. (b) Being disseminated by various means. (c) Producing desired psychological effects.[21]

The way in which at least some of these requirements can be met by genetic engineering is alluded to in the following subsections.

Bacteria

An expert panel convened by the US Department of State claimed that "genetic engineering will not yield pathogens that are any more lethal than some that already exist (e.g., anthrax)".[22] Nevertheless, genetic engineering might be used to modify potential BW agents more efficiently and in a more specific manner than classical genetic techniques would allow with respect to:

1. Increasing their pathogenicity (including their ability to produce a highly lethal toxin molecule).
2. Changing their antigenic structure in order to overcome immunity barriers.
3. Changing those markers usually used in diagnostics.
4. Making them resistant to antibiotics normally used against them, especially if these resistances are normally not developed by spontaneous mutation and natural selection.

5. Making them resistant to ultraviolet radiation and to desiccation to allow their dissemination in aerosol form.
6. Restricting them to defined target organs or tissues by creating specific metabolic demands, or accomplishing the reverse by unrestricting them.
7. Making them easier to produce or store.

As already mentioned, most of these changes might also be introduced and selected for by 'classical' techniques of microbial genetics developed before 1970. These traditional techniques, however, were not very efficient if genes had to be transferred between bacteria of different species and were not applicable to gene transfer between higher systematic orders. Although such non-homologous ('illegitimate') recombination also occasionally takes place in nature, it can be exploited far more readily by the introduction of genetic engineering techniques. Besides, site-directed mutagenesis[23] now makes possible the mutation of genes or sites within genes where spontaneous mutations normally do not take place at all or only with very low frequency.

Viruses

Unequivocal contributions of genetic engineering are possible with respect to viral BW agents.

In vitro *multiplication*

The depositary governments of the Biological Weapons Convention asserted that "use of recombinant DNA techniques in development of biological or toxin warfare agents would not help to reduce the formidable safety requirements for any bacteriological weapon development activity involving pathogenic agents".[24] However, this position is untenable for at least two reasons.

First, the experience gained in following the guidelines for research involving recombinant DNA molecules,[89] including the construction of safety laboratories providing increased degrees of physical containment, has been extremely helpful in making safer experiments with highly pathogenic viruses.

Second, the possibility offered by genetic engineering to replicate nucleic acids of animal and plant viruses within bacterial host cells greatly reduces the safety requirements needed to work with these viruses and to develop them into BW agents manufacturable on a large scale. Thus, highly pathogenic viruses such as Marburg, Ebola, Lassa and smallpox might, with the help of genetic engineering technology, be considered as suitable BW agents because their genetic material can now be replicated, studied and manipulated in the relative safety of the 'biological containment' provided for by *Escherichia coli* K12 or other host bacteria.[26] It should be mentioned here that smallpox virus especially is regarded as "the ideal biological warfare agent. It is stable, easily aerosolized, simple to grow, and [it causes] a terrifying disease with high lethality".[27] In this connection the depositary governments of the Biological Weapons Convention pointed out that it may be useful in the future to evaluate the implications of eradication of smallpox and other infectious diseases. Mass vaccination against smallpox is no longer practised in a number of countries, which could ultimately result in widespread vulnerability to use of a variola (smallpox) virus as a biological warfare agent. Similar vulnerabilities could result if other infectious diseases, such as plague or cholera, are finally eradicated.[28]

One has to agree, of course, with Kaplan's commentary on the paper by Wright and Sinsheimer, that "strains of infective agents exist in nature—for example, Lassa fever, Marburg virus—which could hardly be improved upon in virulence and transmissibility", so that "one does not need to resort to recombinant DNA technology to produce novel strains".[29] But genetic engineering provides the possibilities to study these viruses under rather safe conditions, providing a major prerequisite to develop them into potential BW agents.

The ability to replicate viral nucleic acids in bacteria allows multiplication of the genomes of those viruses which normally do not replicate outside their natural hosts, such as the majority of papilloma viruses and hepatitis B virus. Although up to now such viruses do not represent agents considered to be potential BW agents the situation might well change with the new multiplication methods available.

In vitro *mutagenesis and recombination*

The importance of site-directed mutagenesis holds as true for viruses as it does for bacteria. It is known that viruses occasionally can obtain quite new qualities by mutation or recombination. Numerous cases are known where the virulence, the host range or tissue specificity of a virus is grossly changed by point or chromosomal mutations.[30] With the availability of techniques for site-directed mutagenesis and *in vitro* recombination, the spectrum of such changes might be greatly expanded. Those experiments that use viruses as molecular vectors[31] are especially apt to result in new knowledge suitable for use in the development of viral BW agents. For example, vaccinia virus strains have been constructed *in vitro* which include the gene coding for the surface antigen of another virus (hepatitis B virus) which is expressed in new host cells after transfer by the viral vector.[32] Similar experiments have been made with retro-viruses, with bovine papilloma virus, and with other viruses.[33] There is thus no reason to believe that it would be impossible to develop viral vectors carrying genes coding for highly toxic molecules.

Synthesis and encapsulation of infectious nucleic acids

"The portentous implications of the ... success of Khorana's team in synthesizing a gene *de novo*" were already noted a decade ago[34] within the context of forthcoming possibilities to use infectious nucleic acids protected in micro-capsules. Indeed, much progress has been made in this field during the past decade with respect to DNA sequence analysis,[35] synthesis of polynucleotides,[36] and isolation of infectious nucleic acids. Highly pathogenic infectious nucleic acids might thus be developed as potent BW agents using these methods together with those suitable for manipulating such polynucleotides *in vitro* by mutagenesis or recombination. This is especially so considering that methods have now been worked out to enclose DNA molecules into resealed, loaded membranous vesicles as efficient carriers for their introduction into mammalian cells.[37] Not only can infectious DNA be introduced by such micro-capsules into a broad range of cell lines even if these are resistant to DNA-mediated transformation, but proteins such as diphtheria toxin as well. Such vesicles may also be suitable to deliver macromolecules into specific cells of living organisms,[37] a possibility which might open a new dimension in the application of BW agents.

Vaccines

The expert panel convened by the US Department of State mentioned earlier suggested in its deliberations[22] that the development of more and better vaccines by means of recombinant DNA technology might increase the prospects of some state choosing to use BW agents: "An increased protection capability may be an inducement to use biological warfare, since the instigator has a decreased risk of being harmed by his own actions".

In fact, genetic engineering and other methods of modern biotechnology provide some completely new techniques for the development of vaccines of high specificity[118] either by cloning of the genes that code for major antigens and their expression in bacteria, yeasts or animal cells,[38] or by *in vitro* synthesis of peptides with immunogenic properties.[39] Of course, the production of vaccines destined to protect against any BW agent by means of one of these methods might be possible. Numerous projects sponsored by the DoD (mentioned above) are destined to develop such vaccines—at least ostensibly for protective purposes. The use of monoclonal antibodies should also be mentioned in this connection;[40] they are highly useful not only for purification of proteins, for quantitative determination of wanted products and for diagnostic purposes, but also for the development of BW agents and for efficient passive immunization against BW and TW agents. Furthermore, there are reports that the DoD is studying the effectiveness of aerosol immunization, which does not seem to be promising for peaceful medical purposes but which might be used clandestinely: "An entire civilian population could be covertly innoculated against B.W. agents by spraying a vaccine over wide areas".[114] In this connection secret tests by the US Army with supposedly non-pathogenic germs in the San Francisco Bay area and in the New York City subways[115] must be mentioned.

Toxins

Biotechnology opens up important new possibilities in the development and production of ever more active toxins. Mycotoxins (fungal toxins) have recently attracted special attention owing to repeated allegations by the USA that the USSR and other socialist states have been employing them as CW agents. These charges could not be independently substantiated[41] and are in sharp contrast to reports by individual Soviet scientists[42] as well as to declarations by the USSR. The USSR has stated that, "true to the humane purposes of the Geneva Protocol of 1925, the USSR has never used chemical weapons anywhere and has never transferred them to anyone".[43]

These accusations have resulted in increased interest by research groups in mycotoxins,[44] leading, for example, to a joint study on mycotoxins by the US Army and US National Academy of Sciences.[45] This study is reported to be under way.[46]

Production of toxins by engineered bacteria

All exotoxins secreted by bacteria are proteins consisting of one or more polypeptide chains. In principle they could also be produced by genetically engineered bacteria, either by their natural producers after insertion of regulatory sequences and other manipulations enhancing the synthesis of the toxic products, or by bacteria normally not expressing toxin genes. These manipulations might include those aimed at optimizing the toxic gene products. By the application of 'protein engineering' the following properties of proteins—including proteinaceous toxins—could be controlled in a predictable fashion: kinetic properties, thermostability, temperature optimum, substrate and reaction specificity, cofactor requirements and resistance to enzymatic degradation.[47]

Whether non-proteinaceous toxins will some day be produced by engineered bacteria or cells of higher organisms is still an open question. One can imagine, however, that it should be possible to introduce genes coding for some relevant enzymes into toxin-producing cells in order to add one or more steps to existing biosynthetic pathways so that improved toxins can be obtained.

Structural analysis and chemical synthesis of toxins

The depositary governments of the Biological Weapons Convention point out that some low-molecular-weight toxins (brachotoxin, convallotoxin, saxitoxin and tetrotoxin) have already been synthesized and that the total synthesis of the polypeptide cobra-toxin has been attempted. "In time it will probably be possible to synthesize any toxin, no matter how large or complex" and "the ability to synthesize toxins also implies the ability to synthesize compounds which are closely related and possess comparable (or greater) toxicity but are not found in nature".[48]

There is no doubt that the methods necessary for the total synthesis of high-molecular-weight toxins are already provided by today's biotechnology (i.e., sequence analysis, polypeptide synthesis). At least in some cases it should be sufficient to synthesize only those fragments of a toxic molecule in which the activity resides (as is now done with immunogenic peptides). As more knowledge is gained about the target structures simultaneously with their functions (see below) it should even be possible to tailor specific toxins, or fragments thereof, better able to react with specific receptors or target molecules and also more stable than their genuine prototype toxins. Thus, "new toxic agents which combine rapidity of action with casualty-effectiveness at dosages maybe 30–300 times smaller than the nerve gases"[49] might be developed by biotechnological methods.

New toxins

Growing interest in the various pharmacological activities of microbial secondary metabolites[50] has led to the detection of numerous enzyme inhibitors and other substances with pharmacological properties at least some of which might be interesting in terms of toxic agents usable for BW. Here genetic engineering techniques may be used to increase the productivity of the producer strains.

Target organs and functions of CBW agents

The overwhelming majority of biological and most chemical weapons are "biospecific', that is, they damage human, animal or plant life without damaging inanimate objects.[51] As mentioned above, CBW agents should "consistently produce a given effect (death, disability, or plant damage)".[21] The selection of CBW agents producing such effects in past times proceeded more or less empirically, that is, based mainly on trial and error. The development of genetic engineering, however, provides new insights into the basic structures and functions of living systems, especially those of higher organisms including human beings. The target structures and functions of both conventional and new CBW agents can be identified and described in molecular terms[119], which would enable CBW agents to be tailored more precisely. In addition, those structures (e.g., membranes) and functions (e.g., protein degrading enzymes) which interfere with the toxic action of any given CBW agent, including its penetration and its stability and half-life in an attacked host organism, can be identified and characterized. This too would be useful in tailoring more efficient CBW agents.

Botulinal toxin, tetanus toxin and other neurotoxins as well as most nerve gases, such as tabun, sarin, soman and VX, act by interfering with the release of neurotransmitters, especially by the inhibition of the enzyme acetylcholinesterase. The molecular mechanisms involved are still unknown. However, their elucidation might lead to the construction of new neurotoxic agents and improvement of the existing ones. As organophosphorus compounds are especially involved in the development of lethal binary chemical munitions (for which the building of a factory was started in the USA in 1981), there might be an impact of genetic engineering in this technology through a contribution to determining the desired structure of binary weapons.

Improved understanding of the target organs and processes of crops and animals is, of course, also relevant.

Ethnic weapons

Ethnic weapons would employ differences in gene frequencies among specific population groups to incapacitate or kill a selected 'enemy' population to a significantly greater extent than a selected 'friendly' population. Whether ethnic weapons represent a real threat is still a matter for speculation. The possible development of such 'genotype-targetable weapons'[52] was first suggested by Larson.[53] Even earlier, however, the Japanese World War II BW research programme mentioned above was said to have included comparisons of the resistance to pathogens of various nationalities and races.[54]

There are at least 12 genes in human beings that control individual differences in susceptibility to toxicity.[55] Furthermore, so-called restriction-length polymorphisms reflecting the presence or absence of certain sites of the genetic material recognized by restriction enzymes which cleave DNA molecules in a highly specific and reproducible manner[56] can be found, some of which are much more frequent among members of some distinct ethnic groups than others.[57] However,

it appears almost without exception that no gene has been found that will divide any two populations in an absolute sense. On the other hand, from a military point of view it would be probably argued that the psychological effects on a population of incapacitating or killing 25% of its members cannot be discounted. This . . . is at least theoretically possible in terms of the gene frequencies of a number of polymorphisms.[58]

Progress in the elucidation of basic molecular structures and functions of the genetic material of humans mentioned in the previous subsection should also provide information as to how BW or CW agents might be used to carry out genocide. Even now there are indications that not only might chemicals perhaps be used as ethnic weapons, as discussed by Larson[53] and by Hammerschlag,[53] but bacteria and viruses as well: blacks are said to be more sensitive than whites to *Mycobacterium tuberculosis* and *Coccidioides immitis*,[116] organisms which are stockpiled by the US Army.[117] A recent accusation that the South African Defence Force is carrying out research into "a biological 'race weapon' to which blacks would be more susceptible than whites"[59] mentions that whites are much more resistant to Rift Valley fever than blacks (the latter showing a mortality rate of 20–59 per cent in contrast to 1–11 per cent by whites), Filipinos being even more sensitive. Another example is provided by tumour virology: Epstein–Barr virus, a herpes virus, exerts quite different pathological syndromes in different populations: whites in Europe and in North America develop infectious mononucleosis, a benign disease; blacks in Africa develop Burkitt lymphoma; and people in South-East Asia develop a nasopharyngeal carcinoma.[60] If such knowledge were to be exploited in the development of ethnic weapons the considerations discussed in the subsections above would apply here too.

Less likely possibilities

Genetic weapons

Genetic weapons are CBW agents which act on the genetic material of attacked organisms. It has been pointed out that some CW agents have carcinogenic and mutagenic effects:

Mutagenic and carcinogenic weapons may thus be an interesting field of development. Toxicological knowledge . . . may . . . be applied to develop nitrosamines, hydrazines, vinylchloride and other alkylating agents or any volatile and potent mutagenic/carcinogenic or teratogenic substance [into] a future multigeneration drug bomb. Thus, toxicological warfare may be more dangerous to the human species than the side effects of the civil industrial use of toxic substances.[15]

Some viruses—that is, potential BW agents—are also mutagenic.[61]

A decade ago it was concluded that "chemical mutagens . . . might one day be made into long-term genetic weapons, although for the present it is not possible to control the type of mutation they produce".[62] The subsequent development of site-directed mutagenesis methods has since provided such means. However, these methods are still so sophisticated that although they could conceivably be used to construct BW agents and to study their targets, they are not yet suitable for the battlefield.

Agents (whether physical, chemical or biological) that cause random mutations are not likely to be used as CBW agents because they primarily induce recessive mutations. Such recessive mutations would be harmful at most after several generations.[63] It is hard to imagine that an aggressor would make primary use of the mutagenic and/or carcinogenic activity of a CBW agent because the effect would be much delayed, could not be anticipated and would be of very low efficiency. On the other hand, these and other delayed effects of toxic agents might be considered useful by terrorists, perhaps for blackmail.

There are speculations in the literature regarding CBW agents that induce an inhibition of the capacity of attacked persons to repair DNA damage.[64] Although much is known about these repair mechanisms and their enormous importance for living organisms including humans, it would appear to be far more efficient to use a traditional CW or BW agent for hostile purposes. An inhibition of repair enzymes might make sense only if these people were in addition attacked with some DNA-damaging agent.

Cloning or breeding of amoral generals, soldiers and so on

Concern is sometimes expressed regarding the growing possibilities of modern genetics to clone human beings or even to breed them with respect to their mental and psychical capabilities or behaviour. If this were possible cloning or breeding could, indeed, be used or misused, as with any other technique. It could be used with a more or less humane aim: the cloning or breeding of great writers, of highly qualified surgeons, of skilled sportsmen, of excellent actors, of gifted mathematicians or of able engineers. It could likewise be used for the cloning or breeding of efficient generals or of amoral, willing and strong soldiers.

Fortunately, the cloning or breeding of human beings is not as yet possible.[65] Humans are multifactorially determined by some 50 000 genes in the germ-line cells plus further millions of genes in the somatic cells 'created' by rearrangements of the genetic material during embryonic development, as well as by internal and external environmental (including maternal and societal) factors. It is therefore not possible to induce directed change of human physical or mental capacities or behaviour by the changing of one or another of their 50 000 germ-line genes. However, in principle it should be possible to clone human beings with respect to their genetic material, that is, to create sets of persons carrying the same genetic material, as do monozygotic twins. Ilmensee claims to have succeeded with the cloning of mice, although it is suspected that he falsified his results.[66] Even if it were technically possible, it would appear to be useless. The cloned early embryos would have to develop in different foster mothers and would thus develop in more or less different manners. Even monozygotic twins differ to a greater or lesser extent owing to the random epigenetic interactions among genes, gene products and cells during embryonic development creating 'development noise', as coined by Waddington.[67] Thus, cloning, although already described in successful science fiction,[68] remains impossible in the sense of creating human duplicates.[69]

Interference with normal human development would of course be possible by genetic manipulation. Physical and psychic damage might result from random injuries to human genetic material. But such disablement could be induced more efficiently, more easily and more cheaply by social means, such as by food deprivation, with narcotics or via educational deprivation. Large-scale misuse of genetic engineering to produce bodily or mental illness is highly unlikely.[70]

III. Arms control and disarmament aspects

The 1925 Geneva Protocol

The Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases and of Bacteriological Methods of Warfare was signed at Geneva on 17 June 1925, entered into force on 8 February 1928, and has 106 states parties as of 31 December 1983, including all five of the permanent members of the UN Security Council (see chapter 18). It is one of the most important multilateral agreements dealing with CBW agents.

As its full name indicates, the states parties to the Geneva Protocol declare, *inter alia*, that they "agree to extend this prohibition to the use of bacteriological methods of warfare". Coupled with the growing importance of viruses as possible BW agents, concern is occasionally expressed that the language "bacteriological methods of warfare" might exclude viruses.[71] Such concern is not widespread, however, and is concluded not to be justified. Viruses were not specifically mentioned in the Geneva Protocol because they were not then regarded as biological entities different from bacteria.[72] It became clear only in the late 1950s that viruses were totally different from both bacteria and all other organisms because of their possession of only one type of nucleic acid, either DNA or RNA.[73] Thus "the prohibition of 'bacteriological methods of warfare' as contained in the Geneva Protocol must be understood as a prohibition of biological methods of warfare ... Even though in its scientific meaning the term 'bacteriological' is narrower than the term 'biological', it has always been accepted that in the *legal* context of the Protocol the two words are exact synonyms".[74] In fact, the UN Secretary-General has declared that "various living organisms (e.g., rickettsiae, viruses and fungi), as well as bacteria, can be used as weapons [and that] in the context of warfare all these are generally recognized as 'bacteriological weapons' ".[2] Similarly, the inclusive language 'bacteriological (biological) weapons' and 'microbial or other biological agents' is used several times in the 1972 Biological Weapons Convention.

The 1948 Genocide Convention

The Convention on the Prevention and Punishment of the Crime of Genocide was adopted by the UN General Assembly on 9 December 1948, entered into force on 12 January 1951 and has 89 states parties as of 31 December 1983, including all but the USA of the five permanent members of the UN Security Council (see chapter 18). This Convention declares genocide as a crime under international law which the states parties undertake to prevent and to punish. In the Convention, genocide means "any of the following acts committed with intent to destroy, in whole or in part, a national, ethnical, racial or religious group, as such: (*a*) killing members of the group; (*b*) causing serious bodily or mental harm to members of the group; (*c*) deliberately inflicting on the group conditions of life calculated to bring about its physical destruction in whole or in part; (*d*) imposing measures intended to prevent births within the group . . .".[120]

The enumerated crimes clearly encompass the use of any possible ethnic weapons. Whereas the use of CBW agents is forbidden by the Geneva Protocol, the use of any possible ethnic weapons—agents which might in time be developed by means of genetic engineering—would be forbidden by the Genocide Convention.

The 1972 Biological Weapons Convention

The Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction was signed on 10 April 1972, entered into force on 26 March 1975 and has 99 states parties as of 31 December 1983, including the UK, the USA and the USSR from among the five permanent members of the UN Security Council (see chapter 18). This Convention is another of the most important multilateral agreements dealing with biological weapons and with one important class of CW agents. In Article I, the states parties declare, *inter alia*, to undertake

never in any circumstances to develop, produce, stockpile or otherwise acquire or retain:

1. Microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes;

2. Weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict.[75]

As soon as the new techniques of genetic engineering with their new possibilities for directed change of genetic material emerged, concern arose as to whether the new methods or their products would be covered by the Biological Weapons Convention. As early as 1974 a committee headed by Paul Berg and called by the US National Academy of Sciences in order to consider the potential risks of genetic engineering is said to have referred to the problem of BW agents in an early draft of their final conclusions.[76] Likewise the British Genetic Manipulation Advisory Group in 1977 discussed the possibility of military applications of genetic engineering. However, "according to Sir Gordon Wolstenholme, who was then chairman of the Group, more pressing concerns about safety elbowed it out".[77] During a hearing on the Biological Weapons Convention before the US Senate Committee on Foreign Relations on 10 December 1974, Dr Fred C. Ikle, then Director of the US Arms Control and Disarmament Agency, was asked whether the Biological Weapons Convention would prohibit future types of biological warfare which might employ techniques beyond the current state of the art, for example, some means of altering the structure of genes so as to modify behaviour. He answered that: "The Biological Weapons Convention would prohibit any further type of warfare which employed biological agents or toxins, regardless of when the agent or toxin was first developed or discovered . . . In other words, the Convention prohibits not only existing means of biological and toxin warfare but also any that might come into existence in the future".[78] When James L. Malone, General Counsel of the US Arms Control and Disarmament Agency, was asked in 1975 whether the Biological Weapons Convention prohibits production of recombinant DNA molecules for purposes of constructing biological weapons, he replied: "In our opinion the answer is in the affirmative. The use of recombinant DNA molecules for such purpose clearly falls within the scope of the Convention's provisions".[79] The same position was taken by US Ambassador Joseph Martin, Jr to the UN Conference of the Committee on Disarmament on 17 August 1976:

Permit me to recall that on August 5, 1970, the distinguished biologist, Dr. Joshua Lederberg, pointed out to the CCD the advances being made in molecular biology, and expressed his concern that newly-developed techniques in this field might eventually be used to create infective agents against which no credible defense is possible. The most widely-discussed techniques are often referred to as 'genetic engineering' . . . In principle, such techniques could be used to design radically new viruses for biological warfare purposes. When advances in science and technology are made, it is natural to ask about their possible use for hostile purposes, and whether or not such uses are prohibited or restricted by existing international agreements. In the case of potential use of recombinant DNA molecules for weapons purposes, it is our view that such use clearly falls within the scope of the Convention's prohibition. This interpretation is based upon the negotiating history as well as the explicit language of the Convention, and we believe that it is shared by the other signatories.[25]

Similar conclusions were reached by the Pugwash Council[80] as well as by the participants of a meeting held by the Massachusetts Institute of Technology Program in Science and Technology for International Security convened to examine the generality of applicability of the Biological Weapons Convention to all presently conceivable developments in the biological sciences.[81] The participants of this latter conference came to the conclusion that as the Biological Weapons Convention now stands, it "covers all substances which could be developed or fabricated by recombinant DNA technology and therefore the emergence of this technology does not alter the effects of this Convention".[81]

The views outlined above differ in no way from the conclusions reached by the participants at the first Review Conference of the states parties to the Biological Weapons Convention held in Geneva on 3–21 March 1980. The three depositary governments concluded that: "All substances which could be developed or fabricated using recombinant DNA techniques would be covered by the formulation 'microbial or other biological agents, or toxins whatever their origin or method of production' used in article I of the Convention, and therefore the emergence of these techniques does not alter the effects of the Convention".[16] Among other participating nations, the Swedish government was also convinced that "the convention covers all envisageable types of harmful molecules of biological origin and organisms with harmful effects—regardless of the production method. Harmful synthetic molecules and new techniques of production of existing BW-agents are also covered".[83] And in the Final Declaration of the Review Conference, the states parties to the Biological Weapons Convention declared that: "The Conference believes that Article I has proved sufficiently comprehensive to have covered recent scientific and technological developments relevant to the Convention".[82] Further recent support comes from an official statement by James L. George, Assistant Director for Multinational Affairs for the US Arms Control and Disarmament Agency, that the US programme in BW defence "does not, and will not, involve research to create and screen new organisms as potential biological warfare agents".[84]

All of the above notwithstanding, Wright and Sinsheimer[17] (and others) continue to wonder how much biological *research* is prohibited by the ban on *development*, pointing out that "the Convention does not prohibit research". US government officials have repeatedly stated that the interest of the US Army in genetic engineering is "strictly defensive".[85] Accordingly, James L. George, in his statement referred to above, says that "our research is, and will continue to be, limited to developing protective measures to recognized infectious diseases which pose a biological warfare hazard".[84]

In fact, the Biological Weapons Convention explicitly permits development, production and stockpiling of BW and TW agents for "prophylactic, protective, or other peaceful purposes". "Prophylactic" and "protective" purposes certainly could permit the development and production of potential BW agents with novel immunological or pathogenic characteristics, more resistant, for example, to desiccation or to solar ultraviolet radiation or capable of transmission by unusual vectors in quantities sufficient to allow large-scale immunization.[46] Moreover, it could mean that the dissemination of such agents is allowed in order to develop means to interfere with their dissemination, whether natural or artificial.[46]

One must wonder, however, whether such research is promising and, hence, justified if it deals with agents almost exclusively dangerous as BW agents. Thus King refers to a UN report which concludes that: "it is almost impossible to conceive of the complexity of the arrangements that would be necessary to control the consequences of a large-scale bacteriological attack. Even in peace-time, the development of an epidemic of a highly contagious disease introduced from abroad necessitates enormous material expenditure and the diversion of large numbers of medical personnel".[19]

Actually, potential BW agents could be manipulated in an almost infinite number of ways so that it would be extremely difficult to develop a defence without knowing precisely what changes had been introduced. The very modest scientific progress in developing efficient prophylaxis against viruses, such as influenza virus, undergoing mutations and recombinations with high frequency, should be mentioned in this connection. Therefore, as already mentioned, public concern exists that "the topics the [US] Army wanted ... to study included the *possible offensive* use of recombinant DNA technology in biological warfare, *ostensibly* for the purpose of better understanding how to defend against them"[18] (emphasis added). On the other hand, the development of BW agents can be rather easily camouflaged as permitted medical research. Indeed, the Japanese BW research workers successfully hid their inhumane work of the 1930s and 1940s under the cloak of "water purification" and "vaccine production", so much so that these activities could be to a large extent concealed by denials and disclaimers for some four decades.[86]

Finally, as King[19] notes, whatever might be done to try to save human beings, nothing significant could be done to protect crops, livestock or foodstuffs from a BW attack.

Guidelines for research involving recombinant DNA molecules

Following the proposals of the 1974 Berg committee[87] mentioned above, and also the recommendations of the 1975 Asilomar Conference on Recombinant DNA Molecules, the responsible agencies of numerous governments began to release guidelines regulating recombinant DNA research.[88] Thus, the Director of the US National Institutes of Health (NIH) announced such guidelines on 23 June 1976.[89] The British have subsequently released guidelines, as have France, the USSR, the GDR and others.[88] Within the context of this chapter only the guidelines issued by the USA are considered because they have served as a model for others owing to their comprehensive coverage and continuous updating.

The NIH Guidelines originally were binding only on investigators whose research was supported by NIH. As investigators receiving funds from other federal agencies, such as the US Army, were not obliged to adhere to the NIH Guidelines, a Federal Interagency Committee on Recombinant DNA Research was created by President Gerald Ford in 1976 which includes representation from all departments and agencies that either fund or regulate recombinant DNA research. All agencies represented on this Committee require their grantees to follow the NIH Guidelines.[90] Among the present members are the US DoD, Department of State and the Arms Control and Disarmament Agency.[91].

The NIH Guidelines have undergone a rather rapid evolution[90] mainly as the result of growing knowledge regarding the levels of risk involved in genetic engineering. More and more it turned out that the early estimates of risk had been greatly exaggerated. This development is reflected, *inter alia*, in the relaxation of the regulations that deal with experiments which might lead to agents covered by the Biological Weapons Convention, namely toxins.

When the NIH Guidelines were first designed, it was recognized that "there are certain experiments for which the assessed potential hazard is so serious that they are not to be attempted at the present time".[92] Among the experiments not to be initiated at that time were: (*a*) cloning of recombinant DNA of highly pathogenic organisms; and (*b*) deliberate formation of recombinant DNAs containing genes for the biosynthesis of potent toxins (e.g., botulinum or diphtheria toxin, venoms from insects or snakes).[93] In the first, 1978, revision of the NIH Guidelines new language made it clear that the term "potent toxins" refers specifically to "toxins potent for vertebrates".[94] Two further revisions, issued in 1980, contain the same information.[95]

Following the proposals of an *ad hoc* working group on toxins, formed upon the request of the Recombinant DNA Advisory Committee (established in order to advise the Director of NIH in this field; sometimes referred to as RAC), NIH decided in July 1980 to forbid only the "deliberate formation of recombinant DNAs containing genes for the biosynthesis of toxins lethal for vertebrates at an LD_{50} value of less than 100 nanograms per kilogram body weight (e.g., botulinum toxins, tetanus toxin, diphtheria toxin, *Shigella dysenteriae* neurotoxin)".[96] On the other hand, the cloning of genes coding toxins for vertebrates that have an LD_{50} value in the range of 100 nanograms to 100 micrograms per kilogram body weight were permitted under specified containment conditions; and the cloning of genes for less poisonous toxins was not restricted at all. This softened policy was followed in the two further 1982 revisions of the NIH Guidelines,[97] with, however, the substitution in the August 1982 and subsequent revisions of the term "toxins" by the term "molecules toxic for vertebrates".

The June 1983 NIH Guidelines[98] were weakened further. No experiments with toxic molecules were forbidden, with the exception that the cloning of genes coding for those toxic molecules that have an LD_{50} value of less than 100 nanograms per kilogram body weight require review by the Recombinant DNA Advisory Committee and special approval. Moreover, specific approval is required to clone genes for the following molecules toxic to vertebrates:[99] exotoxin A of *Pseudomonas aeruginosa*; pyrogenic exotoxin type A (Tox A) of *Staphylococcus aureus*; diphtheria toxin; *Staphylococcus aureus* determinants A, B and F (which may be implicated in toxic shock syndrome); *Escherichia coli* heat-labile enterotoxin-like toxin; virulence factors of *Vibrio* strains; shiga-like toxin of *E. coli*; and the A subunit of cholera toxin.

It is important to note that in 1978 NIH prepared an environmental impact assessment of proposed revisions to its Guidelines which, *inter alia*, referred to possible deliberate misuse: "In the event that recombinant DNA technology can yield hazardous agents, such agents might be considered for deliberate perpetration of harm to animals (including humans), plants or the environment. The possibilities include biological warfare or sabotage . . . With regard to biological warfare, the use of recombinant DNA for such purposes is prohibited by the Biological Weapons Convention".[100] In this connection, the assessment also quotes the remarks of Ambassador Joseph Martin, Jr mentioned earlier.

It was recently reported "that the US Army is planning a substantial expansion in its biological warfare research programme, and may be particularly interested in the potential role of recombinant DNA in the development of biological weapons".[18] As a result, US scientists took action to insert into the NIH Guidelines a paragraph explicitly prohibiting the use of genetic engineering to construct BW agents[101] because "use of molecular cloning for the deliberate construction of biological weapons is, per se, the most serious biohazard imaginable for this technology".[102]

Proposals and comments regarding such an insertion were discussed by the Recombinant DNA Advisory Committee on 28 June 1982.[103] Official representatives of the DoD declared that the USA would follow the Biological Weapons Convention without reservation. Committee member David Baltimore insisted that an insertion of this nature would imply the existence of an ambiguity in the Biological Weapons Convention and that this might lead to its undermining. Specifically, he suggested that this could lead to an erosion of the obligations on the USA to follow the Convention. He further felt that this could also substantiate the suspicion that genetic engineering for the development of BW agents might be permissible. In the end, the Committee resolved that: "The Recombinant DNA Advisory Committee advises the Director, NIH, that the existing treaty of 1972 [the Biological Weapons Convention] includes the prohibition on the use of recombinant DNA methodology for development of microbial or other biological agents, or toxins, of types or in quantities that have no justification for prophylactic, protective or peaceful purposes."[103]

Nevertheless, Goldstein, [104] Wright and Sinsheimer[46] and others remain concerned over the potential use of recombinant DNA technology for BW. However, these concerns seem not to be justified except for a consideration of criminal misuse by irresponsible individuals. In this regard it has been suggested that "terrorism is the type of instrument for which C/B weapons would be ideally suited".[4] The fear of terrorist action of this sort is not restricted to the misuse of genetic engineering and is therefore not new. For example, as Hurwitz points out, essentially anyone has long been able to order quantities of *Clostridium botulinum* from the American Type Culture Collection in Rockville, Maryland, for a fee of $34. "All that the collection requires is that the request be made on a business letterhead or requisition form from a suitable research facility or laboratory . . . There is even an 800 [i.e., free] number provided for easier service!"[4]

Toxins in relation to BW agents

Although toxins are chemical weapons, as discussed earlier, uncertainties have been expressed from time to time as to whether they should be regarded as BW agents. These uncertainties have recently been raised again by some because of the possibilities provided by genetic engineering for the production of toxins or active fragments thereof by bacteria or other organisms modified to do so by *in vitro* recombination techniques or even by chemical synthesis. Thus, Edith Brown Weiss felt that: "There is one class of weapons which does not clearly fall within the Biological Weapons Convention: toxic chemicals produced by recombinant DNA techniques".[105]

The participants of the above-mentioned 1977 meeting held at the Massachusetts Institute of Technology had also considered the case of the production of a pathogenic substance completely *in vitro* from synthetic reagents using biosynthesized enzyme catalysis. It was suggested that: "A weapon based on such a substance could be considered a chemical and not a biological weapon and therefore might not be covered by the Biological Convention". Therefore "the group strongly believes that the chemical warfare treaty [i.e., a proposed chemical weapon convention comparable to the Biological Weapons Convention] should contain provisions to cover such fabrication techniques".[81]

"While naturally-occurring toxins are prohibited by the [Biological Weapon] Convention, no matter how they are made", it was not clear to Wright and Sinsheimer:

> that this prohibition would apply to modified toxins produced either by chemical means or *in vitro* by enzymes made available in quantity by recombinant DNA techniques. If these substances were defined as chemicals, they would be made under the chemical warfare program and the processes could be classified. Conceivably, then, use of recombinant DNA technology for such purposes could proceed without public scrutiny.[46]

Apropos this concern, Hedén considers that:

> the methods now available to determine the fine structure of the active sites of toxins may lead to the synthesis of chemical weapons. Recombinant DNA technology . . . permits the manufacture of precisely controlled genetic modifications. If the physiological activity of such modified molecules is studied in relation to their fine structure it is reasonable to assume that the knowledge gained could inspire the design of weapons that might be produced entirely by chemical means.[106]

There should be no problem regarding the question of whether laboratory-synthesized toxins remain under the aegis of the Biological Weapons Convention. This is the case because the Biological Weapons Convention includes BW agents *and* toxins,[107] prohibiting the development, production and stockpiling of toxins "whatever their origin or method of production". Thus, the development of genuine toxins for hostile purposes is forbidden by the Convention.

The Convention includes no definition and "does not make clear what poisons are or are not to be regarded as 'toxins' ".[108] However, according to Goldblat, "the language of the Convention is meant to avoid ambiguity and to ensure that the concept of toxins is understood broadly: both biological and synthetically produced or modified compounds that can be used as warfare agents are covered by the prohibition, 'whatever their origin or method of production' ".[109] But it can be legitimately asked whether the language of the Convention also encompasses, say, fragments of toxins not only much smaller than their original genuine toxin prototypes, but in addition with a more or less changed amino acid composition.

In this connection it can be noted that the 1925 Geneva Protocol is weakened not only by reservations made by a number of states parties, but also by problems raised by its interpretation in the absence of definitions. The United States, for example, has given the Geneva Protocol a narrow interpretation and contends that the use of irritants, such as tear gas, and anti-plant chemicals (herbicides) are not covered by the Protocol.[110] This raises the question whether the Biological Weapons Convention is also open to narrow interpretation, for example, defining fragments of toxic molecules gained by chemical synthesis as not being covered by it.

Additional grey areas

Concern is sometimes expressed regarding completely new types of BW or TW agents which might—at least by malicious interpretation—not be regarded as such. In a discussion on patenting processes and products of genetic engineering, Brenner foresaw that "using both new and old methods it should be possible to speed up evolution in the test tube and go through in a few years what might have taken 10 billion years to accomplish in nature, and so produce something that is totally new".[111] Likewise, Wright and Sinsheimer wonder whether the prohibition of the development of biological weapons by the Biological Weapons Convention covers the construction of novel harmful agents.[46] Soviet scholars Milstein and Semejko some years ago expressed the concern that " 'genetic weapons' can also be qualified as half-synthetic, formed artificially. . . . Those same 'genetic weapons', examined in a broader context, could be considered a new independent type of weapon capable of mass destruction".[112] However, the editor of the *Bulletin of the Atomic Scientists*, in which the Milstein and Semejko paper was published, noted that "this contention directly contradicts not only the letter of the Biological Weapons Convention but also the understanding of it by the scientific community".[113]

It is here unambiguously suggested that as long as agents are able to multiply, even if they are "totally new", they must be defined as BW agents and are thus covered by the Biological Weapons Convention. This holds true also for infectious, self-replicating nucleic acids synthesized *in vitro*. Even the possible use of genetic material of negative-strand RNA viruses, such as Rift Valley fever virus, Marburg virus, Lassa virus, influenza virus, Newcastle disease virus and many others, does not create a loophole in the Convention. These viruses contain RNA molecules in their particles, termed 'negative strands' because they are complementary to messenger RNA. Because they are complementary to messenger RNA they cannot be translated by the infected cell unless virus-specific RNA-dependent RNA-polymerases (replicases) are introduced together with the viral RNA into the host cell. These polymerase molecules transcribe specifically the viral RNA molecules into plus-strand RNAs which can be translated by the protein-synthesis machinery of the host cell and can thus initiate the further steps of viral multiplication. If their RNA genomes might some day be synthesized *in vitro* and then assembled into micro-capsules together with specific polymerase molecules also obtained by chemical synthesis, the question could then be raised as to whether these should be regarded as infectious entities not covered by the Biological Weapons Convention. Here too the answer is clearly no. An artificial virus might thus have been created that is capable of multiplication; and therefore it must be regarded as a biological agent.

IV. Conclusions and recommendations

Despite the new possibilities provided by genetic engineering, BW agents—including viruses and infectious nucleic acids—improved or developed by these methods are concluded to be covered by the prohibition of *use* of CBW (including TW) agents imposed by the 1925 Geneva Protocol as well as by the prohibition of *development, production and stockpiling* imposed by the 1972 Biological Weapons Convention. On the other hand, the risk barrier preventing the use of BW agents has been lowered because genetic engineering and other new biotechnological methods provide, *inter alia*, greater knowledge of the targets of CBW agents on the one hand and more efficient means for the protection of a potential user's armed forces and civil population on the other.

The *use* of any possible ethnic weapon is also concluded to be prohibited by the 1948 Genocide Convention. Absent, however, is any international treaty that would prohibit the development, production and stockpiling of such agents. On the other hand, genetic engineering again provides greater knowledge of the targets. This latter concern also holds true for CW agents with delayed toxic effects, for example, those having mutagenic, carcinogenic or teratogenic properties.

Toxin weapons improved or developed by biotechnological methods are covered by the Geneva Protocol as well as by the Biological Weapons Convention. Both of these treaties lack definitions. As a consequence, the possibility of a loophole can be suggested to exist regarding toxins or fragments thereof which have been produced by chemical synthesis and which differ in size or composition from natural toxins. It therefore becomes important that the states parties to the Biological Weapons Convention reach consensus on a definition making clear that the term 'toxin weapons' encompasses such molecules, and that it also includes 'toxic molecules' as dealt with in the NIH Guidelines of 1978 for research involving recombinant DNA molecules.

In accordance with the conclusion reached by the three depositary governments of the Biological Weapons Convention, "Developments in the ability to manipulate genetic material intentionally should be followed closely and periodically re-evaluated".[16] The forthcoming Review Conference should do so, as well as concerned non-governmental organizations.

In preparation for the forthcoming Review Conference the states parties should consider whether language must and can be found to restrict potential misuse of the permission given in the Convention to develop, produce and stockpile BW and TW agents for "prophylactic, protective, and other peaceful purposes". Various possibilities have been discussed regarding this point during the Committee on Disarmament talks in Geneva. For example, an international bureau could be founded, connected perhaps to the World Health Organization, to which collection of and research on such agents, and the development of vaccines against them, must be notified. At least some measure of international verification must also be considered.

In accordance with the conclusion reached by the participants at the first, 1980, Biological Weapons Convention Review Conference, it is also urged that those states which have not yet become parties to the Convention should do so without further delay.

Finally, greater efforts have to be made in order to reach international consensus regarding a chemical weapon convention which would be at least comparable in scope to the existing Biological Weapons Convention and free of loopholes.

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Appendix 12A

Glossary

Antibody	An immunoglobin. A protein molecule capable of binding and neutralizing a specific antigen, *q.v.* An antibody is composed of units of four polypeptides (two heavy and two light chains) linked together by disulphide bonds.
Antigen	A molecule capable of inducing the production *in vivo* of a neutralizing antibody, *q.v.*
Bacterial conjugation	A parasexual mode of unidirectional transfer of DNA from donor bacteria to recipient cells, involving cellular contact and controlled by so-called fertility plasmids, *q.v.*
BW	Biological warfare.
BW agent	A living organism, including a virus or infective material derived from it, used for hostile purposes to cause disease or death in humans, animals or plants, and depending for its primary effect upon its ability to multiply in the organism attacked.
Clone	A nearly identical group of cells, viruses or molecules descending from a single common ancestor.
Cloning	Preparing a clone, *q.v.*
CW	Chemical warfare.
CW agent	A chemical substance, including a toxin, *q.v.*—whethe gaseous, liquid, or solid—used for hostile purposes to cause disease or death in humans, animals or plants, and depending for its primary effect on its direct toxicity.
DNA	Deoxyribonucleic acid. A polymer of four different building blocks, the deoxyribonucleotides. DNA is the genetic material of all organisms and viruses, except for the small class of RNA-containing viruses.
DNA-mediated transformation	Genetic transformation. A parasexual mode of unidirectional transfer of isolated DNA from donor cells to recipients.
DNA repair	Repair of DNA damage induced by chemical or physical means. Different repair mechanisms are found in living cells catalysed by different repair enzymes.
Ethnic weapon	A genotype-targetable weapon. A BW or CW agent that would employ differences in gene frequencies among different ethnic groups.
Genome	The whole genetic information of an organism. Usually refers to the genes present in the nucleus.

Genetic transformation	See DNA-mediated transformation.
Interferon	Protein inhibiting development of a virus in a cell.
In vitro	An experiment or other action carried out in a cell-free system (e.g., *in vitro* protein synthesis) or with isolated cells from higher organisms (e.g., *in vitro* transformation).
In vitro recombination	The joining of DNA molecules or fragments thereof *in vitro* which can be transferred into recipient cells by means of DNA-mediated transformation or transfection. If 'passenger' DNA molecules are joined with molecular vehicles, *q.v.*, they can be replicated, i.e., cloned, in the transformed cell.
LD_{50}	Lethal dose, 50 per cent. The dose of a harmful agent required to kill 50 per cent of individuals in a population, within a specified period.
Molecular vehicle	Molecular vector; gene vector. A DNA molecule capable of autonomous replication in certain host cells and used to clone 'passenger' DNA molecules joined to them by *in vitro* recombination. Viral DNA molecules and plasmids, *q.v.*, are used as molecular vehicles.
Monoclonal antibody	One of a group of identical antibodies able to react with one and the same antigen, *q.v.*, produced by a clone of engineered antibody-producing ('hybridoma') cells obtained by fusion of immortal tumour cells with stimulated lymphocytes.
Mutagen	A biological, chemical or physical agent causing a mutation, *q.v.*
Mutation	An inheritable change in the genetic material involving single nucleotides, parts of DNA or viral RNA molecules, or whole chromosomes.
Pathogen	Agent causing disease.
Plasmid	A set of additional extrachromosomal DNA molecules of bacteria capable of autonomous replication and conferring upon its host some new genetic information. A plasmid may control the resistance of its host to drugs (resistance plasmids) or its ability to transfer genetic material by bacterial conjugation. Viral DNA of higher organisms may also be in a plasmid-like status. Some plasmids are suitable for use as molecular vehicles, *q.v.*
Polymerase	An enzyme that links nucleotides together to form polynucleotide chains.
Polynucleotide	A polymer of nucleotides : *q.v.*, RNA, DNA.
Polypeptide	A relatively small polymer of amino acids, linked together by peptide bonds. Protein molecules consist of one or more identical or different polypeptides.

Restriction enzyme	A restriction endonuclease—an enzyme capable of recognizing and cleaving specific sequences of deoxyribonucleotides. The sequence-specific cleavage is one of the main prerequisites of genetic engineering because it allows the reproducible generation of fragments of DNA molecules of identical length.
Restriction-length polymorphism	If restriction enzyme recognition sites are lost by mutation, seemingly identical DNA molecules (whether derived from viruses or human beings) are not always cleaved into fragments of the same size. Thus a mixture of fragments might be obtained which are polymorphic with respect to their length.
RNA	Ribonucleic acid. A polymer of ribonucleotides. RNA is the genetic material of RNA-containing viruses. In DNA-containing cells RNA is not the genetic material, but is involved in different processes of gene expression, i.e., protein synthesis.
Toxin	A toxic substance normally produced by a living organism.
Transduction	A parasexual mode of unidirectional transfer of DNA from donor cells to recipients by viruses.
Transfection	A parasexual mode of unidirectional transfer of isolated viral genetic material (transformation with infectious nucleic acid).
Transformation	See DNA-mediated transformation.
TW	Toxin warfare.
TW agent	A toxin used as a CW agent, *q.v.*

13. Nuclear weapon command, control and communications

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Superscript numbers refer to the list of notes and references at the end of the chapter.

I. Introduction

The US military command, control and communications (C^3) system has been identified by the Reagan Administration as the weakest link in US nuclear forces and the number one priority of modernization. Meanwhile, interest has been focused on improving crisis communications and inadvertent confrontation. Any perception that the improvements to the C^3 system are programmes merely to avert accidents or correct weaknesses in internal crisis management is false.[1] The improvements go beyond correcting deficiencies in the peace-time system. The goal of C^3 modernization is to provide wartime 'survivability and endurance' to fight and control a nuclear conflict and to facilitate the 'successful' use of nuclear weapons.

This chapter describes and analyses the C^3 systems of the United States and the Soviet Union which support nuclear weapons. It begins with a definition of C^3 and its relationship to nuclear strategy, discusses US and Soviet C^3 systems in three parts—the command and control of nuclear weapons, early-warning and attack assessment, and strategic communications—and discusses future systems and their implications. Four key issues are then discussed in the conclusion: the adequacy of crisis measures between the superpowers, trends in the control of nuclear weapons, attack assessment programmes and launch-on-warning/launch-under-attack options.

What is C^3?

Command, control and communications is the term used to describe a system of input, processing, decision-making and execution for military forces and operations. Being a 'system', it is largely composed of electronic aids—sensors, computers and communications links—but the central feature remains human decision-making. C^3 supports the routine administrative decision-making to budget and allocate resources in peacetime, to monitor the world-wide political and military situation, and for contingency planning, training and exercises. Nuclear weapons, however, with the compression of time and distance they have brought, and the catastrophic consequences of their use, necessitate absolute central control of military forces and the special C^3 arrangements. Thus, a so-called 'strategic' C^3 system has been developed, focused on nuclear weapons.[2] A recent US Department of Defense (DoD) definition of the strategic C^3 system includes "those capabilities required to provide survivable, reconstitutable, and secure means for management of the strategic nuclear forces and for technical support of operations of these forces prior to, during, and following global nuclear conflict".[3] There are three distinct components of the C^3 system: (*a*) command authorities, nuclear control systems and command centres to analyse data, make decisions, carry out directions and control forces; (*b*) sensors, including intelligence systems, providing inputs of warning and attack characterization; and (*c*) communications links to distribute warning data, and ensure the proper execution of commands.

According to the DoD, the first function is composed of "command centers, in which command decision makers and their staffs evaluate information on enemy actions and the status of friendly forces and provide direction to the forces for the accomplishment of assigned objectives".[4] The centrepiece of command, in both superpowers, is civilian control over nuclear weapons. This control is governed by a concept which is known as the National Command Authority (NCA), establishing heads of state and designated officials as the exclusive authorities for decisions dealing with nuclear weapons.[5]

The second function of the C^3 system is "sensor systems, which provide warning of enemy attacks, intelligence on enemy forces, assessments of enemy actions and own-force strikes, and targeting data for use by own-force firepower".[6] Early warning is divided between what is termed 'strategic warning', intelligence systems which operate 24 hours a day to analyse indications of potential enemy action, and 'tactical warning', which provides immediate data on the launch of missiles or actions preparing for the use of nuclear weapons.[7]

An array of ground- and satellite-based early-warning sensors are in place to provide tactical warning of missile and bomber attack. These sensors consist of three types: (*a*) satellites for infra-red detection of land- and submarine-based missile launches; (*b*) land-based radars for detecting missiles in flight; and (*c*) land-based radars for detecting bombers and airborne objects in flight.

The early-warning system is primarily concerned with avoiding strategic surprise and serving as a means to reliably detect and interpret attacks, but it is also an integral element of nuclear war-fighting strategy. The "strategic surveillance and warning systems", according to the DoD, "must provide extremely reliable and timely decisions of the onset of nuclear attack, to enhance the survivability of strategic forces and the means to direct them, and to support selections by the National Command Authority of the most effective response options".[8] As the early-warning components have changed, greater requirements for 'attack assessment' have been created. As will be seen, the early-warning system no longer merely accomplishes the elimination of surprise attack or false warning.

The third function of the C^3 system is communications, "for conveying information from sensor systems to command centers, interconnecting command centers for coordination of operations and transmitting orders from command centers to the forces".[9] Redundant communications links over almost every electronic transmission medium have been established (see table 13.1) to ensure 'connectivity' between the NCA and the nuclear forces. "Strategic communications", according to the DoD, "must provide for rapid and certain delivery of Emergency Action Messages to the strategic forces, report-back from the forces, and support reconstitution of forces and command entities following an initial attack".[10] These communications links serve the following purposes: (*a*) 'rearward communications systems' to transmit early-warning information from satellites and radars to command centres; (*b*) inter-military communications to evaluate warning information and plan response options; (*c*) command communications for crisis management and direction of military forces; (*d*) special networks for the control of nuclear weapons; (*e*) special networks for discussions with the United States/Soviet Union; and (*f*) war termination communications.

C^3 and nuclear strategy

The C^3 system serves a number of purposes to ensure the success of nuclear weapon strategy.[11] First, it ensures civilian control over nuclear weapons. Second, it serves as a hedge against surprise attack, by providing 'warning' and assisting retaliatory assets to survive. Third, it supports nuclear strategy by providing timely and accurate information about enemy action. All of these can be easily accomplished. Control of nuclear weapons in peace-time is ensured through a combination of security devices and procedures. In wartime, however, the distinction between military and civilian decisions is blurred. Surprise nuclear attack is not considered the most likely scenario facing the superpowers.[12] Thus the C^3 system and the concerns of vulnerability and modernization also serve other purposes: controlling actions after the initiation of conflict, 'multiplying' the usefulness of forces (retargeting, positioning, navigation) and supporting the 'successful' use of nuclear weapons.

At the beginning of the development of the present C³ system—in the early 1960s—the primary concern was connecting the nuclear forces to the President.[13] The primary function of the C³ system was to detect and confirm an attack and relay the President's retaliation orders to the nuclear forces. Maintaining control over those forces grew in complexity as the

Table 13.1. Military use of the electromagnetic spectrum

Frequency	Frequency range (Hz)/ wavelength	Use and requirements
Extremely low (ELF)	30–300 Hz/ 1 000–100 km (surface wave)	Earth ionospheric duct; resistant to nuclear detonations in upper atmosphere; range depends on power radiated; little disruption from weather; jam-resistant; requires largest antenna; penetrates water to 90 m; sonar; submarine broadcast (76 Hz)
Very low (VLF)	3–30 kHz/ 100–10 km (surface wave)	Resistant to nuclear detonations in the upper atmosphere; current ranges depend on amount of power radiated; little disruption from weather; jam-resistant; requires large antenna; penetrates water to 6 m; sonar; long-range navigation; submarine communications (teletype); Gryphon, SLFCS, Verdin
Low (LF)	30–300 kHz/ 10–1 km (surface wave)	Resistant to nuclear detonations in the upper atmosphere; range also dependent upon power radiated; penetrates water to about 0.5 m; jam-resistant; requires large antenna; used for LORAN, fleet and submarine communications (teletype); Clarinet Pilgrim, GWEN
Medium (MF)	300 kHz–3 MHz/ 1 000–100 m (sky wave)	Radio communications (commercial broadcasting, tactical AM, ship-to-ship, ship-to-shore); LORAN, long-range voice (limited), teletype, telegraph (limited)
High (HF)	3–30 MHz/ 100–10 m (sky wave, surface wave)	Radio communications (tactical AM, ionospheric scatter, fleet, submarine); long-range teletype; teletype, voice, digital data, facsimile, telegraph; OTH-B radar; Cemetery Net, Giant Talk, Scope Signal
Very high (VHF)	30–300 MHz/ 10–1 m (direct)	Line-of-sight voice radio communications and relay (tactical FM radio, FM broadcast, television, ionospheric scatter); strategic communications; radar; Clarinet Merlin
Ultra high (UHF)	300 MHz–3 GHz/ 100–10 cm (direct)	Line-of-sight radio communications and relay (television, tropospheric scatter); ALCS; radar (PAVE PAWS; short-range tactical communications and LOS satellite broadcast (AM/FDM/AFSATCOM; ERCS); digital data; teletype; Green Pine
Super high (SHF)	3–30 GHz/ 10–1 cm (direct)	Line-of-sight radio communications and relay (troposcatter, high priority satellite); radar; DSCS II/III, FLTSATCOM, LES-8/9, SDS, AFSATCOM
Extremely high (EHF)	30–300 GHz/ 1–0.1 cm (direct)	Experimental line-of-sight radio; AFSATCOM, MILSTAR, LES-8/9, FLTSATCOM; submarine report-back; radar, Clarinet Omen, Hydrus

Sources: US Army, Combat Communications, Field Manual FM 24-1, 30 September 1976, Appendix R; *Naval Ocean Systems Center, A Guide to US Navy Command, Control and Communications, Technical Document 247*, 1 July 1979; US Army, Radio & Radar Reference Data, Field Manual FM 24-24.

forces grew. Much of the discussion of C^3 was about how to take advantage of emerging electronic developments. The Cuban missile crisis had a catalysing effect on C^3 when it became apparent that the system did not work under stress. It led to the realization that increased and direct command and control over distant operations would have to be exerted "in real time" from central governments. The bureaucratic and fragmented military structure was centralized, and streamlined command procedures were instituted. A fully interconnecting internal communications system was established along with a 'hot line' connecting US and Soviet leaders. Instant, secure communications, possible throughout the world, afforded direct supervision from long distances over military forces.

The C^3 system has since been central to each new refinement of US nuclear strategy. The adoption of counterforce and countervailing nuclear strategies has had enormous implications for C^3. The requirement for 'options' to deal with a wide variety of potential enemy actions, with responses tailored to provocations, resulted in presidential guidance, placing great emphasis on the C^3 system. Numerous new directives of the Carter and Reagan Administrations have conferred on the C^3 system equal status to the weapons they support.[14] Presidential Directive 53 (PD-53) called for "connectivity between the national command authority and strategic and other appropriate forces to support flexible execution of retaliatory strikes during and *after* an enemy nuclear attack ... [and] responsive support for operational control of the armed forces, even during a protracted nuclear conflict" (emphasis added).[15] Another directive, PD-58, created new requirements for the evacuation or survival of the NCA and government leadership, and emphasized programmes which would facilitate the "reconstitution" of an NCA after a nuclear exchange.[16]

Presidential Directive 59, perhaps the best known of the directives, required a C^3 system which would allow the NCA to exercise a wide variety of response options to a nuclear attack, assess the success of those attacks, monitor the status of nuclear forces and control the surviving as well as reserve nuclear weapons for subsequent strikes on specific Soviet targets. The major change in the directive was the introduction of the requirement for 'endurance'. PD-59 required the capability to fight a protracted nuclear war, lasting months if needed, rather than days as previously called for. According to General Richard Ellis, who described the requirements of C^3 before Congress soon after PD-59 was adopted, "national guidance now requires the capability for a more measured and flexible use of forces throughout the spectrum of strategic nuclear operations ... survivable ... enduring ... to support escalation control or follow on force management. There has been a move towards providing the national command authority with greater flexibility and additional nuclear response options", the General concluded, and therefore "more and better tools" are necessary for command and control. "The ability to control our forces and manage them effectively during protracted conflict requires an enduring, survivable C³I network."[17]

The current C³ programme, according to Reagan Administration testimony before Congress, "focuses on enduring survivability" and must be "relatively indifferent to the Soviet response". The priorities are:[18] (*a*) "absolute control of nuclear weapons" and "assured connectivity" providing long-term endurance through a "multiple exchange campaign" over an extended period of time; (*b*) invulnerability to "cheap shots", such as high-altitude electro-magnetic pulse (EMP), sabotage or jamming; (*c*) the ability to "underwrite deterrence", by providing a "good C3 system that is perceived that way"; (*d*) to "complicate enemy set-piece campaign planning", by eliminating weaknesses which would allow the enemy to know how to start, end and win a war; (*e*) to assess the nature of damage done (to both nations) as a result of attacks and retaliations; and (*f*) to "facilitate termination of nuclear strikes".

II. Command and control of US nuclear weapons

The President as Commander-in-Chief of the armed forces is the primary National Command Authority in the United States. According to DoD directives, "the national command authority consists only of the President and the Secretary of Defense or their duly deputized alternates or successors. The chain of command runs from the President to the Secretary of Defense and through the Joint Chiefs of Staff to the commanders of Unified and Specified Commands."[19] US military forces, including six unified and specified commands which have nuclear weapon responsibilities, receive their orders from the NCA. DoD directives identify the NCA as "the channel of communication for execution of the Single Integrated Operational Plan" (SIOP).[20] For matters dealing with nuclear weapons, the constitutional successors to the Presidency would become the NCA, circumstances permitting, if the President, Vice-President, Secretary of Defense and Deputy Secretaries of Defense were incapacitated or unable to communicate. The Joint Chiefs of Staff (JCS) would continue to act within any chain of command, and it is presumed that they would have the authority to order the use of nuclear weapons given the worst set of circumstances.[21]

Secret directives issued in 1962 created the current procedures for Presidential release of nuclear weapons. These directives establish a system which includes the following: (*a*) a permanent military escort for the President who is custodian of the 'football', a black attache case containing the so-called 'gold codes', and other NCA officials, authentication devices for authorizing the use of nuclear weapons, and the 'Black Book', outlining the President's options in the event of a nuclear attack;[22] (*b*) procedures for passing on the National Command Authority including a 'central locater' for contacting potential Presidential successors;[23] (*c*) strict Presidential and NCA communications connectivity requirements, including a number of special Presidential communications networks operated by the White House Communications Agency and the JCS—Mystic Star, Nationwide and Yankee-Zulu;[24] and (*d*) the system of codes, nuclear control orders and authentication/validation devices for the release of nuclear weapons.

The NCA dates from a 10 September 1948 National Security Council document—"United States Policy on Atomic Weapons"—which states that "the decision as to the employment of atomic weapons in the event of war is to be made by the Chief Executive [the President] when he considers such decision to be required".[25] The President has at his disposal the National Communications System (NCS) and its military substructure, the National Military Command System (NMCS), to maintain control over the armed forces.[26]

The NCS was established on 21 August 1963 "to provide a centrally planned, programmed and operational federal government telecommunications system that would be responsive to the federal government's needs under all conditions ranging from normal situations to national emergencies and international crises including nuclear attack".[27] PD-53, put into effect in 1979, further amplified the requirements of the NCS.[28]

The NMCS "is the priority component of the Worldwide Military Command and Control System (WWMCCS) designed to support the National Command Authorities in the exercise of their responsibilities".[29] The WWMCCS was formally established in October 1962 "to provide the constituted authorities with the information needed for accurate and timely decisions and the reliable communications needed to transmit those decisions to the military forces under all conditions of peace and war".[30] "Since survival of the command and control capability of NMCS is fundamental to continuity of operations," the DoD directive states, "a composite command structure with survivable communications is required. This includes the National Military Command Center, the Alternate National Military Command Center, the National Emergency Airborne Command Post and such other command centers as may be designated by the Secretary of Defense."[31]

Ground and airborne command centres

Four primary military command centres ensure central control, evaluating early-warning and attack information and making recommendations to the NCA. According to one DoD document, "strategic command centers are involved in and must directly support decisionmaking, under conditions of extreme stress and urgency, by the highest echelon of command—the NCA's".[32] There are four NCA centres—the National Military Command Center (NMCC) in the Pentagon, the Alternate National Military Command Center (ANMCC) in southern Pennsylvania, the NORAD (North American Aerospace Defense Command) Cheyenne Mountain Complex (NCMC)/Combat Operations Center (COC) near Colorado Springs, Colorado, and the Strategic Air Command (SAC) underground command post in Omaha, Nebraska. Two key early-warning systems—the DSP early-warning satellites and the PAVE PAWS submarine-launched ballistic missiles (SLBM) radars—feed data directly to all four command centres, which receive simultaneous displays.[33] The NCA centres are supplemented by numerous alternative and regional ground centres, a fleet of airborne command posts and a growing number of mobile command centres (see table 13.2).

The NMCC and ANMCC are operated by the Joint Chiefs of Staff and in the chain of command for release of nuclear weapons. The NMCC serves as the peace-time hub of control over military operations. It is connected to the White House Situation Room and Presidential communications networks and contains the Washington terminal of the Direct Communications Link (DCL) (the 'hot line') to the Soviet Union. Because the Pentagon is presumed vulnerable, it is backed up by the hardened ANMCC located 104 km north-west of Washington in the Catoctin Mountains. The ANMCC serves as the hub for the JCS and a representative of the NCA (or potential successor) during crisis and wartime.

The NORAD NCMC and the SAC underground command post are the 'field' centres critical to nuclear weapon decision-making and control, 'capping systems' acting as the focal point for processing information from numerous lesser systems. NCMC has the primary responsibility for monitoring all early-warning sensors and evaluating attack reports. SAC monitors the state of nuclear forces and distributes NCA orders to the nuclear forces.[34] Unified and Specified Commands with nuclear weapon responsibilities are also required to operate primary and alternative command posts "necessary to insure that a capability exists to implement the SIOP execution order of the NCA".[35]

Computer systems are an integral element of the entire command process. Whether at early-warning sites or command centres, computers reduce large masses of data to relevant information suitable for display and rapid human comprehension. In communications, they expedite transmission and routing of messages and facilitate automation of standard operations. Computers are also central to data exchange between command centres, integrating sensor inputs, and storing and retrieving force status and planning information.[36] Computer data bases are constantly updated as field units continually feed information into them. Three key computer systems are used in the command and control of nuclear weapons: the Worldwide Military Command and Control System (WWMCCS) Information System (WIS), the Strategic Air Command and Control System (SACCS) and the NORAD Command Center Processing and Display System (CCPDS).

The WWMCCS network, composed of 35 computer systems at 26 command locations (being modernized under the WIS), provides "current situation monitoring, formulating responses to warning, selecting options, employing forces, assessing damage, reconstituting forces, and conducting activities necessary to terminate a fight".[37]

The SACCS system (Program 465L) is the primary computer system used by SAC for the storage and retrieval of operational data, weather data, force movements, strengths, strike-force readiness and planning information. Command centre personnel, through the SACCS, can retrieve automated data on SIOP status and developments, alert and 'execute' the force, conduct exercises and assess force readiness. Access to the SACCS is through the 200 terminals of the SAC Digital Information Network (SACDIN). Orders to use nuclear weapons (Emergency Action Messages and Nuclear Control Orders) and retarget forces are transmitted through SACDIN.[38] SACDIN is not a communications system, *per se*, but uses other data networks (DDN, AUTOVON, AFSATCOM, SLFCS, PACCS) to relay data.

The NORAD computer systems (under Program 427M)—composed of the Command Center Processing and Display System and the Missile Warning and Space Surveillance System—receive, process, store and display data about the status of air defences, early warning, satellites and enemy submarines. The CCPDS, operational since September 1979, consolidates missile warning and space surveillance information into a single computer system.[39]

Airborne command centres (with their accompanying airborne communications relays) back-up land-based command centres and can take over the functions of "command and control of strategic forces in the pre-, trans- and post-attack phase of a general nuclear war".[40] Since February 1961, a command centre of the Strategic Air Command has been constantly airborne, available to take control of nuclear forces if necessary. The airborne command centres consist of five major elements: (*a*) the National Emergency Airborne Command Post (NEACP) ('Nightwatch'), a JCS 'battle station' and survivable command centre for the NCA or 'NCA Senior Advisor', consisting of four E-4 converted 747-type commercial airliners;[41] (*b*) the SAC Post-Attack Command and Control System (PACCS) ('Looking Glass/Cover All'), consisting of 27 EC-135

Table 13.2. US command centres

Command centre	Date active	Type	Functions
NCA command posts			
NMCC (Pentagon)	1959	Unhardened	NMCS/WWMCCS centre; DCL terminal; primary link from NCA to armed forces; NMIC, JRC, Nuclear Warfare Status Branch of JCS
ANMCC (AJCC)	1955	Hardened	Raven Rock, PA; NMCS/WWMCCS centre; JCS alternate HQ
NEACP	1975 (1961)	Airborne	2 E-4A/2 E-4B; NMCS centre, MEECN element; 13 external communications systems, including SATCOM and VLF; SIOP release capability (NCA Senior Advisor); ALCS on E-4B
MCC	(1988?)	Mobile	NCA, Secretary of Defense and JCS support
NORAD (Cheyenne Mountain)	1966	Hardened	WWMCCS hub; SIOP release capability; monitoring of EW assets; attack assessment; National Warning Center (civil defence); Space Defense
Back-up Facility	1980	Unhardened	Peterson AFB, CO
ALCOP	1950s	Mobile	Malmstrom AFB, MT
22d NORAD region	1960s	Hardened	North Bay, Canada
RAPIER	1982	Mobile	Rapid emergency reconstitution
SAC (Offutt AFB)		Semi-hardened	WWMCCS centre, SACCS centre; line from NCA to SAC nuclear weapons via UHF/HF to VLF; SIOP release capability
HERT	1981	Mobile	Headquarters Emergency Relocation Team
PACCS/Cover All	1959	Airborne	MEECN element; SIOP release capability; SAC Abn CP can launch ERCS; ALCS (UHF); 12 EC-135C, 4 EC-135G, 5 EC-135A, 5 EC-135L, 1 EC-135M
SAC Alt 1		Semi-hardened	Barksdale, LA
SAC Alt 2		Semi-hardened	March, CA
Service command centres			
Navy Command Center		Unhardened	Pentagon
Army EOC		Unhardened	Pentagon
Air Force EOC		Hardened	Raven Rock, PA

Regional nuclear responsible command posts			
EUCOM (Stuttgart/ Casteau-Mons)		Unhardened	US headquarters at Stuttgart-Vaihingen (TNF release); NATO HQ at Casteau
War HQ		Semi-hardened	Unknown; possibly Belgium
Rear War HQ	(1986)	Semi-hardened	High Wycombe, UK
Silk Purse	1966	Airborne	MEECN element, 4 EC-135H
LANTCOM (Norfolk)		Unhardened	Separate NATO and US command centres
Scope Light	1973	Airborne	Langley AFB, VA; MEECN element, 4 EC-135C/H/P
PACOM (Pearl Harbor)		Unhardened	Peace-time operating centre
CINCPAC alternate		Semi-hardened	Kunia, Hawaii
Blue Eagle	1966	Airborne	Hickam AFB, Hawaii; MEECN element, 4 EC-135J
US Forces Korea		Semi-hardened	Taegu, South Korea
JTFAK (Elmendorf)		Unhardened	Joint Alaskan operations, including nuclear weapon plans
Alternate		Mobile	Aboard train
Government command centres (COG, reconstitution)			
WH Sit Room		Unhardened	DCL terminal link
Alt WH Switchboard		Unhardened	Camp David, MD
FEMA Special Facility		Semi-hardened	Mount Weather, VA
Alt. National Warning Centers		Semi-hardened	Olney, MD; Denton, TX
Regional FEMA Centers		Some semi-hardened	Maynard, MA; New York, NY; Thomasville, GA; Battle Creek, MI; Denver, CO; Kansas City, MO; Santa Rosa, CA; Bothell, WA

converted 707-type commercial airliners, flying constant airborne alert shifts with ground alert by back-up planes, consisting of Airborne Launch Control Centers (ALCC), radio relay aircraft and auxiliary command posts;[42] (*c*) the regional nuclear commander-in-chief ('Nuclear CINC') airborne command centres, "which provide survivable adjuncts to ground-based command and control facilities for direction of SIOP forces in these commands", all EC-135 converted planes, consisting of 'Silk Purse' for European Command, 'Blue Eagle' for Pacific Command and 'Scope Light' for Atlantic Command;[43] (*d*) the communications relay aeroplanes of the Navy, known as TACAMO ('Take-Charge-and-Move-Out'); and (*e*) specially configured NCA helicopters, designated 'Crown Helo'.[44]

According to JCS documents, "the NEACP is an alternate command center of the NMCS . . . for direction of the Armed Forces during general war . . . NEACP will operate as the primary control center when the NCA are on board . . . [and] contain the facilities to provide sufficient information upon which to base a recommendation to use nuclear weapons and to specify the amount of force to be applied".[45] The NEACP would not necessarily include the President, however. According to one SAC Fact Sheet, "the mission of the NEACP is to support the Secretary of Defense and the JCS during a general war".[46]

The NEACP has the capability to communicate with the PACCS aircraft, which at full force would consist of eight airborne aircraft: the primary and two auxiliary command aeroplanes, two communications relays and three secondary back-ups, designated Airborne Launch Control Centers 1, 2 and 3. NEACP and PACCS would further connect with the Navy TACAMO aircraft, which would relay communications to the nuclear missile submarines.

The airborne command posts of the so-called SIOP CINCs (known as the Worldwide Airborne Command Post System) (WWABNCP) would "provide a survivable command and control facility for the SIOP CINCs that will support the National Command Authority during all phases of a general war".[47]

At a cost of over $1 billion, all four NEACP aircraft are being upgraded to E-4B models. The modification programme, scheduled for completion in early 1985, will reconfigure the 'A' models with full WWMCCS data access, SHF satellite terminals, improved VLF/LF transmission capability, AFSATCOM, EMP hardening, an IONDS readout terminal (discussed below) and the airborne launch control system (ALCS).[48] The purchase of two additional E-4 aircraft has been rejected by both the Carter and Reagan Administrations, but the aircraft are being rebased inland from Andrews AFB near Washington to Grissom AFB in Indiana, where they are thought to be less vulnerable.[49]

The current WWABNCP aeroplanes will also be modernized with limited VLF/LF transmission, higher power extended transmission range (by 1 600 km), EMP hardening (from FY 1982–87), and new UHF and satellite equipment.[50] SAC has also initiated a request for a new generation of airborne command post aircraft to replace the EC-135 series. The EC-17, a command post version of the C-17 transport being built by McDonnell Douglas, is being examined as a replacement. The EC-17 will have greater space and upgraded communications and data processing equipment. Through the use of fibre optics they will be less vulnerable to nuclear effects, and the weight and space required for cables on the aircraft will be reduced.[51]

In order to operate "beyond the initial stages of a nuclear conflict", mobile command centres are also being developed to "take over the key functions of our airborne command posts if they could no longer operate effectively".[52] The "movement towards enduring command control" necessitates "mobility, deception and covertness".[53] In addition to NCA mobile command centres, both SAC and NORAD have developed mobile and "reconstitutable" command vans to operate if their ground and airborne centres were destroyed, and the Secretary of Defense, JCS and regional nuclear commanders-in-chief are also developing mobile command centres.[54] According to the DoD, "we remain concerned . . . about the ability of airborne command posts to operate beyond the first few days of a nuclear war".[55] A "post-attack WWMCCS" development programme also began in 1980, including a prototype ground mobile command capability.[56] The possibility of deep underground basing for command and control facilities in the 1990s is also being examined.[57]

The release and use of nuclear weapons

Integral to the NCA system are measures to ensure that decisions concerning the release and use of nuclear weapons will always be made at the highest level of government.[58] The enforcement of control over nuclear weapons and the prevention of unauthorized or inadvertent use are accomplished by procedures which inhibit the use of nuclear weapons or devices which provide 'positive control' by interrupting the assembly or firing sequence of a nuclear weapon until secure 'enabling information' is received. The former is accomplished by the use of emergency action procedures, nuclear control orders, two-man rules, Sealed Authentication Systems (SAS) and codes—the latter by use of Permissive Action Links (PAL).[59] Each nuclear weapon system fielded by the DoD is subjected to a study to determine if it meets guidelines regarding unauthorized launch.[60] The types of control device are then determined based upon the conclusion of these studies.

The release of nuclear weapons is in accordance with JCS "Emergency Action Procedures" and would be communicated by the NCA through the "Emergency Action Message" (EAM) (see table 13.3). The EAM is a specially coded and formatted message that must meet rigid specifications to ensure verification of 'authority' before command posts and launch crew members will accept its authenticity. The elaborate NCA instructions to the nuclear forces specify a course of action to be followed by the military forces.[61] The EAM is passed through the Secretary of Defense to the Joint Chiefs of Staff where it is encoded as a "Nuclear Control Order" (NCO) and dispatched by the NMCC/ANMCC to Unified and Specified Commands. The JCS have identified certain NCOs to the forces that would have to be verified using "sealed authentication procedures", and then retransmitted to subordinate units.[62] At each echelon, as coding and decoding takes place, the process can be stopped if a message fails to meet coding and formatting requirements, and would thus be considered invalid.[63]

Table 13.3. Procedures for use of nuclear weapons

1. Emergency Action Message (EAM) from National Command Authority
2. Two men copy and decode EAM, if it is a Nuclear Control Order (NCO)
3. 'Red Safe' is opened and the Sealed Authenticators and 'keying assemblies' are removed
4. NCO is authenticated, matching with duplicates in Red Safe
5. Emergency War Order (EWO) procedures check-list started
6. Access established to missile arming and firing circuits, directly or through ALCS
7. Option implemented and selected, for missiles, option dialed on two-digit selector, corresponding with NCA approved option in NCO
8. 'Launch Enable' established, allowing missiles to accept a 'Launch Execute', or 'Auto' established, combining enable and launch votes in a single action for immediate launch
9. Time Delay determined for missiles
10. 'Launch Inhibit' possible, interrupting next step to execute launch command by second missile launch control centre
11. If second LCC puts in a launch inhibit signal, a second launch vote from a third LCC can override
12. 'Launch Execute', by turning keys, providing two launch votes for an enabled missile
13. If ALCS, 'toggle switch' third vote by pilot of EC-135 or battle staff coordinator of E-4B

Sources: Boeing Company, 'ALCS: Airborne Launch Control System', n.d.; House Armed Services Committee, *FY 1979 Department of Defense Authorizations for Appropriations*, Part 3, Book 1, p. 342; Miller, B., 'ICBMs get major modernization', *Aviation Week & Space Technology*, 10 May 1976, pp. 67–70; Del Papa, E.M.H., 'Will Minuteman work?' *Armed Forces Journal International*, January 1976, pp. 14–15.

If proper release orders are received a further set of procedures for missiles, bombers and submarines would be followed to implement the SIOP, the central US war plan. For the land-based missile force, each

Launch Control Center (LCC) of each squadron (five per 50 Minuteman missiles), is connected to and can fire all 50 missiles. As long as there is one LCC in the squadron to execute orders, the missiles stay connected. If contact between the LCCs and the missiles is broken, the entire 1 000-missile Minuteman force could be launched via the airborne launch control system (ALCS).[64] ALCS access to the missiles is dependent on isolation of the LCCs from the missiles. Each ALCS aeroplane has a missile launch crew which can transmit the secure Minuteman launch codes to the missiles. The ALCS allows airborne crews to launch all Minuteman missiles, but only against targets pre-stored in missile guidance computers.[65] In addition, the ALCS has two "preparatory commands", which implement launch options: Preparatory Launch Command Alpha (PLCA), which enables the airborne crew to select any of 100 pre-planned targeting, targeting mode and delay timing options for an entire Minuteman squadron (50 missiles), or Preparatory Launch Command Bravo (PLCB), which enables the airborne crew to select any of the targets in the missiles' memory and provide timing and targeting mode for an individual missile.[66]

Once bombers and tankers have taken off, "after reaching certain orbit points on their routes, well outside enemy territory, [they would] be returned to their bases unless they receive positive authenticated voice instructions to proceed to their targets".[67] The 'Go Code' is authority from the NCA for bombers to proceed beyond their "positive control" turn-around point. The Go Code would be authenticated at several levels of command and ultimately by two members of the bomber crew. Then, PALs and other arming features would be activated after the Go Code is received.[68]

Transmitting EAMs via TACAMO (VLF) links to submarines (if other communications links were not available) is a time-consuming process. Once a valid NCO is received, launch officers would use the onboard fire control computer to select the proper pre-stored target assignment package containing flight data for each missile and its warheads from a specific launch area. A number of preprogrammed packages are stored in the fire control computers and reprogramming (retargeting) is possible, though time-consuming.[69] Unlike land-based LCCs, four crewmen would have to act in unison to validate launch orders and execute the attack.[70]

Each time nuclear weapons are released, it is for a specific plan or option, and there is no freedom of action on the part of military commanders to subsequently use nuclear weapons again.[71] Once the decision is made to use nuclear weapons, standard procedures are implemented "for coordination of preplanned nuclear operations and reporting of operational data".[72] These procedures, called Coordination of Atomic Operations

Standing Operating Procedures (CAOSOP), are set by the SAC working under the direction of the JCS.[73] What is known about the CAOSOP is that it consists of at least 12 reports which are required for reporting on the course of a nuclear war.[74]

III. Early-warning and attack assessment[75]

The initial warning of land- or sea-based missile attack on the United States would come from early-warning satellites. The current Satellite Early Warning System is the Defense Support Program (DSP), a set of three infra-red detection satellites in geosynchronous orbits, one above the western hemisphere directly over South America, a second over the central Pacific and a third over the Indian Ocean, all maintaining a constant watch on the Soviet Union, China and the oceans.[76]

The infra-red detecting telescope aboard DSP is oriented so that it is always pointing towards the Earth. Offset from the satellite body by 7.5°, the telescope scans a conical area of the planet below as the satellite spins at the rate of seven revolutions per minute, while a counter motion wheel spins in the opposite direction to maintain stability. Infra-red energy is collected into the telescope and reflected off a mirror on to a series of 2 000 angled, two-dimensional detector cells made of lead sulphide, a material sensitive to infra-red energy. Each cell autonomously calculates the intensity of infra-red signals and the corresponding 3.5-km locations on Earth where the signals originate. Data from the various activated cells are then computed and analysed within the satellite, and the precise times of each confirming cell 'hit' and level of intensity are transmitted to ground stations.[77]

When a missile launch occurs, the early-warning satellite senses the infra-red heat from the rocket plume and burning missile motor within a minute of lift-off.[78] 'Mission Data' from the sensing satellite are transmitted to one of two large processing stations (in Colorado or Australia), to a "simplified processing station" in Europe, and to some of six mobile ground terminals (MGTs) where they are processed.[79] A computer library of representative launches is consulted to compare a typical launch with the features of each new launch. Characteristics of previous test flights or satellite launches are compared to determine if the launch is on a 'threat fan'.

Once the data are processed they are transmitted simultaneously ("in near real time") via satellite to the four NCA command centres.[80] Every launch of a rocket from within the Soviet Union and China is monitored to determine whether it is a test, routine civilian space launch or threat. If the launch is determined a threat and all equipment is properly functioning—called a confidence rating—NORAD determines whether the vehicle is going to achieve orbit or impact on the United States.[81]

Extensive modifications of the newest DSP satellites (numbers 14 to 17 are currently being procured) will increase the viewing area of sensors and improve the accuracy of attack assessment.[82] Procurement of the satellites began in 1981, with $2.62 billion already spent on the DSP programme and approximately $2.1 billion planned during FYs 1984–88.[83] Satellite-to-satellite laser crosslink, a second colour focal plane (which reduces laser jamming vulnerability), increased satellite autonomy without ground station command and control, and message rebroadcast will be incorporated into the new satellites.[84] There has also been some speculation about plans to increase the number of operational satellites from three to five.[85]

Even though the DSP is working extremely well, the DoD plans to replace the satellites with a new generation in the 1990s.[86] The desired features of the Advance Warning System (AWS) DSP replacement are improved survivability, earlier detection and more accurate target identification, particularly of submarine-launched missiles.[87] The current AWS R&D programme seeks to develop mosaic sensor arrays, lightweight optics, tunable spectral filters, passive/active thermal coolers and onboard data processing, all with smaller antennas.[88] The satellites will provide data directly to the users, "eliminating the need for vulnerable ground stations"[89] and "designed to operate reliably after an initial Soviet attack".[90]

A number of AWS alternatives are currently being examined: (*a*) Halo/Mini-Halo (DARPA), a dual-capable aircraft- and missile-detection optical system using signal processing charge-coupled devices, which features silicon monolithic arrays and spectral filters allowing a wide field of view at geosynchronous orbits;[91] (*b*) Mosaic Sensor (Air Force), a low-risk DSP follow-on for the 1990s, using focal staring sensor replacing scanning detectors with an array (the Mosaic Sensor lost out to Halo in 1980, and was formally terminated in favour of AWS);[92] (*c*) Hi-Camp (DARPA), a mosaic millimetre-wave receiver, with onboard signal processor, and many more detectors than MSP;[93] and (*d*) Space-Based Surveillance System (SBSS), an IR satellite, part of the ASAT programme, which in addition to tracking satellites would also be able to detect "incoming RVs".[94]

Radar early-warning correlation

As soon as attacking missiles rise above the horizon, shortly after launch, information from other sensors and radars confirms an attack and assesses its nature (see table 13.4). False or incomplete warning is avoided through

Table 13.4. US early-warning and attack assessment systems

System (number)	Function[a]	First deployed	Number active (planned)	Range of sensors (nm)	Comments/status
Space-based					
DSP	ICBM/SLBM/ nudets/verif	1971	3 (3)	–	Simplified processing station deployed in Europe; mobile ground terminals being developed; 17 satellites through FY 1984
IONDS	AA/nudets/verif	1983	4 (18)	–	Three types of sensor to be deployed aboard 18 GPS satellites
Airborne					
ARIA EC-135N	Verif	n.a.	8 (6)	n.a.	'Droop Snoot'; missile test monitoring
AWACS E-3A (411L)	Bomber/CC	1979	7 (12+)	200	Will serve as airborne back-up for ROCCs
Cobra Ball	Verif	1984	– (2)	?	Missile test monitoring programme in RC-135S aircraft stationed in Alaska
Land-based					
BMEWS	ICBM/SLBM/ IRBM/AA/sat	1960	3 (3)	3 000	7 FPS-50 (detection), 4 FPS-49 and 1 FPS-92 (tracking) radars; missile impact prediction computers being upgraded; improved resolution and increased bandwidth being installed
Cadin-Pinetree	Bomber	n.a.	24 (0)	200	Canadian network with $70 million US annual contribution; USA will cease support with phase-out of DEW Line
Cobra Dane (633A)	Verif/ICBM/ SLBM/AA/sat	1977	1 (1)	2 000	AN/FPS-115 phased-array radar replaced AN/FPS-17/80 radars; primary mission: intel collection of missile test data; secondary mission: early warning and satellite tracking
Cobra Shoe	Verif/ICBM/sat	n.a.	2 (2)	2 000	Dormant OTH FPS-17 and FPS-79 radars in Turkey
DEW Line	Bomber	1958	33 (0)	250	AN/FPS-19 radars in Canada, Greenland and Iceland being upgraded under Seek Frost
FPS-85	SLBM/sat	1964	1 (0)	2 500	Radar to be phased out with deployment of south-east PAVE PAWS
FSS-7 (474N)	SLBM	1971	1 (0)	850	Radar to be phased out with deployment of southern PAVE PAWS; 5 inactive FSS-7 radars could be returned to operational status

JSS radars (968H)	Bomber	1982	59 (86)	250	86 radars replacing SAGE/BUIC radars; directed by 8 ROCCs
OTH-B (414L)	Bomber/ICBM/AA	1980	1 (3)	1 800	East (Moscow/Caratunk, Maine), West and South radars under development
PARCS	AA/ICBM/SLBM/sat	1976	1 (1)	2 500	Missile impact prediction computers being upgraded to enhanced PARCS (EPARCS); range from (1 800 nm) upgraded
PAVE PAWS (2059)	SLBM/AA/ICBM/sat	1979	2 (4)	3 000	AN/FPS-115; impact assessment resolution of 25 miles
Seek Frost	Bomber	1984	0 (50)	250	AN/FPS-117 radars and short-range radars replacing DEW Line
Seek Igloo	Bomber	1983	2 (13)	200	AN/FPS-117 replacing existing FPS-93/90 radars in Alaska
Seek Skyhook	Bomber	1971	2 (2)	150	Replacement aerostat-borne radars under development
Ship-based					
Cobra Judy (633B)	Verif	1982	1 (1)	800	AN/SPQ-11 phased array radar for monitoring missile tests

[a] *Function:* AA: attack assessment; AAB: attack assessment (bombers); bomber: bomber early warning; CC: command centre; ICBM: land-based missile early warning; IRBM: land-based theatre missile early warning; nudets: nuclear detonation detection; sat: satellite detection; SLBM: submarine-launched missile early warning; verif: verification and intelligence collection.

Sources: House Appropriations Committee, FY 1980 DoD, Part 3, pp. 888–90; 'Improved U.S. warning net spurred', *Aviation Week & Space Technology*, 23 June 1980, pp. 38–45; Senate Appropriations Committee, FY 1981, DoD, Part 5, pp. 1675–78; *Air Force Magazine*, July 1978; *Air Force Magazine*, July 1977, p. 41; *DoD Annual Reports; JCS Military Posture Statements.*

the requirement for a radar system to confirm detection of a physical object as opposed to the DSP detection of infra-red signatures, a process called "dual phenomenology".[95] Dual phenomenology, according to the JCS, is "to increase warning confidence and to minimize the likelihood of false alarms and possible overreaction [requiring] the sensing of an attack by at least two different methods".[96] Although originally built for initial detection, the large land-based radars confirm information from DSP and then collect and process details ('attack assessment') for relay to central command posts. The major sensors for confirming detection by the DSP and for providing attack assessment are: (*a*) the Ballistic Missile Early Warning System (BMEWS), with three sites at Clear, Alaska, Thule, Greenland and Fylingdales Moor, Great Britain for detecting missile attacks from the north and east; (*b*) two PAVE PAWS dual-faced phased-array radars on each coast at Otis AFB, Massachusetts, and Beale AFB, California for primary detection of submarine launches; (*c*) the Perimeter Acquisition Radar Characterization System (PARCS) at Concrete, North Dakota, used mostly for attack assessments; and (*d*) FPS-85 and FSS-7 radars at two sites in Florida (Eglin AFB and MacDill AFB) for detection of submarine launches from the south.

Additional radars such as the Cobra Dane radar at Shemya in the Alaskan Aleutian Islands also contribute early-warning information, but their purposes are primarily intelligence collection and verification.[97]

All of the ground-based radars are being upgraded or expanded, eliminating any conceivable gaps in coverage or insufficient attack assessment processing. Many of the first early-warning radars and computers were originally built to handle only 20 or so missiles (the AN/FSS-7 SLBM warning radars can only handle one missile at a time) within a five-minute interval, but the current requirement is for detection of much larger numbers of re-entry vehicles with great discrimination over long periods of time. The upgrades include:

1. Two more PAVE PAWS radars will be built in Georgia and Texas for the south-east and south-west approaches to the United States. The south-east site will have "greater target detection capability than other PAVE PAWS radars" and significantly improved space tracking capability to replace the AN/FPS-85 radar at Eglin AFB.[98]

2. The three BMEWS radars will be "modernized to better support the national nuclear retaliatory strategy of flexible response"[99] with "significantly improved attack assessment".[100] Radars and computers will have "enhanced traffic handling capability" and a fivefold increase in computational power in the missile impact prediction hardware.[101] In addition, the Thule detection/tracking radar is receiving a UHF upgrade between FY 1981 and FY 1985.

3. The PARCS radar detection range is being extended from 1 700 to 2 500 nautical miles, and an increase in traffic handling capability is being developed for improved "RV pre-impact prediction accuracy".[102]

A large number of smaller secondary sites are used for warning against bomber and other airspace intrusions. The oldest of these are the 33 sites of the northern DEW Line (the Distant Early Warning Line) first set up in the 1950s, stretching from Alaska through Canada and Greenland and including two radars in Iceland. The DEW Line is augmented by a system of 13 radars in Alaska, the Canadian-operated CADIN-PINETREE line of 24 radars, and specialized regional radars like the two SEEK SKY-HOOK aerostats 3 600 metres above Florida and the air defence radars in Hawaii.[103]

These aircraft radars are all part of the Semi-Automatic Ground Environment (SAGE)/Back-up Interceptor Control (BUIC) system of command centres where warning information is correlated and provided to aircraft interceptors to direct them towards incoming bombers. SAGE is in the process of being upgraded by the new Joint Surveillance System (JSS), which will provide command and control of air defence forces through a network of 86 civilian and military radars feeding data into eight Regional Operations Control Centers (ROCCs).[104] E-3A AWACS aircraft assigned to NORAD for strategic air surveillance work serve as airborne ROCCs should they be destroyed, and "provide command and control during crisis and wartime".[105]

Programmes to improve the early warning of bomber attacks on the North American continent constitute one of the most costly elements of the C^3 upgrade. According to the JCS, "serious gaps in air defense capability exist", necessitating a $7.8 billion programme to guard against surprise attack from Soviet bombers "flying undetected through low-level gaps in radar coverage".[106] AWACS aircraft are a key part of the air defence upgrade. The AWACS is being used to supplement land-based radars with "random AWACS patrol providing a supplementary deterrent until DEW Line radars are improved and OTH-B radars are deployed".[107] Twelve AWACS aircraft (at a procurement cost of $2.2 billion) will be permanently assigned to continental air defence beginning in 1985.[108] The individual elements of the air defence upgrade are:

1. DEW Line/SEEK FROST: Plans are to procure 13 new long-range minimally attended AN/FPS-117 and 37 short-range unattended radars improving the cruise missile and low-level (below 300 m) detection capability of the DEW Line.[109] The new system, SEEK FROST, scheduled for initial operation in FY 1984–85, will provide contiguous low-level radar coverage of the "northern approaches" to North America with the remaining continental US coverage to be supplied by other radars on the borders of the USA and Canada and by the OTH-B. The $610 million

upgrade, to be fully operational in FY 1988, will reduce annual operating costs by one-half.[110]

2. OTH-B: A new Over-The-Horizon-Backscatter (OTH-B) radar is being tested in Maine, the first of three planned radars with a long-range detection capability of 2 880 km and 180° sight.[111] OTH-B will provide wide-area, all-altitude coverage against bombers and air-to-surface missile attacks, in the north-east (Maine), west and south.[112] OTH-B will supplement the northern DEW Line radars although it was "not selected for the northern approaches due to its reduced performance in northern latitudes caused by ionospheric disturbances".[113] The estimated cost of three OTH-B sites is $1.3 billion.[114] In addition to the strategic OTH-B programme, the Navy has instituted a "tactical relocatable OTH-B" programme to develop 1 800 nautical mile-range radars which could be used for air surveillance in key choke points such as the north Atlantic (Iceland).[115]

In addition to the ground radars, another early-warning satellite, Teal Ruby, is under development by DARPA for detection of aircraft and cruise missiles, including "tactical surveillance of theater battlefield events".[116] Teal Ruby was initiated in 1974, with charge-coupled infra-red detectors, using multiplex spectroscopy that permits the simultaneous measurements of wavelengths that enter the spectrometer for cataloguing aerospace vehicle signatures by engine emissions, airframe reflection and sunglint. Launch of a prototype Teal Ruby was originally scheduled for late 1983, but satellite development has been delayed by sensor, coolant system and launch availability problems.[117]

Attack assessment/characterization

After receipt of warning information, NORAD would initiate "conferences" with the other NCA centres to determine the validity of warning information and the severity of the attack. There are three types of formal conference:[118]

1. Missile Display Conferences (MDCs): Routine discussions between duty officers of warning or ambiguous data which must be evaluated to determine if it is associated with a threatening missile launch. Threat MDCs result from actual pick-up of some physical phenomenon rather than reconfiguration of warning sensors. During an MDC, the Senior Controller (duty officer) at SAC can order bombers and tankers to start their engines. MDCs are terminated when the Commander of NORAD makes the judgement that all available data indicate either the presence or absence of a threat to the United States.

2. Threat Assessment Conference (TAC): If the NORAD Commander determines the possibility of a threat, then a TAC is called for senior

commanders including the Chairman of the JCS. Preliminary steps can be ordered for forces to be alerted and survivability measures can be implemented if the threat persists. The Commander of SAC is authorized to direct bombers and tankers for "positive control launch". The Joint Chiefs of Staff can also authorize dispersal and airborne alert.

3. Missile Attack Conference (MAC): The final action, bringing in the Secretary of Defense and the President, is to convene a MAC when a real threat is expected to exist against the United States. No such conference has ever been convened.

From the time the DSP satellites detect a launch, approximately six minutes pass before a determination can be made that an ICBM attack is confirmed and the targets can be accurately determined.

Immediately after detection of an attack, missile impact computers from the BMEWS, PAVE PAWS and COBRA DANE would begin sorting out hundreds, perhaps thousands of warheads, and provide the NCA command centres with precise information about an attack. The Perimeter Acquisition Radar Characterization System (PARCS) radar in North Dakota would detect missiles in their terminal phase of flight and contribute the most detailed attack characterization data. Approximately halfway into the flight of an incoming ballistic missile, the following data would be available to decision makers:[119]

1. A cumulative number of individual warheads detected ('raid size').
2. Cumulative or individual warhead impact points.
3. Impact point given in longitude and latitude.
4. Identification of target as coded in the Selected Target for Attack Characterization (STAC) data base (city, military facility, missile field, early-warning facility).
5. Impact time of each warhead, including Washington impact time and 'next impact'.
6. Identification of type of re-entry vehicle.
7. 'Class' of attack as a way to interpret intentions: Class I: urban/industrial; Class II: missile fields; Class III: bomber/tanker bases; Class IV: command and control centres; Class V: Washington, D.C.
8. 'Time of first event'.
9. 'Number impacted'.
10. 'Number not yet impacted'.
11. Launch points of each missile in the USSR by latitude/longitude.
12. Number of submarines launching missiles.

In less than 30 minutes all of this information would be used to develop the options for the NCA to respond.

IV. US strategic communications

US armed forces are linked to the NCA by a vast network of land-lines, submarine cables, high- and low-frequency stations, tropospheric scattering facilities and orbiting satellites of the Defense Communications System (DCS).[120] The DCS provides for global common-user military communications, supporting peace-time and crisis communications and operations. Most of the DCS systems are not specifically designated for strategic communications, although they generally support nuclear weapons.[121] Theatre nuclear forces, in addition, have unique communications systems which specifically serve them.[122]

In each NCA command centre, subordinate headquarters, LCC, submarine or bomber, numerous communications links are constantly monitored for data or disruption (see table 13.5). NORAD constantly transmits data to the other NCA command centres and Canadian Defense HQ in Ottawa over the circuits that would be used to alert them of an actual attack.[123] 'Nonsecure' (clear) voice circuits would be used for initial alerting and passing of Emergency Action Messages, with 'secure' (encrypted) printed teletype messages required to confirm NCOs to use nuclear weapons.

The primary method by which NCOs are transmitted by the JCS is the voice telephone JCS Alerting Network (JCSAN). Alert and launch orders from the Commander of the Strategic Air Command to bomber and missile forces would then be passed via the voice telephone Primary Alerting System (PAS). Widely separate routes connect SAC headquarters with LCCs, aircraft and subordinate command posts. Teletype terminals are also present in each LCC, individual bomber, submarine and command post to receive printed confirming messages.[124]

The 'survivable' communications means are part of a special JCS controlled network, set up in 1970 and called the Minimum Essential Emergency Communications Network (MEECN). MEECN, according to the Department of Defense, "comprises a system that is intended to survive and to provide those links essential for sending the Emergency Action Message", in order to "exercise deliberate and precise control of strategic nuclear options for the SIOP execution and termination".[125] Using mobile and survivable assets, MEECN ensures transmission of NCOs in 'stressed' environments (jamming, EMP disruption, etc.).[126] MEECN airborne and land transmitters would provide assurance of NCA contact "which, due to their survivability through inherent or procedural design, will assure the delivery of nuclear execution/termination orders to strategic forces".[127] The MEECN is being expanded and improved by the addition of new transmitters from ELF to EHF frequencies, and a number of new programmes. All of the communications improvements are to reduce reaction time in response to attack or in implementing nuclear plans, to increase the survivability of communications assets, to provide more secure and intrusion-proof communications and to increase flexibility. The MEECN comprises the following:[128]

1. Airborne command posts and radio relays, including NEACP, PACCS, the WWABNCP Fleet and TACAMO (described above).

2. The Survivable Low Frequency Communications System (SLFCS) (Program 487L), a world-wide network of VLF/LF transmitters, forming the backbone of MEECN, providing a general Defense Department "command channel and reserve communications system".[129] The SLFCS is a teletype communications system composed of two high-power Air Force ground sites and airborne command post transmitters, connected to over 200 receive-only sites at headquarters, command centres, LCCs, submarines and Green Pine sites (for relay to bombers).[130] The Navy also operates a large network of VLF and LF transmitters (Verdin) (discussed below) which contribute to the SLFCS, and the TACAMO VLF relay aeroplanes.

3. The Emergency Rocket Communications System (ERCS) (Program 494L), deployed aboard eight Minuteman II missiles based near Whiteman Air Force Base in central Missouri.[131] In place of the 1.2-Mt warhead are radio transmitters providing "alternate communications with the nuclear force under surprise attack conditions".[132] The ERCS programme was started in 1961 to provide a back-up rocket-launched emergency means of communications ensuring that communications from airborne command posts could be received by bombers and submarines.[133] First operational in 1965 aboard 'Blue Scout' boosters, ERCS transmitters were later incorporated into Minuteman II missiles in 1970. If all other means of communications fail or are destroyed, missiles with the ERCS payloads can be launched from airborne command posts "very high" in "sub orbit" trajectories to transmit a prerecorded, coded EAM on two UHF frequencies to bombers and other nuclear forces within line of sight.[134]

4. The Air Force Satellite Communications System (AFSATCOM) (Program 1205), which has been assuming a greater and greater portion of the communications burden for nuclear weapon control. AFSATCOM was established in March 1974 to be the primary one-way NCA to forces and two-way teletype communications system for nuclear weapons.[135] Put into operation in May 1979, small UHF/SHF AFSATCOM repeaters are installed on 'host' satellites: multichannel FLTSATCOM for equatorial coverage, Satellite Data System for north pole coverage, single channel on DSCS III, LES-8/9 and other classified reconnaissance and commercial satellites.[136] AFSATCOM transmits low-speed (100-wpm) teletype messages in line of sight for force execution, report-back and

Table 13.5. US strategic communications

System	Frequency	Mode and function
AFSATCOM/Special Communications System	UHF/SHF	MEECN element; slow record (TTY) and voice transponders on FLTSATCOM, SDS, DSCS III, LES-8/9 and others; receivers in bombers, reconnaissance aircraft, command centres, GLCM MOBs, nuclear storage sites, tanker aircraft, LCCs
Cemetery Network	HF/SSB	European voice radio and secure teletype
CINCNET	UHF	
Circuit Mayflower	?	Submarine-to-shore communications
Clarinet Merlin	VHF	Submarine-to-shore emergency communications (voice or CW) through expendable buoy
Clarinet Omen	EHF	Submarine-to-shore satellite communications
Clarinet Pilgrim	LF	Shore-to-submarine via superimposing signals on Loran C carrier waves
DSCS II/III	SHF	Data channel (TTY, secure voice, AUTODIN)
ECCCS		European voice/TTY, terrestrial voice conferencing system connecting nuclear units to HQs
ELF	ELF	Low data rate TTY communications to submarines
ERCS	UHF	MEECN element; LOS voice from high-orbit Minuteman II
FLTSATCOM	UHF/SHF/EHF	Link to TACAMO; AFSATCOM, transition to MILSTAR
Giant Talk	HF/SSB	Primary means for positive control of bomber forces; 14 stations world-wide
Green Pine	UHF	Supplement to Giant Talk; Arctic region communications system, using DEW Line system
Gryphon	VLF	Submarine communications using modulation compression and coding
GWEN	LF	MEECN element; CONUS proliferated network, ultimately 300–500 stations, two-way data communications
HICOM/CINCPAC Voice Alerting Net	UHF	CINC command nets, shore-to-TACAMO and submarines
Hydrus	EHF	Submarine satellite communications
IACS	–	Ship-to-submarine active sonar acoustic signalling network
JCSAN	–	Unsecure telephone over leased circuits; connections between NCA, CPs and U&S commands; initial system for transmission of EAM/NCOs
LES-8/9	EHF	MEECN element; two-way secure LOS communication; anti-jam
MILSTAR	EHF/UHF	MEECN element; operational in 1989, initial receive capability in LCCs

Nationwide/Mystic Star	UHF	Presidential radio voice communication nets; Nationwide has 41 stations in CONUS
NEACP	HF/UHF/VHF/SHF/ EHF/LF/VLF	MEECN element; VLF transmission on E-4B
PACCS	HF/UHF/VHF/SHF	MEECN element; VLF capability being developed
PAS/'Red Phone'	–	Commercial unsecure telephone, land-line network; 200 subscribers (152 LCCs, 35 unit CPs); initial system for voice notification of actual alert
Regency Network	HF	European radio net supporting custodial units; replacing Cemetery Net
SACDIN	–	Secure record network for EAM, retargeting transmission to LCCs, HQs, and airfields
Scope Signal	HF/SSB	Replacing Giant Talk, 12 transmitters; coverage in Northern Hemisphere, connected to PACCS; EAM transmission to airborne forces
SDS	UHF	AFSATCOM; two-way secure transpolar communications
SLFCS (616A)	VLF	Secure record (TTY) communications from two AF sites and airborne CPs, over 200 receivers
SSIXS	UHF/SHF	Satcom to VLF stations for transit to TACAMO and submarines
STN	–	Unsecure routine telephone supplement to PAS
TACAMO	HF/VLF/LF	MEECN element, commands to submarines and bombers, receives on UHF through VLF
Verdin	VLF/LF	Transit terminal at shore stations and TACAMO; encryption; anti-jam
Yankee/Zulu	VHF	Presidential radio voice network

Sources: DoD, C3I, p. 41; *Signal*, May/June 1982, p. 9; House Appropriations Committee, FY 1984 DoD, Part 4, p. 161; FY 1984 Descriptive Summaries, pp. 388–95; House Appropriations Committee, FY 1981 DoD, Part 5, pp. 671–74; House Appropriations Committee, FY 1981 DoD, Part 1, pp. 747–54; Senate Armed Services Committee, FY 1981 DoD, Part 4, p. 2455; Senate Appropriations Committee, 'Communications', *Air Force Fact Sheet 81–006*, August 1981; GAO Report; 'Communicating with the silent service', *Proceedings*, (US Naval Institute), December 1981, pp. 75–78.

redirection and provides a means of EAM dissemination.[137] Terminals are installed on airborne (TACAMO, EC-135, E-4) and ground command posts, LCCs, bombers (FB-111, B-52), reconnaissance aircraft (SR-71, U-2, RC-135), transport and tanker aircraft, nuclear weapon storage sites, GLCM main operating bases and submarines.[138] In December 1983, the system became fully operational with some 900 terminals.

5. The Groundwave Emergency Network (GWEN), a future element of the MEECN, a low-frequency, jam-resistant, EMP-hardened "austere communications backbone" relay system of some 300–500 continental US (CONUS) nodes at headquarters, sensor sites, bomber bases and LCCs. According to the Air Force, this "proliferated groundwave communications system . . . [will] provide U.S. strategic forces with the ability to maintain critical CONUS long-range command and control connectivity despite disruptions induced by physical damage as well as ionospheric disturbances caused by nuclear detonations".[139] The initial nine-station network was activated in 1982, and a 45-station "thin line connectivity capability" is planned for FY 1984. The fully operational capability is planned for operation by FY 1989.[140] The full distributed GWEN network, highly survivable against an attack on a single critical node, will, according to the DoD, "discourage attacks on terrestrial communications links"[141] and "support reconstitution and recovery operations after nuclear attack".[142]

6. LES-8/9, GAPFILLER and FLTSATCOM satellites, which use higher frequencies and thus are more incorporated into nuclear war-surviving MEECN networks (see table 13.6). LES-8/9 are two 'experimental' satellites, built by the Air Force's Lincoln Laboratory, launched on 4 March 1976, using a new gyro which eliminates dependence on ground satellite control, EHF frequencies and cross-linking. Spaced thousands of kilometres apart, the satellites, each with a ground visibility of 12 800 km in diameter, can cover more than three-quarters of the surface of the Earth when operating together. The LES power plants are designed to survive the effects of nuclear explosions by using "high-power radioisotope thermo-electric power sources [rather than solar power] to increase satellite nuclear hardness and to eliminate the large radar cross section of solar panels".[143] GAPFILLER and FLTSATCOM satellites are also using SHF/EHF channels, increasing their importance in passing communications to nuclear forces.

7. MILSTAR, a future satellite system scheduled to replace AFSATCOM, will provide two-way, highly jam-resistant EHF communications, "more capable of effectively operating in a nuclear environment",[144] "so we can better manage our forces in a protracted war".[145] It is "designed to be highly survivable for all levels of conflict and is the centerpiece of the President's strategic C3 modernization program".[146] The military strategic–

tactical and relay (MILSTAR) satellite programme evolved from the cancelled SSS programme proposed by the Air Force in the late 1970s as a more versatile common-use system. The new EHF system, with its small terminals and antennas, will allow intercommunications between Army, Air Force and Navy units (including strategic submarines at sea) and their commanders. MILSTAR will also provide UHF channels to facilitate transition from AFSATCOM.

Each component of the strategic triad is served by specialized communications networks. Land-based ICBMs have "redundant and intrusion secure communications" and are considered the most reliable and survivable.[147] Bomber forces have two specialized world-wide high-frequency communications nets set up to provide radio contact with the airborne bomber force to ensure "positive control launch" and "failsafe" links. The prime function of these nets is "transmission of execution instructions to SAC aircraft launched under positive control":[148] (*a*) Green Pine/Northern Area Communications System (NACS), a UHF radio system, set up on an arc ranging from Adak in the Aleutian chain to Keflavik, Iceland, for communications in the nothern latitudes;[149] and (*b*) Giant Talk/Scope Signal, an HF/SSB radio system of 14 large stations world-wide, for communications in all areas of the world other than the Arctic.

High-frequency communications, largely abandoned because of low reliability while satellite technology and LF communications were being pursued, are also to be significantly upgraded "for communications in nuclear environments" and eventually will become a part of the MEECN.[150] New 'adaptive' HF radios are being developed "to automatically relay messages transmitted in HF band to mitigate effects of nuclear blackout and jamming and provide more reliable EAM transmission to bombers and submarines".[151] The 'New Look' system, being developed by ITT Avionics, is an adaptive HF/VHF system, with distributed transmission techniques featuring high anti-jam capability.[152] It will provide a new modular set of radios which will improve the reliability of two-way communications beginning production in FY 1985.[153]

Submarine communications

The difficulty of communicating with submerged submarines has necessitated the greatest number of special networks. The covert nature of the submarine force ranks it highest in terms of invulnerability. It is also the most difficult leg of the triad to communicate with. The operational requirement for continuous one-way communication from the shore to submarines at sea without the submarine revealing its position and the inflexibility of long trailing-wire receiving antennas limit the ways in which signals can be passed.[154] Current submarine communications systems

Table 13.6. US communications satellites

Type/(year)	Functions	Orientation	Frequency	No. of channels	Weight (kg)	Design life (years)	Number active	Spares	Remarks
DSCS II (1973–87)	Secure voice, relay of EW, NMCS	Geosynch	SHF	4	570	5–7	4	3	SHF installed on airborne command posts
DSCS III (1982–)	Secure voice, Pres, AFSATCOM, relay of DSP	Geosynch	SHF/UHF	6	820	10	(4)	(2)	14 in programme (fully operational 1986); single channel for EAM dissemination increased ECM and AJ capability, EMP hard
FLTSATCOM (1978–)	Secure voice, AFSATCOM, DoD wideband, Pres	Geosynch	UHF/ SHF/EHF	23	1 865	5	4	1	12 AF channels (5 kHz); 10 Navy channels (25 kHz): AFSATCOM/DoD channel (500 kHz) anti-jam, computer-to-computer exchange; satellite 7 incorporates EHF; 8 in programme; TNF (25 kHz)
GAPFILLER (1976–83)	Secure voice, MEECN	Geosynch	UHF/L, C-band	(3)	n.a.	7	3	0	Leased service on all 3 MARISAT; Navy uses one 1 500 kHz and two 25 kHz channels, all others use C and L Band; partially operational
LES-8/9 (1976–)	Secure voice, MEECN AFSATCOM, submarine comms	Near synch	SHF/EHF	?	455	10	2	0	Jam-resistant, cross-linked; 500 kHz AFSATCOM channel, TNF use
LEASAT (1984–91)	Secure voice	Geosynch	UHF	(4)	n.a.	n.a.	(4)	(0)	Leased service on 4 Hughes commercial satellites, TNF use, launch delayed by STS; four 25 kHz channels, replaces Gapfiller

MILSTAR (1989–?)	Secure voice MEECN	Geosynch & orbiting	EHF/UHF	n.a.	n.a.	12	(7)	(1)	Operates at 30.2 GHz; anti-jam; UHF to aid transition from AFSATCOM
NATO IIIC (1976–)	Secure voice TNF release	Geosynch	SHF	3	380	5	1	3	Connects with SKYNET (UK) and DSCS
Satellite Data System (1971–)	Polar comms, AFSATCOM nudets	Polar	SHF/UHF	..		n.a.	2	0	5 in programme; anti-jam, TNF use; possible submarine use

Sources: DoD Annual Reports; TRW, 'DSCS II', n.d. (1976); General Electric, 'DSCS III', n.d.; House Appropriations Committee, FY 1984 DoD, Part 8, pp. 329–33, 373, 393; Schemmer, B. J., 'Strategic C3: the satellite arena—20 years after Sputnik', *Armed Forces Journal*, February 1978, pp. 18–30; DoD, *C3I*, TS; TRW, Space log.

provide 98–99 per cent successful continuous communication in peacetime, but new requirements of nuclear war-fighting strategy demand more flexible and capable means.[155] The world-wide network of 27 Navy VLF and LF transmitters, the airborne fleet of TACAMO VLF/LF relay aircraft, and the prototype ELF system are the primary means for sending messages to submarines without revealing their position.[156] Eighteen TACAMO EC-130Q aeroplanes, divided into two squadrons on the east and west coasts of the USA, provide the most survivable transmission system.[157] The TACAMO aeroplanes, continuously airborne in "a random walk pattern" since 1974, retransmit communications received from ground stations, airborne command posts, ERCS and satellites (AFSATCOM and FLTSATCOM) to submarines on frequencies from VLF to UHF.[158]

TACAMO aircraft will be replaced by a new aeroplane, designated E-6A, with initial operating capability by FY 1987. Fifteen of the new aircraft, based upon the 707 design, will be 95 per cent common with the E-3A AWACS, EMP-hardened, capable of inflight refuelling with extended range and speed, and have satellite antennas in the wingtips.[159]

Transmissions from TACAMO, HF systems, surface ships, ERCS, "various acoustic signalling methods", land-based VLF/LF communications sites and EHF/UHF/SHF satellites are all used for submarine communications.[160] If emergency submarine communications are required, if submarines are incapable of carrying out their mission or receive 'inquiries' from one-way down-links, they are required to establish contact with NCAs over a number of special communications links:[161]

1. Gryphon: modulation compression and coding of VLF signals for shore-to-submarine communications.[162]

2. Hydrus/Clarinet Omen: EHF secure submarine-to-shore report-back communications.[163]

3. Clarinet Pilgrim: shore-to-submarine communications by superimposing information on the LF carrier wave transmitted by LORAN C stations world-wide.[164]

4. HF radio stations at 24 locations world-wide, for simultaneous transmission of broadcasts with VLF/LF transmitters.[165]

5. Circuit Mayflower: a special submarine-to-shore satellite communications system.[166]

6. Clarinet Merlin: the emergency communications systems using AN/BRT-1 submarine-launched one-way transmissions (SLOT).[167]

7. The Integrated Acoustic Communications System (IACS), using active sonars on surface ships.

8. The Submarine Satellite Information Exchange System (SSIXS), a UHF satellite buoy which can be launched from a submarine at depth, providing rapid response via FLTSATCOM and GAPFILLER satellites to inquiries at a high data rate.[168]

The Navy also utilizes an experimental ELF transmitter (part of the planned operational system approved by President Reagan on 8 October 1981) for communications with submarines, particularly in the Arctic region.[169] The usefulness of ELF is its ability to allow the submarine to operate at optimum depths and speeds (as deep as 90 m) and to remain in contact with communications while remaining undetected, therefore affording greater flexibility and protection for submarines in normal day-to-day operations.[170] According to Admiral Powell F. Carter, former Director of Strategic and Theater Nuclear Warfare for the Navy, "The Soviets would try to locate our submarines before hostilities start, as many as they possibly could, with the idea of destroying them in the initial strike if possible." The almost totally jam-resistant ELF system would ensure that "our submarines with ELF operational, can operate at depth and speed offering a very good hedge against any Soviet possibility of locating them".[171]

When completed in 1986, the ELF system will be composed of 45 km of antenna near Clam Lake, Wisconsin, and 90 km of antenna near K.I. Sawyer AFB, Michigan. ELF acts as a 'bell ringer', sending short digital coded two- or three-letter messages in about 15 minutes to the submarine force advising them to employ other means to receive an Emergency Action Message.[172] Submarines in transit to or from patrol areas at depth will be required to communicate immediately with NCAs if ELF signals cease. According to the Navy, "if ELF did not exist, those submarines at depth in transit would not know anything has occurred".[173]

Many new communications systems are being developed for post-attack communications in 'the nuclear environment': emergency submarine launch of communications satellites from missile launch tubes; balloon-lofted transponders for reconstitutable vertical ELF and VLF communications; 100-kW VLF/LF airborne transmitters on command centre aircraft; upgrading or replacement of the ERCS; and small VLF/LF receivers on bombers, for "improved dissemination of war orders via the secure VLF/LF system".[174]

Common user systems such as MILSTAR will have greater usefulness in routine as well as crisis operations.

A number of longer-range alternatives have been examined in the course of the long history of the ELF programme, as future options for submarine communications:[175]

1. Ultra-low frequency.
2. Lithospheric waveguides, using a low conductivity layer of the Earth, about 5–15 km below the surface, to provide a reflector for acoustical transmission of ELF or ultra-low frequency (ULF) signals.
3. Slow acoustic systems.
4. ELF satellites, orbiting in the ionosphere or magnetosphere.

5. Airborne ELF systems, such as balloon and conventional aircraft, taking better advantage of the efficiency of vertical antennas.[176]
6. Superconductor antennas using rotating super-conducting magnets.
7. Superimposition of ELF on powerlines.
8. Picosecond pulse technology.
9. Blue-green optical transmissions.

The joint DARPA/Navy research programme for a blue-green laser for optical communications has received the most attention. Operating with either a mirror satellite reflecting laser beams produced on Earth, or laser-producing satellites which would direct a pulsed laser beam on the surface of the ocean, blue-green lasers could theoretically provide communications at great depths. The research programme, however, has numerous operational drawbacks, and is not expected to be deployable until early in the 21st century. Significant technological breakthroughs are required to improve transmitter power, energy sources, efficiency and reliability. Current work is to develop a practical, narrow-band, wide-field-of-view optical filter for receivers.

V. Soviet command, control and communications

The primary NCA in the Soviet Union is the General Secretary of the CPSU (and the Politburo), head of the Defence Council and presumably Commander-in-Chief (CINC) of the armed forces. The Politburo is most probably the decision-making body which counsels the NCA on the use of nuclear weapons. The Ministry of Defence serves as the link between the NCA and the three operational CINCs who have control of the strategic forces: CINC, Strategic Rocket Forces; CINC, Air Defence Forces (*Voiska protivovozdushnoi oborony* or *Voiska PVO*); and CINC, Navy—all have their headquarters in Moscow.[177] In wartime, a 'Defence Committee' would take over from the Defence Council and give advice to the Politburo and direction to the Supreme High Command (VGK) (or *Stavka*, as it was called in World War II).[178] Also in wartime, the General Staff of the MoD "would act as executive agent of the national leadership and adopt plans for control of the forces".[179] It would have the responsibility for executing all operational decisions of the Supreme High Command which affect nuclear weapons. The General Staff thus serves in a similar role to the JCS to pass orders from the NCA to the forces, and is able to bypass command headquarters and exercise direct operational control of the nuclear forces.[180] The General Staff also reportedly prepares Soviet nuclear war plans. Reporting to the General Staff are five commands with nuclear weapons or C^3 roles: (*a*) Strategic Rocket Forces (SRF), which control ICBMs and IRBMs; (*b*) Ground Forces, which control short-range missiles and nuclear artillery; (*c*) Air Defence Forces (PVO), which control the early-warning assets; (*d*) Air Forces, which control the bomber and tactical air forces; and (*e*) Navy, which control ballistic missile submarines and tactical nuclear weapons aboard ships and submarines, and in naval aviation.

The SRF is organized according to army, division, regiment and battery. There are reportedly six operational rocket armies commanding missile forces, three independent intermediate-range threatre corps and 10–12 rocket divisions.[181] Each division consists of approximately 10 regiments. The regiment contains a number of launch control centres (including mobile command stations) controlling a launch group, comprised of either six or ten missiles.[182] Approximately 300 hardened command and control centres exist for SRF missiles, including 110 "3X command and control silos".[183] A battery consists of a single missile launcher.[184]

According to US intelligence agencies, "Soviet ICBMs, like U.S. ICBMs, are fully manned and on a normal readiness condition on a routine basis. Most, if not all, Soviet ICBMs could be launched within minutes of a valid launch order".[185] "Soviet air force bombers do not maintain an airborne alert or continuous ground alert (that is, with a reaction time of 15 minutes or less). Soviet air force bombers would assume higher stages of readiness during periods of international crisis."[186]

The Air Defence Forces (PVO), responsible for early warning of a nuclear attack, are the second largest branch of the Soviet military after the ground forces.[187] The PVO is responsible for strategic air defence—anti-air, anti-missile and anti-satellite—and controls the early-warning and attack assessment system of the Soviet Union.[188] It is organized into 10 air defence districts, including two large (Moscow and Baku) and eight small, which operate similarly to the SAGE/BUIC and ROCC regional centres.[189] In addition, air defence units stationed with Soviet forces outside the Soviet Union are also subordinated to the PVO.

The Soviet Union has taken major steps to ensure the continuity of government and connectivity between the NCA and military forces. Redundant and centralized control is ensured through a network of primary command centres at the national level within a 130-km radius of Moscow.[190] The Defence Council is reported to have several hardened command posts, and a central underground Air Defence command centre, similar to NORAD, is reportedly located about 50 km from Moscow.[191] Every ministry has a primary and alternate facility, some hardened to "several thousand PSI".[192] These facilities have "extensive communications facilities into and out of" them.[193] In addition, there are "very hard, capable command and control facilities for a wide variety of ministries and military", although US analysts are "not sure exactly what functions they serve".[194]

According to the US Department of Defense, "higher commands have multiple hardened facilities and mobile command vehicles and aircraft available for their use".[195] Alternative NCA operating centres are known to exist, including command centres and airborne command posts at Lipetsk, Kuntsevo, Khodinka, Podlipki and Zhiguli. Theatre commands, normally associated with 'front' operations in wartime, could also play an important role in command and control of regional ground and air forces. Reorganization within the Soviet military to activate peace-time theatre command headquarters (the first was activated in the Far East at Chita in 1979) probably indicates that the USSR views centralized command and control as increasingly inappropriate given improvements in communications and the vulnerability of central authorities to attack.[196]

While a number of redundant underground command centres exist, only a modest airborne or mobile strategic level command structure has been activated. Airborne command posts consist of only a few converted Il-76 Candid transports. The rocket armies of SRF also reportedly have airborne command centres. The USSR also uses shipboard command posts installed in two Sverdlov Class cruisers and at least one Golf Class submarine, which have been "reconfigured with extensive redundant capabilities for communicating with fleet headquarters as well as with the Naval commander-in-chief based in Moscow".[197]

In addition, "alternate locations have been established for virtually the entire structure of the Soviet leadership".[198] Some 1 500–2 000 hardened leadership facilities to "retain party control" and "preserve wartime management infrastructure" exist.[199] Continuity of government and reconstitution plans include "command vehicles, and evacuation plans designed to protect party, military, governmental, and industrial staffs, essential workers and, to the extent possible, the general population".[200] "Deep, hard, urban sheltering and an extensive network of hardened relocation sites outside the cities, with redundant communications systems" have been created.[201]

The Soviet command system probably makes less extensive use of computers than the US system. A 1981 US Air Force briefing stated that the "Soviets can be expected to increase their use of automated systems which will increase their data handling capabilities", thereby increasing the time available for reaction.[202] Another report, however, stated that "deployed Soviet military computers are no less capable than those used in the West even though Western computer capabilities in general exceed those of the USSR. This is because Soviet military computers are on the leading edge of their technology while those in the West tend to lag the state-of-the-art by a wide margin".[203]

Communications

The means of communication are constantly being upgraded as the Soviet military makes better use of new electronic technology. According to the US Department of Defense, "technological advances in ICBM and SLBM weapons systems have been accompanied by major improvements in communications systems".[204] A rigid hierarchy and excessive secrecy, however, still probably affect the release of nuclear weapons and the ease in maintaining flexible control over dispersed forces. According to a number of reports, the KGB has its own Government Signal Troops, which provide COMSEC and handle the most sensitive communications traffic, including the Soviet equivalent of EAMs.

According to the US Air Force, "the Soviets are maintaining vigorous research and development programs to upgrade their C^3 systems emphasizing the use of cable as the primary means of communications when practicable, and increasing use of satellite and point-to-point systems operating in a number of frequency ranges".[205] The links between the command centres include "extensive networks of cable and open-wire lines, radio-relay links, radio-communications stations, and communications satellites".[206] The USSR makes extensive use of secure underground land-lines, and high-power HF and VLF for long-distance communications.[207] There are at least 26 VLF stations in the Soviet Union for communicating with submarine and bomber forces, including six high-power sites.[208]

Soviet military use of outer space includes meteorological, communications, navigational, reconnaissance, surveillance and targeting missions, and is becoming more technically sophisticated.[209] Over 50 photographic and electronic reconnaissance satellites are launched annually, including nuclear-powered ocean-surveillance radar satellites (RORSATS).[210] Soviet strategic communications are also making greater use of satellites "to support its political leadership and its military, diplomatic and intelligence missions".[211] Molniya ground stations are deployed at major headquarters throughout the Soviet Union.[212] Standard Orbita satellite ground receiving stations (first fielded in 1967) are reportedly also available near headquarters of military districts, naval bases and missile fields.[213] Some 80 receivers make up the network.[214]

At least seven different Soviet satellite systems are used for military command and control (see table 13.7). These comprise three different orbital modes: Molniya, geosynchronous and low-altitude store dump. The Molniya satellites operate in a highly elliptical orbit of 40 651 km apogee and 640 km perigee, providing 8–10 hours per day of continuous communications. Three Molniya constellations are currently operational, providing primary military command and control functions on UHF and

Table 13.7. Soviet communications satellites

Type/(year)[c]	Functions	Orientation	Frequency	No. of channels	Weight	Design life (years)	Number	Spares	Remarks
Molniya I (1965–)	Mil C^3, domestic & intl	Molniya[a]	UHF/	n.a.	n.a.	2	8	0	Satellites grouped in pairs
Molniya III (1974–)	DCL, civ C^3	Molniya[a]	UHF/SHF	n.a.	n.a.	2	5	0	Fifth satellite launched 30 August 1983 back-up for DCL; could replace Molniya I
Cosmos (1970–)	Store-dump, naval, tac C^3	~1 500 km orbit	UHF	n.a.	n.a.	2–3	36–48	n.a.	Launched in sets of eight
Potok[b]	Mil C^3	Geosynch	4 GHz	n.a.	n.a.	..	1	0	Cosmos 1366 (1982) prototype for new class "which might relay transmissions for manned orbital command centres"

[a] Molniya satellites operated in a highly elliptical orbit of 40 651 km apogee and 640 km perigee, giving 8–10 hours per day of continuous coverage.
[b] Not yet operational.
[c] Geosynchronous Ekran (1976–), Gorizont (1978–) and Raduga (1975–) satellites are primarily civilian, although *Soviet Military Power*, 2nd ed. states: "These satellites could also provide military communications to ground, sea and air elements of the Soviet Armed Forces."

Sources: Defense Systems Review, October 1983, p. 54; *Defense Electronics*, October 1983, pp. 140, 145–47; Ball, D., *Can Nuclear War be Controlled?, Adelphi Paper No. 169* (International Institute for Strategic Studies, London, 1981); Polmar, N., 'Soviet C3', *Air Force Magazine*, June 1980, p. 61; DoD, *Soviet Military Power*, 1st and 2nd editions; Johnson, N. L., 'Soviet strides in space', *Air Force Magazine*, March 1983, p. 51; 'Soviets integrating space in strategic war planning', *Aviation Week & Space Technology*, 14 May 1983, p. 111.

SHF, and facilities for the DCL between the United States and the Soviet Union.[215] Geosynchronous communications satellites—Raduga, Ekran and Gorizant—have been orbited since July 1974, operating in UHF and SHF and providing a "large percentage of military traffic".[216] Large constellations of low flying Cosmos satellites have been flown since 1970, with 36–48 in sets of eight in orbit at any one time. These satellites have been reported to have dump storage or real-time tactical military communications missions, including communications to ships and submarines.[217]

A new class of geostationary satellites, named Potok and operating in SHF (4 GHz), is also being prepared for deployment. Cosmos 1366, placed in geostationary orbit during 1982, is most probably the prototype for this new constellation, which according to the US Department of Defense "might relay transmissions from manned orbital command and control platforms".[218]

Early warning

The Soviet early-warning system is similar in structure to the US system, including "a satellite-based ICBM launch detection system . . . an over-the-horizon-radar missile launch detection system to back up the satellites, and . . . large phased-array radars ringing the USSR".[219] The satellite early-warning system has a constellation of nine satellites, flown at semi-synchronous altitudes, in 12-hour Molniya-type orbits.[220] These IR sensor-equipped satellites have an ICBM/SLBM/IRBM detection capability and are capable of relaying targeting and positioning data to Moscow.[221] The Soviet Union has had some difficulty in developing a reliable satellite early-warning system, due primarily to a lag in infra-red detection-array technology.[222] The satellites are also restrained by their limited lifetime of about one year and their non-geostationary orbits.[223] During 1982, the ground track of the launch-detection satellites was adjusted eastwards for better viewing of the USA, China and ocean areas from which submarine-launched ballistic missiles would be launched.[224] This shift afforded better coverage of the Pacific Ocean, where US Trident submarines were beginning operations.

While the Soviet Union maintains a huge network of acquisition radars and height finders for detecting enemy aircraft, it also has a network of large missile early-warning systems (see table 13.8). This radar network is being significantly upgraded, with the deployment of new phased-array radars looking out towards the Arctic region and SLBM detection radars on the Soviet coasts.[225] Soviet research and development, according to one report, is concentrating on "improving the performance of their large phased-array detection and tracking radars, and on developing a rapidly

Table 13.8. Soviet early-warning radar assets[a]

Military district/ country	Early warning/ OTH-B	GCI/Surv	Acquisition/ height finders
Baltic	3	28	141
Byelorussian	2	21	105
Carpathian	1	35	176
Central Asia	3	48	144
Far East	6	142	427
Kiev	1	36	182
Leningrad	4	66	199
Moscow	5	37	185
North Caucasus	1	29	146
Odessa	2	38	190
Siberia	1	122	367
Trans Caucasus	1	44	221
Transbaikal	1	57	169
Turkestan	1	24	97
Urals	1	12	46
Volga	0	15	58
Sub-total	*27*	*754*	*2 853*
Bulgaria	0	28	111
Czechoslovakia	0	36	178
German Democratic Republic	3	69	275
Hungary	0	33	131
Mongolia	0	9	35
Romania	0	32	128
Sub-total	*3*	*207*	*858*
Total	**30**	**961**	**3 711**

[a] This table represents electronic emitters and not numbers of sites, since more than one radar is often present at one site, particularly for surface-to-air missile sites.

deployable ABM system".[226] This includes "higher power radars" and "redundant ballistic missile early warning coverage".[227]

The first layer of land-based detection is a network of "large over-the-horizon (OTH) radars that can detect the launch of US and Chinese ICBMs".[228] The first three installations of a new OTH-Backscatter network were identified in 1980.[229] The second layer is a network of more than a dozen Hen House ballistic missile early-warning radars near the borders of the USSR.[230] New, large, 1 500 nautical mile-range, phased-array radars are being built on the borders to "close gaps" in the Hen House network, as well as improve attack assessment and "impact predictions as well as target handling for ABM battle management".[231]

Recently, there has been a great deal of controversy over the functions of a number of radars under construction in the Soviet Union. According to the US Joint Chiefs of Staff, "a new large phased-array radar is being constructed near Moscow . . . augmenting or possibly replacing existing Dog House and Cat House battle management systems . . . [and] Try Add engagement radars at the Moscow complex".[232] This is most likely the new

ABM phased-array radar at Pushkino, deployed since 1981, with 360° coverage, similar in capacity to PARCS but twice the size.[233] Another radar, a new phased-array radar at Abalakova, 800 km north of Mongolia, near Krasnoyansk, and deployed since 1982, is pointed northwards rather than directly towards the borders of the Soviet Union, and reportedly has some ABM battle management function, although the Soviet Union states the function is satellite tracking.[234] A third transportable radar (presumably Flat Twin), associated with a new ABM-X-3 mobile system, has been tested since 1981. This radar "would provide battle management and attack characterization to discriminate U.S. reentry vehicles from decoys or penetration aids".[235]

Backing up the large missile early-warning radars is a huge complex of interceptors, surface-to-air missiles and bomber early-warning radars, to counter the size and capabilities of the US bomber force (see table 13.9).[236] According to the latest reports, "the Soviets have about 7 000 radars throughout the USSR dedicated to detecting and supporting the engagement of enemy aircraft".[237] These radars are generally of three types (see table 13.10): (*a*) border radars of approximately 250 nautical mile range, to support interceptor forces;[238] (*b*) acquisition and fire control radars to

Table 13.9. Main Soviet early-warning radar locations

Location	Radar
Abalakova, near Krasnoyansk	Hen Roost
Angarsk (Mishelevska), Irkutsk	Hen House ICBM PAR
Chekhov	Unknown ABM support
Kamchatka	Hen Egg
Kiev	OTH-B; SLBM PAVE PAWS-type
Komsomolsk	OTH-B
Komsomolsk-Amure	SLBM PAVE PAWS-type
Lyaki, near Baku	Hen Roost
Minsk	Hen House ICBM PAR
Naro-Fominsk	Unknown PARCS-type MIP
Nikolaeyev	OTH-B
Novgorod	Hen House ICBM PAR
Olenegorsk	Hen House ICBM PAR
Pechora	Hen Roost BMEWS-type
Pushkino	Cat House PAR
Sary Shagan	Space, ABM and test PAR
Skrunda	Unknown ICBM PAR

Sources: Jones, D. R. (ed.), *Soviet Armed Forces Review Annual*, Vol. 6, 1982, pp. 164–66; DoD, *Soviet Military Power*, March 1983; 'New Soviet missile defenses', *Foreign Report*, 14 April 1983; Evans, R. and Novak, R., 'New Soviet radar violates SALT pact', *New York Post*, 27 July 1983, p. 35; Hann, M., 'Soviet SALT cheating: the new evidence', *Heritage Foundation Executive Memorandum*, 5 August 1983; Wallop, M., 'Soviet violations of arms control agreements?' *Strategic Review*, Summer 1983, pp. 11–20; 'Soviets said to have six radars with potential ABM capabilities', *Aerospace Daily*, 15 August 1983, pp. 243–44; 'Soviet ABM breakout', Editorial, *Wall Street Journal*, 16 August 1983; Klass, P., 'US scrutinizing new Soviet radar', *Aviation Week & Space Technology*, 22 August 1983, pp. 19–20; Federation of American Scientists.

Table 13.10. Soviet early-warning and attack assessment radars

Type	Function	Range	Year deployed	Description
Back Net	GCI			Search radar predecessor of Bar Lock; SA-5 acquisition
Barlock A/B	GCI/EW	180/300 km	1958	Primary mobile (P-50) twin-scanner, medium-to-high altitude, 2 695–3 125 MHz; SA-5 associated; developed as replacement for TOKEN, Slant Mesh, Big Mesh and Strike
Big Bar A	GCI/EW	180 mi	?	
Big Mesh	GCI/EW	180 mi	1964	Both radars are derivatives of Barlock, medium-to-high altitude, twin scanners
Big Net	EW			Long-range air surveillance radar, D/E bands
Cat House	BMD	3 000 km	1982	Large PAR, single site at Pushkino, near Moscow
'Chekhov'	BMD	2 800 km	1975?	Single radar located about 65 km SW of Moscow; detects and tracks RVs; similar to Dog House
Dog House	MEW/BM/sat	2 800 km	1969	Two large PARs; early tracking and target assignment, 100 MHz; serves as battle management between Hen House and Try Add engagement radars
Flat Jack	AEW			Tu-126 Moss AWACS radar
Hen Egg	MEW	2 500 km	1977	Single E-band site near Kamchatka
Hen House	MEW/AA	6 000 km	late 1950s	High power, initial early-warning sites around USSR periphery; 150 MHz
Hen Nest	MEW/sat	Long-range	1970s	Single site at Sary Shagan for space surveillance, test and ABM development support; 800 MHz
Hen Roost	MEW	3 000 km	1982	At least three sites known; high-powered PAR; 500 MHz
Knife Rest	EW/GCI	350 km	1954	Mobile truck mounted P-10 series VHF (70–90 MHz) high-altitude radar
NYSA-C	EW	~ 150 mi	late 1950s	Long-range, high-altitude air search, twin scanning, probably VHF/UHF, acquisition for air defence aircraft, in use with WTO countries
Odd Lot	GCI/HF		1972	E-band; reported similar to Stone Cake
Odd Pair	HF		1972	Height finder; E-band; replacement for Side Net
Rock Cake	HF	200 km	1958	Mobile, fixed feed nodding height finder, 2 GHz
Ship Globe	EW/sat			Shipboard
Ship Wheel	Sat			Shipboard circular reflector
Side Net	HF	110 mi	1962	Main height finder, mobile, collocated with Bar Lock, Big Net, Tall King and other EW radars; associated with SA-2, SA-3 and SA-5; 2 650–2 710 MHz

Sponge Cake	HF	300 km		Similar to Rock Cake; upgraded, 2 GHz
Spoon Rest	EW	160 mi	1959	Mobile high-altitude detection (P-12); VHF (A: 150 MHz; B/C: > 100 MHz) radar; acquisition radar for SA-2, follow-on to Knife Rest
Squat Eye	EW		1966	EW radar deployed along WTO border; associated with SA-3
Steel Work	MEW	3 000 km	1976	Three long-range OTH-B radars with beam steering mode or wide-angle steering for aircraft, ICBM or SLBM; two north-facing; 20 MHz
Stone Cake	HF	250 km	1960s	Mobile, improved Rock Cake
Strike Out	EW/GCI			Similar to Barlock
Tall King	EW	350 mi	1959	Main fixed high-altitude detection (P-14), collocated with Side Net radars, high powered
Thin Skin	HF		1965	Mobile nodding, H-band
Token	EW/GCI	250–350 km		Twin scanner similar to Bar Lock
Try Add	BMD		1965	Four missile control and engagement radars near Moscow

Source: Macdonald, G., Ruina, J. and Balaschak, M., 'Soviet strategic air defense' (with Appendix A), in *Cruise Missiles: Technology, Strategy, Politics*, Betts, R. K. (ed.), (Brookings Institution, Washington, D.C., 1982); Jones, D. R. (ed.), *Soviet Armed Forces Review Annual*, Vol. 4, 1980, pp. 57–66, Vol. 6, 1982, pp. 165–66; Senate Armed Services Committee, FY 1978 DoD, Part 10, pp. 6574–79; *The International Countermeasures Handbook*, 8th Edition, 1982–1983 (Palo Alto, CA; EW Communications, 1983); Joint Chiefs of Staff, *U.S. Military Posture for FY 1984* (and previous years).

support over 1 000 fixed strategic SAM sites within the Soviet Union;[239] and (*c*) mobile radars supporting surface-to-air missiles.

The radars themselves vary in quality and age "from some very impressive installations to mediocre back-up facilities" and include "many older models that offer little utility".[240] "A typical Soviet radar site has several radar sets which not only serve distinct functional purposes—such as early warning . . . and height finding—but also provide redundancy in coverage and frequency diversity."[241] According to the US Joint Chiefs of Staff, "radars with improved low altitude acquisition capabilities are not yet fully operational".[242]

First-generation AWACS aircraft have been developed to provide airborne command and control, forward extended-range fighter defence and low-altitude surveillance back-up for bomber detection. So far, AWACS development has been technologically unsuccessful.[243]

There are also reports of Whiskey Class (Canvas Bag) radar picket submarines with Boat Sail (search and surveillance) and Stop Light (ELINT) radars aboard.

Conclusion

The use of new technology, including early-warning satellites, satellite communications and better radars, are part of the "improved C^3 for strategic forces".[244] According to a 1979 report, the "principal lag [of Soviet military in command and control] . . . is in microminiaturization in computers, [and] the ability to package a lot of complex command and control apparatus in their equipment".[245] This picture may be changing; as "the Soviets appear to be entering another phase in radar production in this new decade, they seem to be diverging somewhat from their traditional design philosophy of gradual changes using time-tested technology, to more significant design advances. This undoubtedly is a result of Soviet progress in microelectronics, advanced to a degree by acquisition of Western technology."[246]

The Soviet command and control system, even considering the additional redundancy in command centres, or duplicative air defence forces, is structurally similar to the US system. The major improvements which have been identified are similar to the initiatives of the Reagan strategic C^3 modernization programme: (*a*) "initial production of the IL-76/MAINSTAY airborne warning and control system (AWACS)";[247] (*b*) "deployment of many new types of ground-based air defense radars and control systems";[248] (*c*) "additional construction of large phased-array radars around the periphery of the USSR";[249] (*d*) "continued construction of hardened shelters and command posts";[250] and (*e*) upgrade of space command, control and tracking sites.[251]

VI. Major issues in C^3

Does the C^3 system provide the degree of control which it should? Are arrangements sufficient to prevent accidental wars and provide a high level of peace-time control? Or is C^3 jeopardizing peace through the objective of waging controlled and winnable nuclear wars? The requirement is no longer that the C^3 system merely supports "deterrence" but that it should support military operations with nuclear weapons *after* the initiation of nuclear exchanges. Four major issues are central to determining the effect and priorities of the upgrading of the C^3 system: the adequacy of crisis measures between the superpowers, trends in the control of nuclear weapons, attack assessment and time reducing programmes and their relationship to war fighting, and launch-on-warning/launch-under-attack options.

Crisis control measures

The significant reduction in decision time following the development of ICBMs led to the first surprise attack conference held by the superpowers in 1958. After the Cuban missile crisis, in which Soviet and US leaders realized that there were inadequate communications links between Moscow and Washington, discussions began on the establishment of a hot line.

The Moscow–Washington Emergency Communications Link (or MOLINK) first went into service over radio and land-lines on 30 August 1963. The USSR and the USA subsequently agreed, on 30 September 1971, to upgrade the system to satellites, and it was redesignated the Direct Communications Link. The US side was operational in FY 1975, but both links were not fully operational until 1978. At each end, identical facilities are provided, including two satellite Earth stations, encryption devices, expert linguists and secure teletype terminals. The Washington terminal for the DCL is in the NMCC at the Pentagon; the Soviet terminal is in a similar unhardened facility. Back-up for the DCL is still provided by telegraph circuits. The system is tested daily.[252] In addition to the DCL, the USA and the USSR have also agreed to institute measures which could prevent accidental wars. In 1971 the Accidental Measures Agreement required that missile launches and accidents "which could create a risk of outbreak of nuclear war" must be reported to the other superpower. In 1973 another agreement on the Prevention of Nuclear War required the two sides to refrain from acts that could lead to military confrontations. Recently, US and Soviet officials again met (in August 1983) to discuss a number of US proposals to improve crisis communications, following speeches and proposals by President Reagan in 1981 and 1982 and DoD proposals presented to Congress in April 1983.[253]

The various proposals offered for improving crisis measures include the following:

1. Addition of high-speed facsimile transmission to the DCL.
2. Advanced notification of missile test launches and major military exercises.
3. Establishment of a joint military-to-military communications link to supplement the DCL.
4. Establishment of better links between US and Soviet embassies and their governments.
5. Creation of a Soviet–US Joint Consultation Centre for dealing with crises.
6. Improving exchanges of data about nuclear forces.

It is ironic that, although the initial talks between the superpowers on crisis communications arose from the reductions in warning time resulting from ICBM deployment, the USA and the USSR are now reluctant to discuss further substantive crisis measures to deal with the additional reductions in warning time caused by new nuclear weapons in Europe, submarine patrols and sea-launched cruise missiles. The general concern demonstrates an awareness of the need for more stability and more measures to deal with possible crises between the USA and the USSR, yet the trend does not appear to be for the use of the resources of C^3 to improve crisis management.

Control of nuclear weapons

There has been little progress in upgrading the links of communication between the superpowers. On the other hand, there are substantial programmes to upgrade the numerous and redundant links between the NCA and the nuclear forces. According to the JCS, "a major concern affecting all elements of the TRIAD is the prospect that, following a nuclear attack, communications between the NCA and strategic nuclear forces could be interrupted".[254] Two sets of programmes have been established to deal with the possible loss of control. The first, according to the manager of the NCS, sets out "ways to reconstitute a functioning telecommunications system using facilities which survive a major disaster . . . ensuring from the outset, a survivable system which can support the National Command Authority".[255] The second is for loosening control of nuclear weapons.

Continuity of government plans, governed by PD-58 (1980), requires the survival of the Washington leadership in order to ensure central control of the military and government. These requirements have existed ever since the first Presidential command networks of trains, ships and underground bunkers were set up in the Truman and Eisenhower Administrations. But now, with the emphasis on "reconstitution", the *assumption* is that the President will be killed in the initial stages of a nuclear war and that control will have to be shifted to the surviving NCAs for follow-on strikes in the war plans to be implemented.

Increasingly, the strict NCA system is being thought of as being a liability. In recent testimony before Congress, Under-Secretary of Defense Richard Delauer stated that "One of the real problems this country has—and the Soviets know and exploit it—is the fact that we have a very secure and thorough way of having the NCAs release nuclear weapons. That is one of the reasons we are striving so hard to get this whole question of command and control, of continuity of government and all that sort of thing, put into our capability."[256] Commenting on the decision to "go nuclear", one trade magazine noted that "it's very difficult to get really top level people—the ones most likely to be involved in a serious crisis—to turn their attention to this in a serious way."[257] One alternative provided to Congress in a study on C^3 is to "expand direct control over force execution in the trans-attack period. Rather than executing pre-planned attack orders [the present SIOP], nuclear force commanders would be able to adapt plans of action and redirect forces as circumstances changed during the course of a nuclear exchange."[258]

Much is already being done without any formal change in the NCA system. Two-way surviving communications capabilities like MILSTAR or GWEN support a more flexible control policy, ensuring that someone acting as the proper NCA could 'authorize' the next step in a war. More survivable command centres also support the adoption of a more flexible NCA policy. While 'predelegation' has been discussed but is clearly politically impossible in peace-time, a DoD C^3 official told Congress in 1980 that "preplanning is being used a great deal more than it ever was, and I think that that is helpful in getting the commanders to make the decision on which options they should exercise".[259] There has also been discussion of "timed responses", "time dependent launch locks" and "auto assignment", all of which would ensure that nuclear weapons were used in the worst circumstances.

The discussion about civilian control has a sense of make-believe, given the seriousness with which officials concern themselves with the technicality of civilian control (and many of the programmes are solely to preserve this technicality), while ignoring the serious erosion of US–Soviet relations and the move towards nuclear war. Donald Latham, Assistant Secretary of Defense for C^3I, told Congress in early 1983 that "Whatever the level of conflict, no matter how the war starts, you must always have civilian control of those weapons. We are trying to make absolutely sure we have the necessary devices so that you can lock the weapons up, that they cannot be used without civilian authority."[260]

Attack assessment

Improvements in attack assessment/characterization are one of the key elements of the entire C^3 programme. The goal, to provide "more precise estimates of an attack's size and likely targets" through the modification of computers and fielding of new sensors, is not just to eliminate surprise attacks. The programmes, according to the DoD are "also needed to support the retaliatory process".[261] "We want to be able to determine the accurate magnitude and probable effect of the attack in progress so that our selected response is appropriate", an Air Force official reported to Congress in 1983. "To achieve better attack assessment", he said, "we are developing the capability for more precise tracking and improved data processing to provide better preimpact assessment in support of critical, time-sensitive NCA decisions".[262]

Improved attack assessment will enable the NCA to communicate to the nuclear forces in the first few minutes of an attack, prior to any nuclear explosions, the instructions for retaliation, as distinct from actual launch-on-warning instructions (discussed below). According to DoD testimony, "attack assessment is a vital function which we need even *if* we ride out an attack, because it allows the NCA to select the proper SIOP option" (emphasis added).[263] It also serves to ensure the technicality of civilian control over post-nuclear attack decisions if the command structure is the target of attack by quickly relaying commands to the airborne command centres "to start the devolution chain".[264]

The greater demands on attack assessment are coming at a time when new weapon deployments reduce warning time. By placing greater reliance on computers to begin the chain of alerts and decisions which would eventually launch nuclear weapons (the very argument against launch on warning), the C^3 system is creating greater pressure for earlier decision making.

The special tactical warning/attack assessment programme established in FY 1983 includes a number of projects which further reduce time and significantly speed up the decision-making process:

1. Incorporation of AFSATCOM, SLFCS and SACDIN "will reduce the transmission, receipt, and processing time for emergency action messages as well as crew workload during time-urgent situations".[265]

2. Replacement and upgrading of automatic data processing equipment at command centres, including the NORAD CCPDS and SAC Control System (SACCS) with an upgraded digital network (SACDIN), will reduce data processing time.[266]

3. Upgrading radar resolution and processing at the sensor site, including new radars and upgrading current radars and satellites, will provide more information more quickly with which to assess the nature of an attack.

4. The Improved EAM Automatic Transmission System (IEMATS), a JCS programme which began in 1977, will reduce manual coding and decoding steps in the release process.

5. The Automated Message Management System/Selective Release Improvement Program (AMMS/SELRIP), for theatre nuclear forces, will reduce the time needed to make nuclear decisions.

6. Improvement of BMEWS computers will "support pre-impact option selection such as sending the Emergency Action Message (EAM) prior to loss of communication connectivity or loss of a portion or all of the silo based forces".[267]

7. New programmes for post-attack damage assessment, particularly the Integrated Operational Nuclear Detection System (IONDS), encourage war fighting and the illusion of controlled nuclear war.

IONDS will upgrade the attack assessment capability, but only after nuclear detonations, providing a real-time assessment of nuclear explosions anywhere in the world. Scheduled to replace the older satellite-borne NUDETS sensors, IONDS is being developed to give the NCA instant information on the locations of nuclear detonations and, according to the Defense Department, "for estimation of strike damage and indirect assessment of residual capability".[268] IONDS consists of a set of sensors developed by Sandia Laboratories which will be deployed on the 18 satellites of the NAVSTAR global positioning system. The system will be used for 'damage assessment' both in the United States and abroad, reporting the locations, yields and heights of bursts of nuclear detonations, including 'hard target damage assessment'. Forty small mobile read-out terminals will be widely deployed (including on airborne and mobile command centres) to allow retargeting and assessments of nuclear strikes. The full set of IONDS sensors will be deployed by 1986, providing world-wide coverage.[269]

Launch on warning/launch under attack

The improvements in attack assessment may not actually lead to the public adoption of a launch-on-warning policy, but again the technicality seems a moot point. "Launch on warning", according to the Strategic Air Command, "is an option we have and must maintain".[270] Undoubtedly, the human factor would prove to be a nightmare in the few minutes' warning postulated in most scenarios. By the time the DSP satellites and early-warning radars had correlated a Soviet missile launch, the amount of time left to make a decision before impact would range anywhere from 5 to 20 minutes.

It may not be the lack of decision time which would ultimately leave no other alternative for the NCA than launching nuclear weapons upon warning, but rather the huge amounts of attack assessment data flowing into command centres, poor crisis communications and the lack of doctrinal or practical alternative. The military objective is clearly to use weapons rather than have them destroyed. Early actions by the NCA to ensure 'survival' of bombers or airborne command centres may facilitate implementation of war plans, but not resolve crises or even terminate wars. Too much of the launch-on-warning discussion has concentrated on whether the *capacity* exists to launch, and whether the formal adoption of such a policy would redress land-based ICBM vulnerability, rather than on the problems of time and of the effects of what Paul Bracken calls "interacting alerts".[271]

According to the DoD, the Soviet Union has "wide ranging programs" to support "executing offensive forces after weapons aimed at the USSR have been launched but before they hit their targets". In addition, "the Soviets practice launching weapons under the stringent time constraints that would prevail under hypothetical launch-under-attack circumstances".[272] The problem, then, with greater communications, attack assessments and constantly streamlined procedures on both sides is that the C^3 system could influence 'certain' decisions in a crisis because that is what it is configured to do.

Retired General Lee Paschall, former Director of the Defense Communications Agency, told a Harvard University symposium on C^3:

> From the time somebody sees something launching on one of those satellite sensors, or one of the radar sensors along the shore, seventeen minutes is the decision time. That's a very short time indeed. Moreover, people don't want to believe news like: they have launched, the world is coming to an end, it's time for you to launch in return. President after President has called for options, more options. Each option called for imposes an enormous demand and strain on the command and control system. So how are we to solve decision time problems? How can we make warning completely credible to the President or to his successors? How do we ensure that the successors can communicate, can establish contact with the force commanders to execute the retaliation or the strategic reserve, or continue to negotiate, or whatever? That's a very difficult task.[273]

Conclusion

The current concern about C^3 exists because the system has been perceived as vulnerable to direct attack or disruption and has been declared inadequate as an aid to stability and crisis management. The C^3 system is normally described as including a number of weaknesses:[274]

1. The United States or the Soviet Union could each 'decapitate' the nuclear force and means of retaliation of the other by striking command and control capabilities.

2. Tactical warning sensors, too few or too vulnerable to attack, could be destroyed.

3. Communications links to nuclear forces could be disrupted.

4. Facilities vulnerable to the secondary effects of nuclear detonations—particularly electro-magnetic pulse—or vulnerable to jamming, will not operate in the "nuclear environment".

The scenario which is most used by military analysts to show the fragility of C^3 facilities is that in which submarines patrol off the coasts of the United States (this is, of course, a possibility for either side). According to SAC testimony before the Senate Armed Services Committee, this could cause the following:

> The submarines, because of their close proximity to Washington and coastal military installations, greatly decrease the amount of warning and decision time available. Here, we are talking about minutes . . . a very few minutes . . . during which the NCA must make national decisions of the greatest possible importance . . . Attack assessment information must be weighed, possible response options discussed and the correct decision made. Even after a decision is reached, the information must still be formatted and disseminated to the forces in the field.[275]

This scenario has been given further credence by the Hart/Goldwater report on C^3 systems which stated that "since SLBMs could destroy a large part of our ground-based sensors and command posts, it must be assumed that the time from detection to the first impact during which we will have full use of our present system could be short . . . We would become dependent on those assets that could survive the initial attack, in general those which become airborne in time to escape the attack".[276]

The instability and postulated threat created by this scenario are being corrected, even though the likelihood of a large-scale direct attack on C^3 installations, requiring hundreds of warheads, seems as remote a scenario as the 'bolt-out-of-the-blue' attack. Improvements in command centres (E-4B, EMP hardening, upgraded computers), early warning (mobile ground terminals for DSP, gap-closing radars) and communications (significant upgrades to VLF/LF, EHF and ELF transmitters, new TACAMO) have repaired many of the 'weaknesses' in the system.

In addition, since the early 1970s communications failures have steadily decreased and computer malfunctions have been gradually reduced. In the strategic C^3 system, the speed, quality and quantity of information on early warning, forces and plans have dramatically increased and improved over the past 20 years. The established nuclear weapon chain of command has been tested again and again, and the release of nuclear weapons regularly practised. What is shown in a close analysis of the countless C^3 projects is that the priority is not only to correct the visible 'weaknesses'. The broad and imprecise requirement of 'endurance' is the highest priority.

With the exception of airborne command centres, mobile assets and satellites, all of the command, early-warning and communication sites are land-based and incapable of surviving any type of prolonged or large-scale nuclear exchanges. Even airborne command centres, once thought to be invulnerable, are being augmented by 'reconstitutable' command centres and communications facilities. Land-based sites are continuing to be built, and satellites are being made more survivable but primarily for use in 'trans-attack warning' during controlled and limited nuclear war scenarios. The overall C^3 system, however, never meant to do just one thing, is being upgraded with the outside appearance of solving weaknesses, while actually being improved to operate against the 'worst case' with dubious benefit. The C^3 system is being improved to support a dedicated war-fighting strategy.

The key to the US C^3 upgrade programme is the comprehensive Nuclear Weapons Employment and Acquisition Master Plan, an integrated 'architecture' for the entire nuclear weapon system through the year 2000. The objective, according to the DoD, is to put C^3 into a cohesive framework, giving it equal priority with the weapons it supports.[277] The plans are to make "sure that the policy, the resources and the forces are formed into a coherent mix".[278] The many missions of C^3 thus feed upon ambitious doctrinal requirements for "surviving and enduring" forces, and better co-ordination to carry out nuclear war-fighting plans, under any scenario.

According to Donald Latham, "The difficulty of the C^3I mission is intensified by the fact that our basic national security policy is one of deterrence, which requires that we sustain a capability to react quickly and effectively after the enemy has taken the first initiative".[279] He has further stated that "C^3 capabilities are crucial for national security because the U.S. as a matter of policy is committed to defensive use of military power . . . because our strategy is one that does not include a first strike, the ability of the command and control and intelligence system to survive an attack and provide the wherewithal to retaliate is the key to deterrence".[280] Throughout the nuclear age, weapon systems have been constantly upgraded with defence analysts and government officials citing hypothetical threats, scenarios and weaknesses which were supposedly eroding deterrence. It is now clear that these upgrades have only served to draw us closer to nuclear war. The attention on C^3 is bound to produce the same results. The problem is whether in the process of "underwriting deterrence", as the DoD says, C^3 improvements end up streamlining the process for initiating nuclear war to where it becomes the specified "alternative" in any future crisis. An open opportunity exists for the superpowers to make further advantage of C^3 technology to *prevent* the prospect of nuclear war, but that clearly does not seem to be the priority.

Notes and references

See notes 17, 177, 178, 185 and 195 for the key to several often cited abbreviations.

[1] A number of reports in the 1970s concentrated on the weaknesses of the C^3 system in peacetime. See, for instance, US Congress, *Review of Worldwide Communications*, Phase I, Report of the Armed Services Investigations Subcommittee, Housed Armed Services Committee, 10 May 1971; US Congress, *Review of Department of Defense Command, Control and Communications Systems and Facilities*, Report by the C^3 Panel, House Armed Services Committee (94–72), 18 February 1977.
[2] This chapter does not include a discussion of tactical C^3 systems, avionics, technical intelligence-collection and verification systems, space or electronic warfare.
[3] DoD, *C^3I Program Management Structure and Major Programs*, 10 December 1980, Top Secret (declassified), p. 12 (hereafter referred to as DoD, *C^3I*).
[4] DoD, *C^3I* (note 3), p. 4.
[5] See US Congress, *Authority to Order the Use of Nuclear Weapons*, Report Prepared for the Subcommittee on International Security, House Committee on International Relations, 1 December, 1975.
[6] DoD, *C^3I* (note 3), p. 4.
[7] Strategic warning in this context—intelligence collection—is not discussed in this chapter.
[8] DoD, *C^3I* (note 3), p. 7.
[9] DoD, *C^3I* (note 3), p. 4.
[10] DoD, *C^3I* (note 3), p. 7.
[11] The command and control of strategic nuclear forces has always been considered a 'problem', going back as early as the 1950s when Soviet development of nuclear weapons and missiles first began. At that time, numerous studies of the system were instituted: the 'Winter Study', the Partridge Committee, Orrick Committee, Powell Committee, Rand Corporation, Mitre Corporation and the Martin Board—all proposing a variety of measures to improve command and communications.
[12] See Betts, R., *Surprise Attack* (Brookings Institution, Washington, D.C., 1982); and Frei, D., *Risks of Unintentional Nuclear War* (Allanheld, Osmun, London, 1983). Although strategic surprise is often given in public as a scenario which the system must prepare for, 'generated alerts' (actions taken during crisis periods) change significantly the assumptions about time needed to react to warning. See also Ball, D., *Can Nuclear War Be Controlled?* Adelphi Papers No. 169 (International Institute for Strategic Studies, London, 1981) for a discussion of the shift in C^3 from *before* to *after* nuclear conflict.
[13] Although a comprehensive history of C^3 does not exist, a number of good sources are worth noting: *Mitre: The First Twenty Years* (Mitre Corporation, Bedford, Mass., 1979); Historical Division, US Air Force Electronics Systems Division, *History of the Electronics Systems Divisions, Vols. 1 and 2, SAGE: Background and Origins, December 1964* (declassified; US Army Communications Command, *History of the United States Army Communications Command from Origin through 1976* (Fort Huachuca, Ariz., 1977); US Air Force Communications Command, AACS, AFCS, AFCC, 1938–81, *Providing the Reins of Command* (Scott Air Force Base, Ill., 1981); US Naval Ocean Systems Center, *A Guide to U.S. Navy Command, Control and Communications* (NOSC, San Diego, Calif., 1 July 1979).
[14] See *DoD Annual Report, FY 1984*, p. 82 (hereafter referred to as DoD, *FY*____).
[15] White House, Presidential Directive/NSC-53, *Subject: National Security Telecommunications Policy*, 15 November 1979.
[16] Discussions with US government officials. PD-58, *Continuity of Government*, signed 30 June 1980, has not been released to the public.
[17] Numerous articles have been written about PD-59, *Nuclear Weapons Employment Policy*, signed 25 July 1980, which also has not been released to the public. See also US Congress, Senate Armed Services Committee, Department of Defense *Authorization for Appropriations for Fiscal Year 1982*, Hearings, Part 7, p. 3791. [Hereafter Congressional hearings on the DoD budget will be referred to by committee—Senate Appropriations Committee (SAC), Senate Armed Services (SASC), House Appropriations Committee (HAC), and House Armed Services Committee (HASC)—Fiscal Year, and Part].
[18] Congressional Budget Office, *Strategic Command, Control, and Communications: Alternative Approaches for Modernization* (October 1981); HAC, *FY 1984 DoD, Part 8*, p. 321; DoD *FY 1981*, p. 140.
[19] DoD, *Continuity of Operations and Planning*, Department of Defense Directive 3020.26, 22 January 1982, Enclosue 2, pp. 2–3. The National Military Command Structure was

established by the National Security Act of 1947 as amended in 1949 and by the Defense Reorganization Act of 1958.
[20] DoD, *Worldwide Military Command and Control System (WWMCCS)*, Department of Defense Directive 5100.30, 2 December 1971.
[21] DoD, *Order of Succession to Act as Secretary of Defense, Secretaries of the Army, Navy and Air Force*, Department of Defense Directive 3020.4, 11 February 1976.
[22] Harvard University, Center for Information Policy Research, *Seminar on Command, Control, Communications and Intelligence*, Spring 1980, p. 43.
[23] The locater is operated by the WHCA and provides "expeditious processing of telephone calls . . . from statutory presidential successors to the central locater". Operators within the Central Locater maintain current locations of staff, cabinet members and military aides including "names, titles, code names" of individuals including recognizing individuals by voice. Army Regulation 611-201, 2 January 1978, p. 3-31-57; Defense Communications Agency (DCA), *Telephone Procedures for the Central Locater System*, DCA Circular 310-70-10, 20 May 1981.
[24] The WHCA was originally established as the White House Signal Det. of the Army Signal Corps in March 1949; USACC, *History* (note 13), p. 5.
[25] See Gaddis, J. L. and Etzold, T., *Containment: Documents on American Policy and Strategy, 1945–1950* (Columbia University, New York, 1978).
[26] The NMCS was created in May 1963 with a 'Master Plan' resulting from a 1960–61 study group headed by the former NORAD commander General Earl E. Partridge. Requested by Secretary of Defense McNamara following a shift from massive retaliation to 'controlled response', the study concluded that control facilities were needed to permit time to issue a presidential release order to the nuclear forces and that a primary and alternate command centre, with two mobile emergency centres, was required. The NMCS contained the provisions by which the order to use nuclear weapons can be made and the authority can be transferred to officials other than the President.
[27] National Communications System (NCS), *Organization and Functions*, September 1982, p. 1; White House, Memorandum to the Heads of Executive Departments and Agencies, *Subject: Establishment of the NCS*, 21 August 1963.
[28] White House, *National Security Telecommunications Policy* (note 15).
[29] DoD, *WWMCCS* (note 20).
[30] Ball (note 12), p. 3.
[31] DoD, *WWMCCS* (note 20).
[32] DoD, *C³I* (note 3), p. 7.
[33] NORAD transmits its attack assessment data (from all sensors) to the other three command centres while they are also receiving data directly from two key early-warning radars (DSP and PAVE PAWS). Each command centre thus has two separate computations to avoid mistakes, one directly from the sensors and one from NORAD. US Congress, *Recent False Alerts from the Nation's Missile Attack Warning System, Report of Senator Gary Hart and Senator Barry Goldwater to the Senate Committee on Armed Services*, 9 October 1980, p. 3 (hereafter referred to as *Hart Report*).
[34] SAC, Fact Sheet, *SAC Underground Command Post*, August 1981.
[35] DoD (note 19), p. 2. The Unified and Specified Commands with nuclear weapon responsibilities are European Command, Pacific Command, Atlantic Command, Strategic Air Command, Central Command and NORAD.
[36] DoD, *C³I* (note 3), p. 7.
[37] *DoD Statement before the HASC*, 24 March 1983, p. 6.
[38] DoD, *C³I* (note 3), pp. 44–45; see also Thompson, T. R., 'The Strategic Air Command Automated Total Information—Satin IV', *Signal*, August 1974, pp. 88–94.
[39] *Aviation Week & Space Technology*, 23 June 1980, p. 39.
[40] Air Force, *Supporting Data for FY 1984 Budget Estimates Submitted to Congress, Descriptive Summaries, RDTE, FY 1984*, 31 January 1983, p. 370 (hereafter referred to as *Descriptive Summaries*).
[41] The NEACP previously consisted of three EC-135J aircraft of the PACCS but have been operational with separate aircraft since 1975.
[42] SAC, Fact Sheet, *Post Attack Command and Control System*, August 1981. Trial testing of the first airborne centre began on 1 July 1960 when one of five modified KC-135A tankers, military versions of the Boeing 707, redesignated EC-135As, began a programme of 15-minute runway alert at Offutt. Manned by a SAC General and technical and communications staff, the mission of the airborne command post was to be prepared to take over from the disabled underground command post and its three ground auxiliaries.

[43] DoD, *C³I* (note 3), pp. 12, 64.
[44] HAC, *FY 1984 DoD, Part 8*, p. 316.
[45] JCS, *Organization and Functions of the Joint Chiefs of Staff*, JCS Publication 4, July 1983, p. III-3-70-71.
[46] SAC, Fact Sheet, *E-4A/B Airborne Command Post*, August 1981.
[47] *Descriptive Summaries* (note 40), p. 320.
[48] 'E-4B boosts SAC's communications net', *Aviation Week & Space Technology*, 16 June 1980, pp. 77–83; *Descriptive Summaries* (note 40), p. 370; DoD, *FY 1984*, p. 230.
[49] HAC, *FY 1982 DoD, Part 9*, p. 195.
[50] HAC, *FY 1980 DoD, Part 2*, p. 554; *Descriptive Summaries* (note 40), p. 391; HAC, *FY 1984 DoD, Part 7*, p. 303; HAC, *FY 1982 DoD, Part 9*, p. 195.
[51] SAC, *FY 1983 DoD, Part 3*, p. 386.
[52] DoD, *FY 1984*, p. 231.
[53] HAC, *FY 1984 DoD, Part 8*, p. 316.
[54] HAC, *FY 1984 DoD, Part 8*, p. 325.
[55] DoD, *FY 1983*, p. III-68.
[56] *Statement of the Director of the DCA/NCS*, House Armed Services Committee, 18 April 1983, p. 6.
[57] DoD, *FY 1984*, p. 221.
[58] The President, Vice-President, Speaker of the House, Secretary of Defense, Chairman of the Joint Chiefs of Staff, NMCC, ANMCC, NEACP and PACCS are all supplied with the identical capability of acting as the NCA, but under what conditions the authority would pass on remains highly secretive. Conflicts over control of nuclear weapons and the succession to the NCA have come to public attention at various crises, most recently after the assassination attempt on President Reagan in 1981. See Pringle, P. and Arkin, W., *S.I.O.P.: The Secret U.S. Plan for Nuclear War* (W. W. Norton, New York, 1983); Congressional Research Service, *National Security Policy: Conflicts over Control*, IB81086, 18 May 1981 (updated); Stathis, S. W., 'Presidential disability agreements prior to the 25th amendment', *Presidential Studies Quarterly*, Spring 1982, pp. 208–15; and Legere, L. J. and Corson, J. E., *Presidential Succession and the Authority to Release Nuclear Weapons*, IDA Research Paper P-537, August 1969.
[59] US Army, *Nuclear Unit Operations in Combat*, Field Manual FM 100-50, 31 March 1977, p. 6. A PAL is "a code system and a family of devices integral or attached to nuclear weapons which have been developed to reduce the probability of an unauthorized nuclear detonation ... The code system is a highly secure system which permits the using unit to obtain the proper numerical code only after PAL unlock has been authorized". US Congress, Committee on International Relations, *First Use of Nuclear Weapons: Preserving Responsible Control*, Hearings, 1976, p. 93.
[60] HASC, *FY 1984 DoD*, p. 127.
[61] CBO (note 18), p. 12.
[62] US Army (note 59), p. 7.
[63] HASC, *FY 1984, DoD, Part 5*, p. 499.
[64] Cutler, K., 'Inside the looking glass', *Airman*, September 1982, pp. 7–12.
[65] This includes six prestored Minuteman II targets and four sets of three Minuteman III targets. SASC, *FY 1981 DoD, Part 5*, p. 2912; HAC, *FY 1982 DoD, Part 9*, p. 268.
[66] Boeing Company, *Airborne Launch Control System*, n.d. An upgrade to ALCS, Phase III, was cancelled in October 1981. It would have provided airborne command posts with the added capability to receive alert status information (two-way contact) with the missiles and the ability to retarget missiles. SAC, *FY 1983 DoD, Part 2*, p. 386; HASC, *FY 1979 DoD, Part 3, Book 1*, p. 342.
[67] SAC, Fact Sheet, *Positive Control*, August 1981.
[68] Note 67.
[69] General Accounting Office, *Countervailing Strategy Demands Revision of Strategic Force Acquisition Plans*, MASAD-81-35, 5 August 1981, pp. 36–37.
[70] Pringle and Arkin (note 58).
[71] SASC, *FY 1982 DoD, Part 7*, p. 3870.
[72] JCS, *Joint Reporting Structure*, JCS Publication 6, Vol. 1, *General Instructions*, June 1977, p. 7–2.
[73] Note 72, p. 4-1.
[74] Note 72, p. 6-21. The 12 reports listed are: Force Generation Report, Launch Report, Atomic Intentions Report, Atomic Strike Crew Broadcast Report, Atomic Post Strike Results Report, Reconnaissance Launch Report, Reconnaissance Intentions Report, Atomic Reconnaissance Crew Broadcast Report, Nuclear Immediate Photo Interpretation Report,

Atomic Intercept Report, Atomic Supporting Request and Atomic Strike Approval Request.
[75] *Hart Report* (note 33).
[76] DSP is secret, as it provides cover for signals intelligence-collection satellites in similar positions as well as having some intelligence collection capabilities. According to one report, "spaceborne IR sensors can 'read' the state of nuclear power reactors of submarines in port—that is, differentiate between a boat with its reactor in a standby mode, and one that is running up its reactor and thus presumably is getting ready to put to sea"; *Air Force Magazine*, August 1979, p. 20. See also Kenden, A., 'Military manoeuvres in synchronous orbit', *Journal of the British Interplanetary Society*, Vol. 36, 1983, pp. 88–91; Klass, P. J., 'Early warning satellites seen operational', *Aviation Week & Space Technology*, 20 September 1971, pp. 18–20; SASC, *FY 1980 DoD, Part 6*, p. 3009.
[77] 'Improved U.S. warning net spurred', *Aviation Week & Space Technology*, 23 June 1980, pp. 38–45.
[78] *Hart Report* (note 33).
[79] *Descriptive Summaries* (note 40), pp. 353–61. The SPS was deployed to Boerfink, FR Germany in 1981 and can handle data from only one satellite. HASC, *FY 1982 DoD, Part 5*, p. 635.
[80] HASC, *FY 1979 DoD, Part 3, Book 1*, pp. 96–97; "additional users receive data via teletype communications lines".
[81] Early detection by DSP is the key "in the survival of our bomber forces" according to the Air Force. HASC, *FY 1981 DoD, Part 4, Book 2*, p. 1913.
[82] ACDA, *FY 1981 Arms Control Impact Statements*, p. 164.
[83] Air Force Audit Agency, *Report of Audit 945-9, Management of the Defense Support Program*, Space Division, Los Angeles, California (Project 818118), 10 January 1983; HASC, *FY 1983 DoD, Part 3*, p. 168; *Aviation Week & Space Technology*, 6 April 1981, p. 13.
[84] *Aviation Week & Space Technology*, 23 June 1980, p. 38; HASC, *FY 1981 DoD, Part 4, Book 2*, pp. 1702, 1905.
[86] JCS, *FY 1984*, p. 39; HAC, *FY 1980 DoD, Part 3*, p. 865.
[87] HAC, *FY 1980 DoD, Part 3*, p. 880.
[88] ACDA (note 82), p. 167; *Descriptive Summaries* (note 40), pp. 220–30.
[89] Note 88; DoD, *FY 1984*, p. 230.
[90] DoD, *FY 1983*, p. III-67.
[91] Note 90.
[92] HASC, *FY 1980 DoD, Part 3*, pp. 77–83; HAC, *FY 1980 DoD, Part 3*, pp. 861–95; HASC, *FY 1981 DoD, Part 4, Book 2*, p. 1912.
[93] Note 92.
[94] HAC, *FY 1984 DoD, Part 8*, p. 320.
[95] Early-warning data from the various sensors is correlated and processed via the NORAD and WWMCCS ADP systems (discussed elsewhere).
[96] JCS, *FY 1984*, p. 39.
[97] A number of verification or intelligence-collection projects also contribute to early warning: Cobra Judy (633B), a phased-array radar operated aboard ship; Cobra Ball, specially equipped RC-135S aircraft flown out of Alaska; and Cobra Shoe, a dormant OTH radar programme in Turkey. See *Air Force Magazine*, July 1977, p. 41; *Air Force Magazine*, July 1978, p. 97.
[98] Statement by Latham, Senate Armed Services Committee, 18 March 1983, p. 2; DoD, *FY 1984*, p. 229.
[99] *Descriptive Summaries* (note 40), p. 347.
[100] ACDA (note 82), p. 165.
[101] 'U.S. upgrading ground-based sensors', *Aviation Week & Space Technology*, 16 June 1980, pp. 239–41; DoD, *FY 1984*, p. 229.
[102] ACDA (note 82), p. 166.
[103] For more information on Seek Skyhook, see HAC, *FY 1983 DoD, Part 6*, pp. 350–57; *Descriptive Summaries* (note 40), p. 337; 'USAF using balloon-borne radar system', *Aviation Week & Space Technology*, 14 November 1983, pp. 215–16.
[104] The JSS system consists of eight ROCCs at Griffiss AFB, New York; March AFB, California; McChord AFB, Washington; Tyndall AFB, Florida; Elmendorf AFB, Alaska; Wheeler AFB, Hawaii; and North Bay, Canada (two sites). There are 86 radars reporting into the JSS system: 46 radar sites in the continental USA [31 joint AF/FAA, 8 Air Force only, 1 joint AF/Navy (Oceana, Virginia), 1 Seek Skyhook, and 5 data tie sites (without height-finder radars)]; 14 in Alaska (13 AF sites (Seek Igloo and 1 data tie site); 24 in Canada on the East and West coasts; and 2 sites in Hawaii. 'Air Force upgrading radar network', *Aviation Week & Space Technology*, 16 June 1980; *Descriptive Summaries* (note 40), pp. 336–37.

[105] *Descriptive Summaries* (note 40).
[106] JCS, *FY 1984*, p. 18; 'Pentagon details $7.8 billion air defense plan', *New York Times*, 6 March 1983, p. 26; see also 'Air Force upgrading radar network', *Aviation Week & Space Technology*, 16 June 1980, pp. 229–32.
[107] JCS, *FY 1984*, p. 40.
[108] DoD, *FY 1984*, pp. 226–27.
[109] DoD, *C^3I* (note 3), p. 35.
[110] HAC, *FY 1984 DoD, Part 2*, pp. 913–32; *Descriptive Summaries* (note 40), pp. 341–43.
[111] 'Backscatter radar unit enters production phase', *Aviation Week & Space Technology*, 16 August 1982, pp. 68–77.
[112] DoD, *FY 1984*, p. 226.
[113] HAC, *FY 1984 DoD, Part 2*, p. 920.
[114] GAO, *Acquisition of the OTH-B Radar System should be reevaluated*, C-MASAD-83-14, 15 March 1983.
[115] DoD, *FY 1984*, pp. 145, 248.
[116] *Air Force Magazine*, July 1978, p. 49.
[117] 'Problems double cost of Teal Ruby', *Aviation Week & Space Technology*, 6 July 1981, pp. 23–24.
[118] *Hart Report* (note 33), pp. 4–5; HASC, *FY 1980 DoD, Part 3, Book 2*, p. 2464. According to NORAD (Fact Sheet appending correspondence 30 June 1983), the following Emergency Action Conferences have actually taken place in response to warning information:

Year	Routine missile display conferences	Possible threat (MDCs)	Threat assessment conferences
1977	1567	43	0
1978	1009	70	2
1979	1544	78	2
1980	3815	149	2
1981	2851	186	0
1982	3716	218	0
1983[a]	1479	130	0

[a] To May 1983.

[119] 'Improved U.S. warning net spurred', *Aviation Week & Space Technology*, 23 June 1980, pp. 38–45.
[120] The Defense Communications System is made up of three major common-user networks:
AUTOVON/DSN: The military unsecure telephone system, part of the NCS, and including a precedence calling system for alerts and NCA access during crisis. AUTOVON uses microwave, HF radio, troposcatter, cable and satellites for transmission. In the USA the system is primarily leased from commercial circuits. Overseas, AUTOVON is US government-owned. The AUTOVON system consists of 69 switching centres (45 in the USA, 8 in Canada, 1 in Panama and 15 abroad) serving some 9 000 circuits.
AUTOSEVOCOM: The secure (encrypted) telephone system, with backbone transmission provided by the AUTOVON network.
AUTODIN/DDN: The data communications network of the DoD, for transfer of automatic data processing information between computers (query/response, interactive and bulk data) and record communications. The AUTODIN system consists of 15 switching centres and 1 300 terminals. The Defense Data Network (DDN) is a follow-on to AUTODIN (initial capability in FY 1983), a common-user packet switched network for data communications, evolving from the ARPANET, with subnetworks comprising WIS, SACDIN and the DoD Intelligence Information System.
[121] Satellite communications, for instance, service strategic communications. In fact, budgeting for satellite communications was redesignated from the defence-wide C^3 mission area in FY 1984 to the strategic C^3 mission area.
[122] These systems include Cemetery Net, Regency Net, the European Command Control Console System and special mobile satellite terminals.
[123] *Hart Report* (note 33), pp. 3, 7.
[124] SAC, *Communications*, Air Force Fact Sheet 81-006, August 1981.
[125] HASC, *FY 1983 DoD, Part 3*, p. 152.
[126] HASC, *FY 1983 DoD, Part 3*, p. 141.

[127] *DoD Statement before the HASC*, 24 March 1981, p. 1.
[128] HASC, *FY 1983 DoD, Part 3*, p. 153.
[129] Air Force, Electronics Systems Division (note 13), p. 20.
[130] SAC, *Communications* (note 124).
[131] JCS, *FY 1983*, p. 71.
[132] JCS, *FY 1984*, p. 15.
[133] SASC, *FY 1982 DoD, Part 7*, p. 3895.
[134] SAC, *Communications* (note 124).
[135] DoD, *FY 1984*, p. 244.
[136] HASC, *FY 1981 DoD, Part 7*, p. 402. The first AFSATCOM terminals were installed in B-52 bombers and EC-135 airborne command posts in 1978. A transportable ground terminal, part of the SAC Headquarters Emergency Relocation Team (HERT), was delivered to Offutt Air Force Base in November 1978. On 22 May 1979 General Richard H. Ellis, Commander of SAC, declared the AFSATCOM operational when he sent a message from his ground terminal, via satellite, to an airborne bomber, his airborne command post and the Cobra Dane radar station at Shemya, Alaska. His message stated, "It opens a new chapter in command and control communications for the strategic forces of the United States."
[137] SAC, *Communications* (note 124).
[138] *Descriptive Summaries* (note 40), pp. 388–395.
[139] *Descriptive Summaries* (note 40), p. 283; DoD, *FY 1984*, p. 245.
[140] HAC, *FY 1984 DoD, Part 8*, p. 339.
[141] Statement by Donald Latham, SASC, 18 March 1983, p. 4.
[142] HAC, *FY 1984 DoD, Part 7*, p. 303.
[143] *Air Force Magazine*, July 1978, p. 50.
[144] Statement by Donald Latham (note 141).
[145] DoD, *FY 1983*, p. I-40.
[146] DoD Statement; HASC, 8 April 1983, p. 3.
[147] JCS, *FY 1984*, p. 15.
[148] SAC, *Communications* (note 124).
[149] The Green Pine System was one of the first specialized northern latitude communications systems set up (in February 1964) for strategic weapons control. The Northern Area Communications System (NACS), a series of powerful tropospheric scatter communications sites and 22 60-foot antennas across the DEW Line, was set up in 1965.
[150] HASC, *FY 1983 DoD, Part 3*, p. 343.
[151] SASC, *FY 1980 DoD, Part 1*, p. 362.
[152] *Defense Electronics*, January 1983, p. 24.
[153] *Descriptive Summaries* (note 40), p. 391.
[154] GAO, *An Unclassified Version of A Classified Report Entitled 'The Navy's Strategic Communications Systems—Need for Management Attention and Decisionmaking'*, PSAD-79-48A, 2 May 1979; SASC, *FY 1980 DoD, Part 3*, p. 488; SASC, *FY 1982 DoD, Part 6*, p. 4107.
[155] SAC, *FY 1980 DoD, Part 3*, p. 488.
[156] SASC, *FY 1982 DoD, Part 7*, p. 4055; GAO (note 154), p. 33; HASC, *FY* 1983 *DoD, Part 3*, p. 149. Six major US Navy VLF transmitters (referred to as Verdin), the primary means of routine communications to the submarine force, provide continuous communications with submarines, but not those in transit. These six transmitters, able to send a 67-word-per-minute encrypted signal which can penetrate water to depths of about 9 metres, are located at Oso, Washington (Jim Creek); Cutler, Maine; Annapolis, Maryland; Yosami, Japan; Wahiawa, Hawaii; and North West Cape, Australia. The VLF stations are supplemented by 21 LF secondary stations, which have the ability to penetrate water to about 5 metres.
[157] Black, K. M. and Lindstrom, A. G., 'TACAMO', *Signal*, September 1978; Starkey, R. J., 'The renaissance in submarine communications, Part II: TACAMO', *Military Electronics/Countermeasures*, December 1980, pp. 52–57; GAO (note 154).
[158] HASC, *FY 1980 DoD, Part 3*, p. 447.
[159] DoD, *FY 1984*, p. 246; 'Navy selects Boeing E-6A for TACAMO role', *Aviation Week & Space Technology*, 9 May 1983.
[160] SAC, *FY 1980 DoD, Part 3*, p. 1362.
[161] SAC, *FY 1980 DoD, Part 3*, p. 1362; HAC, *FY 1980 DoD, Part 3*, p. 449; HASC, *FY 1983 DoD, Part 3*, p. 149; SASC, *FY 1980 DoD, Part 5*, p. 2686; HAC, *FY 1981 DoD, Part 7*, p. 534.
[162] Carlin, R. J., 'Communicating with the silent service', *Proceedings* (US Naval Institute), December 1981, pp. 75–78.

[163] SASC, *FY 1982 DoD, Part 7*, p. 4095.
[164] Carlin (note 162), p. 76.
[165] GAO (note 154), p. 34.
[166] GAO (note 154), p. 38.
[167] In an emergency, the submarine could launch an expendable transmitting buoy, the AN/BRT-1, from a signal ejector tube for one-way communications. The buoy would rise to the surface and, after a pre-set delay of 5 or 60 minutes, begin transmitting a prerecorded message in VHF voice or CW. The message would be repeated for nine hours until a receiving aircraft sent a properly coded message to the UHF receiver on the buoy, at which time it would cease transmission, scuttle and sink. The approximate position of the submarine could then be determined through the HF direction-finding net. See GAO (note 154), p. 38.
[168] GAO (note 154), p. 34.
[169] GAO (note 154); HAC, *FY 1984 DoD, Part 8*, pp. 325, 431. Work on an ELF communications system began in 1958 when a 170-km test antenna was laid in the Blue Ridge Mountains of North Carolina and Virginia. Secret research on ELF transmission and reception continued until 1968 when Wisconsin was chosen as the operational site, creating an environmental impact debate. Project Sanguine, as it was then called, was to consist of 9 600 km of buried and hardened cable laid in a grid at 10 km spacing across the northern 40 per cent of the state, providing survivable, global communications coverage with coded messages. A 'test' site was built on federal land in the Chequamegon National Forest near Clam Lake in 1969, but by 1973 local opposition had grown so strong that Secretary of Defense Melvin Laird, formerly a Congressman from Wisconsin, announced that Sanguine would not be built in his state but in Texas or Michigan instead. The project continued to receive negative reception, and in 1975 the Navy significantly scaled down the project (to 3 840 km of cable) and changed the name to Seafarer. Jimmy Carter, campaigning in Michigan in 1976, promised that Seafarer would not be built against the wishes of residents. In 1977 the Navy proposed splitting the project between Wisconsin and Michigan, but when this was also rejected, President Carter (in 1978) ruled out a full-scale Seafarer system and the name was again changed to ELF. The Wisconsin Test Facility remained operational, but Congress decided that no additional money for the programme would be appropriated until the President found an appropriate site. On 8 October 1981 the DoD announced that President Reagan had approved its recommendation to go ahead with an ELF communications system.
[170] DoD, *News Briefing by Captain Daniel E. Donovan, USN, Deputy Director of Naval Communications at the Pentagon*, Thursday, 8 October 1981; Ruhe, W. J., 'ELF communications for submarines', *Nato's Fifteen Nations*, June–July 1981.
[171] SASC, *FY 1982 DoD, Part 7*, p. 4054.
[172] Beam, H. H., 'Resurrection of the ELF', *Proceedings* (US Naval Institute), April 1983, pp. 115–17; 'Project ELF finally wins a vote', *Science*, 12 August 1983, pp. 630–31; HAC, *FY 1980 DoD, Part 3*, pp. 446–65.
[173] SASC, *FY 1982 DoD, Part 7*, p. 4055.
[174] *Descriptive Summaries* (note 40), p. 325; HASC, *FY 1983 DoD, Part 3*, p. 79.
[175] SASC, *FY 1980 DoD, Part 7*, p. 4096; GAO (note 154), pp. 39–44.
[176] In FYs 1983–84 a new demonstration of vertical VLF/ELF communications is being initiated by the Air Force Geophysics Laboratory employing an aerostat with a 900 metre tether/antenna for reconstitution of communications. *Descriptive Summaries* (note 40), p. 134; *Defense Electronics*, December 1982, p. 36. According to the GAO, balloon-supported antennas have had many practical problems; GAO (note 154), p. 41.
[177] In a change of name on 1 January 1981, *PVO Strany* (national) became simply *Voiska PVO*; Jones, D. R., ed., *Soviet Armed Forces Review Annual* (Academic International Press, Florida), Vol. 5, p. 83 (hereafter referred to as *SAFRA* __ depending on volume number).
[178] DoD, *Soviet Military Power*, 1st ed., 1981, pp. 15–18 (hereafter referred to as *SMP 1*); see also DIA, *The Soviet Ministry of Defense and Military Management*, DDB-2610-22-79, 1979.
[179] JCS, *FY 1983*, p. 105.
[180] *SMP 1*, p. 55.
[181] *SAFRA 6*, p. 104.
[182] *SMP 1*, p. 55.
[183] Ball (note 12), p. 45; Gray, C. S., 'Strategic rocket forces: military capability and strategic utility', *Air Force Magazine*, March 1978, p. 51.
[184] *SMP 1*, p. 55.
[185] US Congress, *Allocation of Resources in the Soviet Union and China*, Hearings before the Joint Economic Committee, 1981, p. 199 (hereafter referred to as *ARSUC*, with year of hearing).

[186] *ARSUC*, 1981, p. 199.
[187] *SAFRA 5*, p. 81.
[188] Betts, R. K., ed., *Cruise Missiles: Technology, Strategy, Politics* (Brookings Institution, Washington, D.C., 1981), pp. 53–82.
[189] *SMP 1*, p. 65. It is possible that, with the exception of Moscow, air defence districts have or are being eliminated and air defence forces are being placed under an organization of the military districts or theater commands. *SAFRA 5*, pp. 83–85; *SAFRA 6*, p. 140.
[190] *SMP 1*, p. 18; Ball (note 12), p. 44.
[191] Weiner, F., *The Armies of the Warsaw Pact Nations* (Carl Ueberreuter, Vienna, 1981), 3rd ed., pp. 53, 167.
[192] SASC, *FY 1983 DoD, Part 7*, p. 4672.
[193] HAC, *FY 1984 DoD, Part 8*, p. 316.
[194] HAC, *FY 1984 DoD, Part 8*, p. 316; SASC, *FY 1983 DoD, Part 7*, p. 4672.
[195] *DoD, Soviet Military Power*, 2nd ed., p. 17 (hereafter referred to as *SMP 2*).
[196] Baird, G. C., 'The Soviet theater command: an update', *Naval War College Review*, November–December 1981, pp. 90–93.
[197] SASC, *FY 1983 DoD, Part 7*, p. 4675; US Navy, *Understanding Soviet Naval Developments*, 4th ed., p. 46.
[198] *SMP 1*, p. 18.
[199] HAC, *FY 1984 DoD, Part 8*, p. 316.
[200] *SMP 2*, p. 15.
[201] *SMP 2*, p. 30.
[202] US Air Force, Foreign Technology Division, *A Determined Quest for Military and Technological Supremacy*, 1981.
[203] *SMP 2*, p. 75.
[204] *SMP 1*, p. 54.
[205] Air Force FTD (note 202).
[206] *SMP 1*, p. 18.
[207] Ball (note 12), p. 44.
[208] Ball (note 12), p. 44; HAC, *FY 1980 DoD, Part 3*, p. 458.
[209] *SMP 2*, p. 65.
[210] *SMP 2*, p. 69.
[211] *SMP 2*, p. 69.
[212] *SMP 1*, p. 19.
[213] Ball (note 12), p. 44.
[214] Sheldon II, C. S., 'The Soviet space program in 1979', *Air Force Magazine*, March 1980, p. 89.
[215] *Defense Systems Review*, October 1983, p. 54; Polmar, N., 'Soviet C^3', *Air Force Magazine*, June 1980, p. 61; *Defense Electronics*, October 1983, pp. 140, 145–47.
[216] *Defense Electronics*, October 1983, pp. 140, 145–147.
[217] Note 216; Ball (note 12), p. 44.
[218] *SMP 2*; 'Soviets integrating space in strategic war planning', *Aviation Week & Space Technology*, 14 March 1983, p. 111; Johnson, N. L., 'Soviet strides in space', *Air Force Magazine*, March 1983, p. 51.
[219] *SMP 2*, p. 16.
[220] *Defense Electronics*, October 1983, p. 145.
[221] Note 220.
[222] 'US scrutinizing new Soviet radar', *Aviation Week & Space Technology*, 22 August 1983, p. 20.
[223] Johnson (note 218).
[224] *Aviation Week & Space Technology* (note 218); *SAFRA 5*, p. 207.
[225] The new PAR at Pechora is reportedly looking out towards the Arctic regions and two new SLBM detection radars, similar to the US PAVE PAWS, have been deployed; *Aviation Week & Space Technology* (note 222), pp. 19–20.
[226] *ARSUC*, 1981, p. 197.
[227] JCS, *FY 1982*, p. 102.
[228] *SMP 2*, p. 27.
[229] *SAFRA 5*, p. 98.
[230] *SMP 2*, p. 27; Ball (note 12), p. 44.
[231] JCS, *FY 1983*, p. 105, 110; *SMP 2*, p. 27; *SMP 1*, p. 68; *SAFRA 5*, p. 99.
[232] JCS, *FY 1983*, p. 110; JCS, *FY 1982*, p. 101.
[233] *SMP 2*, pp. 5, 28.

[234] 'Soviets test defense missile reload', *Aviation Week & Space Technology*, 29 August 1983, p. 19; *Aviation Week & Space Technology* (note 222). The ABM Treaty prohibits deployment of radars "for early warning of strategic ballistic missile attack except at locations along the periphery of national territory and oriented outward".
[235] 'Soviets stage integrated test of weapons', *Aviation Week & Space Technology*, 28 June 1982, pp. 20–21.
[236] JCS, *FY 1981*, p. 8.
[237] *SMP 2*, p. 27; *SMP 1*, p. 64 stated that there were "more than 5 000 early warning and height-finding air defense radars throughout the USSR".
[238] *SAFRA 5*, p. 93.
[239] *SMP 2*, p. 67. Some sources (*SAFRA 5*, p. 94) suggest 1 200 sites.
[240] *SAFRA 5*, p. 98.
[241] *ARSUC*, 1975, p. 102.
[242] JCS, *FY 1983*, p. 110.
[243] *SMP 1*, p. 65. The earliest type, some 10 Tu-126/MOSS AWACS, were operational in 1980 but have been or are being phased out in favour of a new AWACS based on the Il-76 Candid; *SAFRA 6*, pp. 149–50.
[244] JCS, *FY 1984*, p. 14.
[245] *ARSUC*, 1979, p. 111.
[246] *ARSUC*, 1980, p. 47.
[247] *SMP 2*, p. 17.
[248] *SMP 2*, p. 27.
[249] *SMP 2*, p. 17.
[250] *SMP 2*, p. 18.
[251] *SMP 2*, p. 66.
[252] USACC *History* (note 13), pp. 237–43, 248.
[253] DoD, *Report to the Congress by Secretary of Defense Caspar Weinberger on Direct Communications Links and Other Measures to Enhance Stability*, 11 April 1983; Jackson, H. M., 'Nuclear war and the hotline', *Wall Street Journal*, 3 September 1982, p. 14; *Congressional Record*, 30 November 1982, pp. E4793–E4794.
[254] JCS, *FY 1984*, p. 15.
[255] *Signal*, May/June 1982, p. 36.
[256] SASC, *FY 1983 DoD, Part 7*, p. 4213.
[257] Schemmer, B. F., 'Who would start the war? A civilian? The military advisors? Will it be a woman?', *Armed Forces Journal International*, December 1981, pp. 36–46.
[258] CBO (note 18), p. ix.
[259] HASC, *FY 1981 DoD, Part 4*, p. 2328; IDA (note 58).
[260] HAC, *FY 1984 DoD, Part 8*, p. 321.
[261] *Statement before the SASC*, 18 March 1983, pp. 10–11.
[262] Note 261.
[263] HAC, *FY 1980 DoD, Part 3*, p. 878.
[264] HAC, *FY 1980 DoD, Part 3*, p. 879.
[265] JCS, *FY 1983*, p. 71.
[266] *Descriptive Summaries* (note 40), p. 334.
[267] HASC, *FY 1979 DoD, Part 3*, Book 1, p. 99.
[268] CBO (note 18), p. 24.
[269] SASC, *FY 1982 DoD, Part 7*, p. 3833; *Descriptive Summaries* (note 40), p. 325; HAC, *FY 1982 DoD, Part 9*, p. 272.
[270] SASC, *FY 1982 DoD, Part 7*, p. 3834. William Perry, former Under-Secretary of Defense for Research and Engineering, also stated: "We have the technical capability to launch our ICBM force prior to an attack, and we plan to maintain this capability"; SASC, *FY 1980 DoD, Part 1*, p. 305.
[271] Bracken, P., *The Command and Control of Strategic Forces* (Yale University Press, New Haven, CT, 1983).
[272] *SMP 2*, p. 16.
[273] Harvard University (note 22).
[274] CBO (note 18), pp. 4, 13ff; GAO (note 154), pp. 20–23.
[275] SASC, *FY 1982 DoD, Part 7*, p. 4333.
[276] *Hart Report* (note 33), p. 3.
[277] HAC, *FY 1984 DoD, Part 8*, p. 301; DoD, *FY 1984*, p. 82.
[278] HAC, *FY 1984 DoD, Part 8*, p. 318. The Nuclear Weapons Employment and Acquisition Master Plan incorporates a number of previous plans: North American Air Defense Master

Plan, DoD Plan for Intelligence Support to Operational Commanders, and the Strategic Connectivity Plan. See also DoD, *FY 1984*, p. 83; HAC, *FY 1984 DoD, Part 8*, p. 317.
[279] *Statement before the HASC*, 16 March 1983, p. 1.
[280] HAC, *FY 1984 DoD, Part 8*, p. 300.

14. The Honduras–Nicaragua conflict and prospects for arms control in Central America

JOZEF GOLDBLAT and VICTOR MILLÁN

Superscript numbers refer to the list of notes and references at the end of the chapter.

I. Introduction

In the past decade, the Central American isthmus, south of Mexico, has had a large number of inter-state conflicts. Most of the conflicts have their roots in the internal upheavals generated by the backward social and economic structures of these countries. Continuous interference by outside powers, both hemispheric and extra-hemispheric, exacerbates the situation. In particular the United States, which considers Central America to be a region of vital importance to its national security, maintains a preparedness for prompt military intervention, as was most recently illustrated by the invasion of Grenada. On the other hand, since 1959 Cuba has assisted revolutionary movements in Latin America, introducing a new element into the ideological confrontation in the region. The Soviet Union became indirectly involved in the Central American controversies by its military presence in Cuba and owing to supplies of weapons of Soviet origin to Nicaragua.

The two most important events which attracted attention to this part of the world in the late 1970s were the *coup d'état* in El Salvador and the revolution that abolished the Somoza dictatorship in Nicaragua. Marking a new phase in the ongoing civil wars, these events have also provoked political turmoil in the neighbouring states, giving rise to international conflicts. This chapter is devoted to one such conflict, that between Nicaragua and Honduras, which is particularly menacing for peace in Central America.

Section II gives a concise background to this conflict, while section III provides facts and figures on the military potential of the parties, against the background of the militarization of the whole region. Section IV reviews the armed attacks which have taken place in recent years, including an account of the losses and costs. Efforts made to reach a peaceful settlement are described in section V. Recommendations to reduce tensions in the region and to facilitate durable political arrangements are put forward in the concluding section.

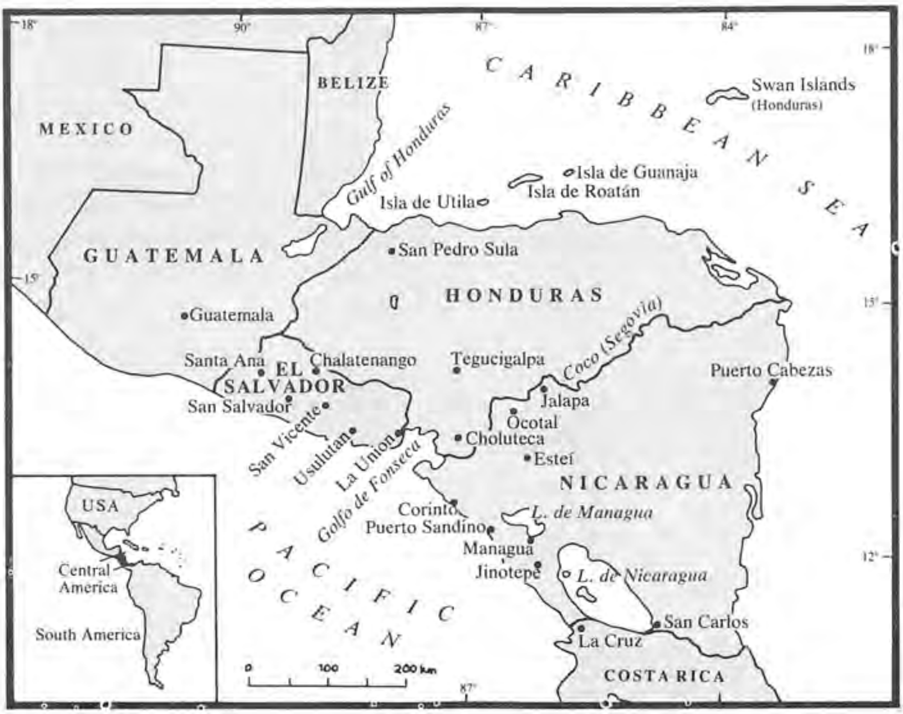
II. Background

Nicaragua

Nicaragua, which occupies an area of 139 000 km², is the largest of the Central American republics and has a population of about 3 million. In 1982 its gross domestic product (GDP) per capita amounted to US $934 (in constant 1980 dollars). Its main export products are coffee, cotton and sugar.

From the 1930s until 1979, Nicaragua had been governed by a succession of presidents from the Somoza family, who exercised almost absolute power over the country. The dictatorship fostered corruption and repression of civil rights, and kept the economy in a state of utter backwardness. In 1958 a guerrilla campaign to bring about a change started, initially in the northern part of the country. Four years later a National Front of Liberation, called Sandinista (after a national figure, who in the 1920s fought US Marines occupying Nicaragua), was founded. Its war, waged throughout the country against the Somoza regime, came to a victorious end in July 1979. Some 50 000 people lost their lives in this civil war, another 100 000 to 150 000 were wounded, as many as 200 000 families were left homeless

Figure 14.1. The Central American isthmus



and some 30 000 children orphaned. Approximately 33 per cent of the industry was destroyed and much of the rest was damaged in the last stages of the war, and agricultural production was set back at least two years.[1]

The fall of Somoza marked the first successful insurrection in Latin America against a dictatorship since the fall of Batista, the Cuban dictator, in 1959. It provided encouragement to guerrilla groups operating in neighbouring countries. Nicaragua became a sanctuary from which these groups could operate, and its authorities have been accused of assisting militarily the guerrilla movement in El Salvador and, in particular, of serving as a conduit for arms supplied by Cuba and the Soviet Union. However, since it came to power, the new Nicaraguan government has had to deal with strong opposition from former members of Somoza's National Guard. Having found refuge in neighbouring Honduras, these guards have been launching forays into Nicaragua, provoking serious armed clashes. With the passage of time, splinter Sandinista groups, dissatisfied with government policies and with the ties established with Cuba and the USSR, also left Nicaragua, mainly for Costa Rica, and engaged in harassing operations from across the border. In addition, in 1981 the indigenous Indian people, the Miskitos, living on the border with Honduras, started, in alliance with anti-Sandinista groups, an armed struggle against the Nicaraguan government in response to the expropriations of land under the guise of agrarian reform and to oppose all forms of political and cultural oppression. In March 1984 a representative of the Miskito Indians, addressing the UN Commission on Human Rights, denounced what he called the "systematic extermination" of this ethnic population by Nicaraguan authorities. Indeed, there have been numerous cases of forced resettlement of the Miskito Indians from the coast to the interior of the country, placing them in camps, and subjecting them to compulsory hispanization. The Nicaraguan government recognized that it had committed errors but it denied the accusations of human rights violations.

Honduras

Honduras, situated north of Nicaragua, occupies an area of 112 000 km^2 and has a population of almost 4 million. In 1982 its GDP per capita amounted to $609 (in constant 1980 dollars). The main export products are bananas and coffee. Honduras is the fourth poorest country in Latin America, after Haiti, Bolivia and El Salvador.

In 1979, after two decades of military rule, the Honduran government called elections for a constituent assembly to draft a new constitution and establish procedures for the transfer of power to a civilian government. The Liberal Party won over the National Party, and a civilian liberal candidate was elected president in 1981. However, in January 1982, at the initiative of the commander-in-chief of the Honduran armed forces, a violent anti-communist campaign started in the country. Former Somoza National Guardsmen were allowed to settle in the border areas and to launch attacks against Nicaragua. Furthermore, US training camps were set up for Salvadorean soldiers and for anti-Sandinista forces. Honduras began conducting military manoeuvres together with the United States along the Honduran–Nicaraguan border.

The Honduras–Nicaragua conflict must also be seen in the context of the civil wars being waged in the adjacent states, in particular in El Salvador.

El Salvador and Guatemala

In El Salvador, rebels belonging to two organizations—Frente Democrático Revolucionario, FDR (a political organization), and Frente Farabundo Martí para la Liberación Nacional de El Salvador, FMLN (a federation of guerrilla groups)—have been fighting for years against the alliance of the military and the oligarchy that has prevented the implementation of reforms needed in this backward and overpopulated country to redistribute economic and political power concentrated in the hands of a few. The civil war intensified after 1979, and from then until 1983 an estimated 45 000 Salvadoreans died, another 200 000 were left homeless within the country, while at least 300 000 emigrated.[2]

Guatemala is one of the most violence-ridden nations in the western hemisphere. The regime, which took office in 1978, has engaged in a massacre of opposition politicians and of the Indian population suspected of favouring the opposition. The professed aim is to eradicate 'Marxist subversion' and to block any efforts aimed at bringing about land reform. The proportions of the repressive measures are exemplified by the fact that, during the six months that followed the military coup in 1982 (one of several attempted coups in recent years), 3 000–5 000 people were killed, some 250 000 were displaced from their homes, while 30 000 fled to Mexico.[3]

The United States

The dramatic events in Central America and the Caribbean since the 1970s have had a profound impact on the pattern of international relations in the region. In particular, the revolutionary governments which came to power in Grenada and Nicaragua in 1979 appeared to weaken the US position, already seriously undermined by the Cuban revolution. Any revolutionary government in Latin America is considered by the USA to be, by definition, a pro-Soviet regime. But the significance of Central America for the USA may go beyond ideology. The region is considered to be an essential link in a number of US military activities. Moreover, it is rich in strategically important, unexploited resources,[4] and the USA fears that the emergence of unfriendly regimes in the area could lead to the disruption of the lively sea-borne traffic to the detriment of US interests. Hence the USA has endeavoured to restore the *status quo ante*; this led to the occupation of Grenada in 1983 and to the intensification of the threat of invasion of Nicaragua.

III. Militarization of the region

The isthmus

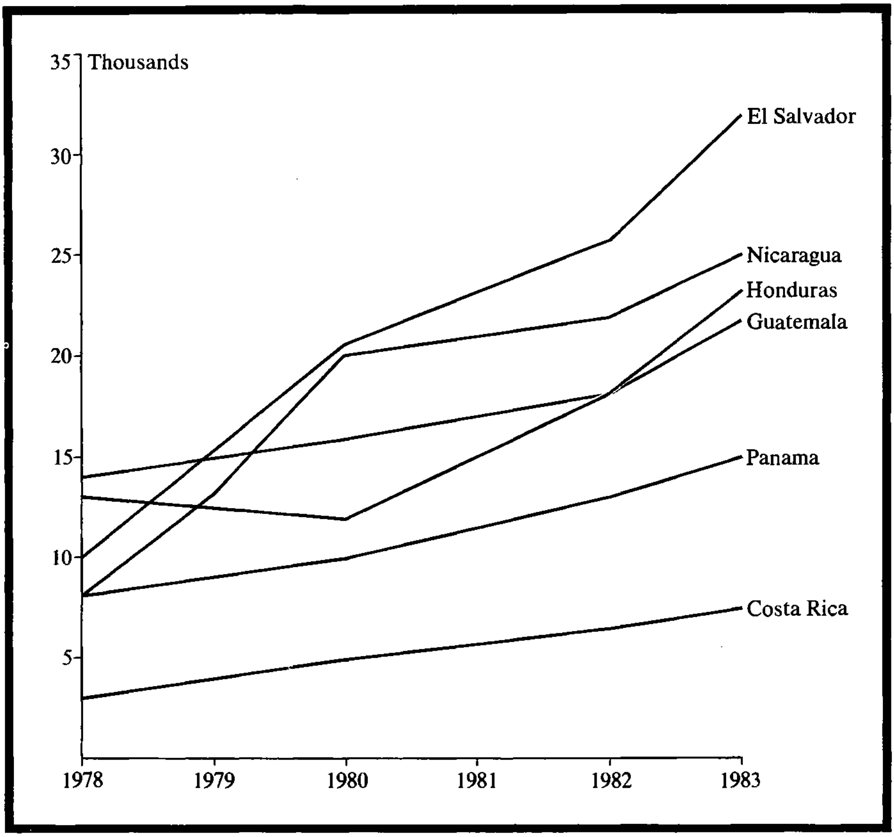
The increase of internal violence in the countries of Central America has in recent years been accompanied by a heightened level of militarization. The term 'militarization', as used here, denotes a steady growth in military potential, which reinforces the role of military institutions both in national affairs, including the economic, social and political spheres, and in international affairs. The military potential is measured by such indicators as military spending, military personnel and military hardware. Unless stated otherwise, the data given in this section are for the latter part of 1983. The figures are approximate, as they are intended chiefly to serve the purpose of comparison.

From 1979 to 1983 the overall military spending of Guatemala, El Salvador, Honduras, Nicaragua and Costa Rica increased by over 50 per cent in real terms. Since 1970 the total number of military personnel of these nations almost tripled, and important shifts occurred in their composition. From 1978 to 1983 in particular, the strength of the para-military forces increased by 180 per cent owing to the new needs of the governments in power to maintain internal security and to fight and suppress internal opposition. Costa Rica is a special case since the 1949 constitution prohibits armed forces; only civil guards are maintained, but their number has also increased (to some 7 000). In 1983 Costa Rica formally declared its "perpetual, active and non-armed" neutrality. However, it is doubtful that this will affect the strength of the guards.

Weapons stockpiled and used in Central America are suitable mainly for police and counter-insurgency (COIN) missions. With the possible exception of Guatemala, which may have started manufacturing ammunition and which is planning to produce rifles under Israeli licence, none of the countries in question is an arms producer. Practically all the weapons found in the region are of foreign origin.

Until the beginning of the 1970s, armed forces in Central America were equipped almost exclusively with US surplus equipment, delivered under

Figure 14.2. The size of the armed forces in Central America, 1978–83



US military assistance programmes. The equipment consisted of COIN and transport aircraft, mortars, howitzers, machine-guns, rifles and ammunition. Israel has also, since 1975, been a major supplier of weapons to Central America; it has provided STOL (short take-off and landing) transport and COIN trainer aircraft, as well as fighter-bombers and helicopters, to Guatemala and Honduras; armoured vehicles and missiles to Honduras; various other weapons, such as sub-machine guns, machine-guns, rifles or rockets, to El Salvador, Honduras and Guatemala and, until the fall of the Somoza regime, also to Nicaragua.[5]

Since the beginning of the 1980s, in spite of the declining growth in GDP, and in spite of increasing fiscal deficits, foreign indebtedness, high rates of unemployment and natural disasters (earthquakes and floods),[6] the countries of the region have undergone an accelerated arms build-up and new arms suppliers have entered the Central American arms market.

Trends in foreign security assistance usually reflect outside involvement in current conflicts. Thus, following the collapse of the Somoza dictatorship in Nicaragua, the United States, preoccupied with the 'domino theory', stepped up its assistance to the friendly regimes of El Salvador and Honduras with a view to stemming the tide of revolutionary developments and re-establishing its influence in the region. Steps were simultaneously taken to resume US military aid to Guatemala which had been cut off in 1977 because of human rights violations in that country.[7]

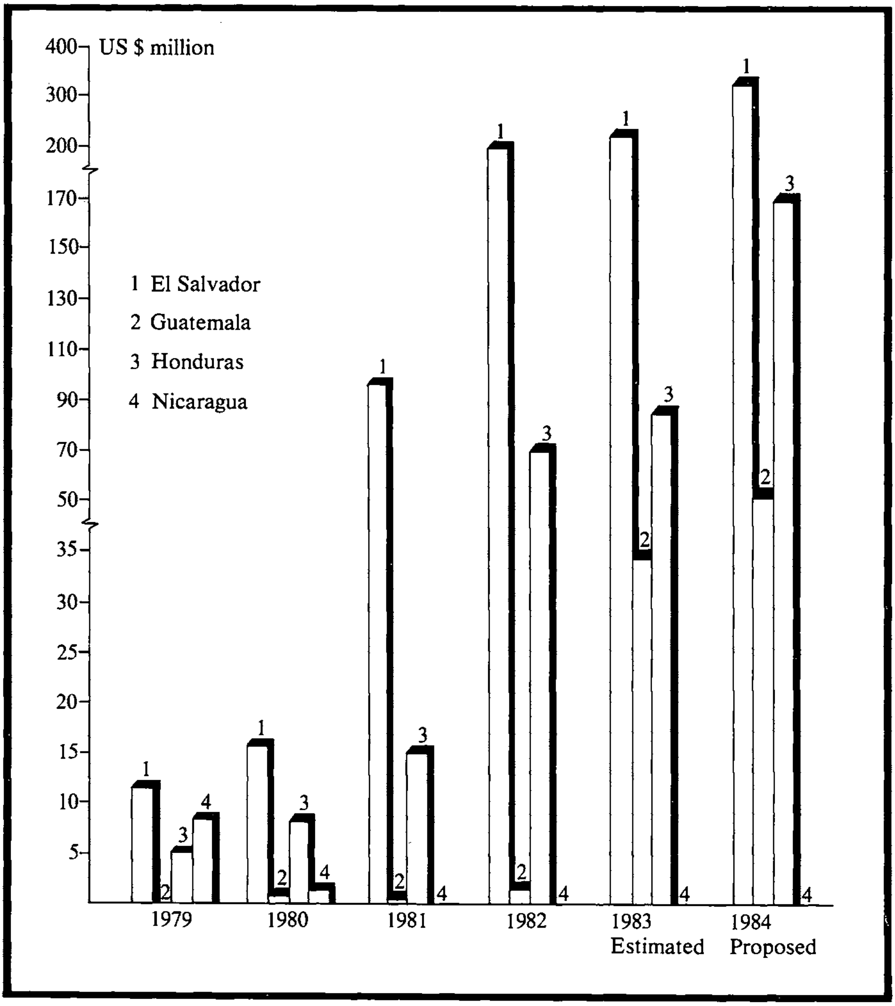
US aid to Nicaragua was first suspended and then in mid-1981 terminated. US military advisers were sent to Honduras, which became a base for operations against Nicaragua. To stay in power, the Nicaraguan authorities had no choice other than to turn for assistance to east European countries, mainly the USSR and Bulgaria, and invited military and internal-security advisers as well as civilian instructors from Cuba.[8] The USA reacted to these developments by casting the problems of the area in an East–West context. It issued a White Paper charging that significant amounts of arms were being channelled by east European countries through Nicaragua and Cuba to guerrillas in El Salvador. Nicaragua denied these charges, but the USA described the situation as a "textbook case of indirect armed aggression by a communist power".[9] The USA multiplied its efforts to isolate Nicaragua and encouraged anti-Sandinista groups to carry out armed attacks against the country. US military assistance provided to El Salvador and Honduras included the training of Salvadorean and Honduran troops, and the dispatch of additional military advisers to both countries.[10] In 1981 the US Administration approved $19 million for Central Intelligence Agency action against Nicaragua.[11]

In December 1982 the US Congress adopted the Boland Amendment, which prohibited the conduct of 'covert' activities to overthrow the government of Nicaragua or provoke a military exchange between Nicaragua and Honduras.[12] A year later the amendment was allowed to expire. The Congress authorized $30 million in fiscal year 1983 and $50 million in fiscal year 1984 for 'overt' aid to help friendly nations in Central America to prevent the use of their territory for the shipment of arms from or through Cuba or Nicaragua to groups seeking to oust any government in the region.[13] In 1983 legislation was approved which provided $24 million in 'covert' aid to insurgent forces in Nicaragua.[14]

In 1982 the USA authorized $21 million under the military construction budget of the Department of Defense for the improvement of Honduran airport facilities. The number of US military advisers in Honduras, as well as weapon deliveries to that country, increased considerably.[15]

Furthermore, the USA encouraged the reactivation of the 1963 agreement (in force since 1964) which established the Central American Defense Council (CONDECA). This agreement declined in importance after the withdrawal of Honduras in the wake of its war with El Salvador in 1969 and, especially, after the fall of Somoza, whose National Guard had been

Figure 14.3. US security assistance programmes for El Salvador, Guatemala, Honduras and Nicaragua, 1979–84[a]



[a] US security assistance programmes include Foreign Military Sales (FMS), Military Assistance Programs (MAP), International Military Education and Training (IMET) and Economic Support Fund (ESF).

Sources: Foreign Assistance and Related Programs Appropriations for 1982, 1983, 1984, Hearings before a Subcommittee of the Committee on Appropriations, House of Representatives, 97th Congress, 1st and 2nd sessions, and 89th Congress 1st session, Parts 1 and 6 (US Government Printing Office, Washington, D.C., 1981, 1982 and 1983); *Country Reports on Human Rights Practices for 1981 and 1982,* Reports submitted to the Committee on Foreign Relations, US Senate and Committee on Foreign Affairs, US House of Representatives, by the Department of State, 97th Congress, 2nd session, February 1982, and 98th Congress, 1st session, February 1983 (US Government Printing Office, Washington, D.C., 1982 and 1983); *US Security and Military Assistance: Programs and Related Activities,* Report by the US General Accounting Office, GAO/ID-82-40, 1 June 1982 (US General Accounting Office, Documents Handling and Information Service Facility, Gaithersburg, Md.); and *International Herald Tribune,* 21 February 1984, pp. 1–2.

the backbone of the alliance.[16] CONDECA provides for reciprocal assistance by the countries concerned to meet armed attacks and to defend the democratic system against "forces which are attempting to destroy it by violence and the infiltration of totalitarian ideas". During the first eight years of its existence CONDECA conducted 10 anti-guerrilla manoeuvres in the region.[17] The revival of CONDECA was announced on 1 October 1983, at a meeting of the military leaders of Honduras, Guatemala, Panama and El Salvador, with US General Paul Gorman (commander-in-chief of the US Southern Command) present as an observer, with the avowed purpose of responding to the "Sandinista threat".[18] The reconstituted Council is thus, effectively, an anti-Nicaraguan alliance.

At a meeting subsequently held in Honduras, the chiefs of staff of the CONDECA states recommended that a study be made to determine the legality of a possible joint military action against Nicaragua. Another recommendation called for the USA to provide support and aid to CONDECA, including advice, training, joint exercises, information sharing, communications and logistics.[19] According to some reports, the members of this alliance were considering whether opposition forces should set up a provisional government on Nicaraguan territory and should ask for outside military assistance.[20] The use of the Organization of Eastern Caribbean States (OECS) to legitimize the US invasion of Grenada has given rise to apprehension that a similar role may be accorded CONDECA with respect to Nicaragua.[21]

Honduras

Honduras considers that its sovereignty and territorial integrity are threatened by the activities of the Nicaraguan armed forces and Salvadorean guerrillas who have been operating in and through Honduras for a considerable period of time. The country has become a shelter for more than 30 000 refugees, mostly Nicaraguans, whose numbers are continuously growing.[22] In this situation, Honduras finds it necessary to engage in an intensive military build-up, even though it has a stagnant economy and a declining national income.[23] From 1979 to 1983, its military expenditures increased by 100 per cent in real terms, while the growth of its GDP decreased from plus 7.5 per cent in 1978 to minus 2 per cent in 1982.[24]

During the same period, Honduran military manpower had more than doubled: from about 11 000 to 23 000, excluding some 5 000 to 10 000 armed opponents to the Nicaraguan regime, who operate from Honduran territory and who for all practical purposes supplement the Honduran forces.

The Honduran Army has 17 (British) Scorpion tanks, each of which mounts one 76-mm gun and two 7.62-mm machine-guns, and can reach a speed of 75 km/h. It also has 15 (British) Alvis Saladin armoured vehicles;

15 (British) Spartan FV-103 armoured personnel carriers; 12 (Israeli) RBY light armoured reconnaissance vehicles; 15 (US) M-3A1 armoured cars, which are World War II vehicles and carry 12.7-mm and 7.62-mm machine-guns; and about 24 (US) 105-mm and 75-mm howitzers.[25]

Honduras has concluded an agreement with Israel for the supply of rebuilt Super Sherman M-4A1-E3 and M-4A1-E8 tanks, as well as artillery and Picket anti-armour weapons.[26] Small arms, in particular 9-mm sub-machine-guns, are supplied by the Brazilian Tauros Company.[27] In November 1983 the USA delivered 12 105-mm howitzers.[28]

The Honduran Air Force has been almost completely re-equipped since the war with El Salvador in 1969, to become a formidable power in Central America in comparison with its neighbours. It now possesses 20 (Israeli/French) Dassault Super Mystère B-2 fighter-bombers; 10 (US) F-86 Sabre fighter-bombers, each armed with two Sidewinder missiles and four 20-mm cannons and able to carry 2 000-lb bombs; 10 (US) A-37B Dragonfly COIN fighter-bombers; 24 (US) T-28 Trojan trainer aircraft, a number of which are armed with two 50-mm machine guns, two 750-lb bombs and two 2.75-inch rocket pods; 3 (Israeli) Arava utility aircraft; and 3 (US) Lockheed RT-33A reconnaissance aircraft.[29]

The opposition in the US Congress has so far prevented the supply to Honduras of the requested 12 F-5E modern fighter-bombers, and of the Israeli Kfir-C2 (to replace the Super Mystère B-2s), which are powered by the US-made General Electric J-79 turbojet and cannot be delivered without explicit US consent. But other important items which have been made available to Honduras by the USA include 10 US Bell UH-1Hs and two S-76 helicopters, bringing to 23 the number of helicopters in service. Moreover, Israel has delivered two Westwind jet aircraft,[30] and Spain will deliver four jet trainer aircraft in 1986.[31]

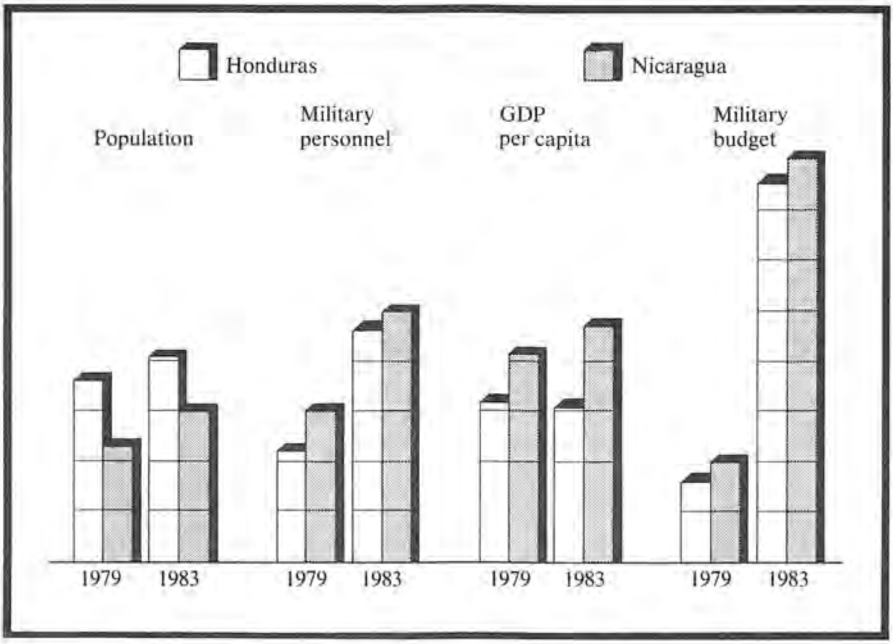
At the end of 1983, Honduras was negotiating the purchase of eight EMB-312 Tucano turboprop trainers from Brazil, with an option for a further four to replace the obsolescent US T-6s and T-28s.[32] The number of Honduran military airstrips has increased from 5 to 10,[33] and new airstrips are being built with US aid for supply and support missions by USAF C-130s.[34] An advanced US air control radar south of Tegucigalpa became operational in 1983 and is manned by US military personnel;[35] a radar system operated by 100 US Marines was installed on Tiger Island in the Gulf of Fonseca to monitor air operations.[36] In mid-December 1983, a $10 million shipment of arms was reportedly despatched from Argentina to Honduras, presumably contracted before the new Argentine authorities took office.[37]

Parallel to arms acquisitions, Honduras is also building, again with the help of the USA, a new general headquarters for the army and a new training school for the air force. The Puerto Castilla harbour, situated near the Nicaraguan border, including a training camp used by the United States to train Salvadorean soldiers,[38] is to be taken over by Honduras. Since 1979, the number of Honduran naval bases has increased from two to four or five, and the number of naval units, mainly coastal patrol boats, from 9 to about 15.[39]

Honduran troops have reinforced their presence on the Coco River, along the Nicaraguan border, and in the proximity of the Nicaraguan Miskito Indian region, ostensibly to protect the frontiers and the refugee camps. This presence has helped to provide a military shield for incursions into Nicaragua by the former Somoza guards, and an easy conduit for transfer of US weapons to these guards. Roads have been improved, especially in the border region, to enhance the mobility of the forces.[40] In August 1982, the US Air Force flew a 1 000-man Honduran battalion and its equipment to a new headquarters in Morocon, 25 km from the Nicaraguan border.[41]

Military involvement of the USA in the Honduras–Nicaragua conflict has been most strikingly manifested in the large-scale joint US-Honduran manoeuvres along the borders with Nicaragua. These manoeuvres, designated as *Big Pine* (Ahuas Tara), were held in February 1983 (*Big Pine I*) and from August 1983 to March 1984 (*Big Pine II*). An estimated 5 000 US and 6 000 Honduran troops, plus some 2 800 US Marines off the Honduran coast,[42] participated in the *Big Pine II* exercises,[43] using two US aircraft carriers, a cruiser and 17 other warships, as well as about 140 US aircraft, including C-5 Galaxy, C-130 Hercules, fighter planes such as the F-15, and helicopters.[44] The declared aim was to train the Honduran troops, to familiarize US troops with the terrain near the Nicaraguan borders, and to build an infrastructure of roads and landing strips. Follow-on manoeuvres (*Big Pine III*), the largest ever held in Central America, were to start upon the termination of *Big Pine II* manoeuvres, this time with the participation of armed forces from El Salvador and Guatemala, in addition to the US and Honduran forces.[45] Even airborne warning and control systems (AWACS) were used by the USA on missions to Central America, although observation of the limited military potential of Nicaragua and arms shipments to the region might have easily been carried out by other means.[46] Military engineers were to be sent by the USA also to Costa Rica, to build roads, bridges and airports along the frontier with Nicaragua and to provide help to Nicaraguan refugees.[47] The government of Costa Rica declined the offer and reiterated its determination to maintain neutrality in the current conflicts.[48] All these US activities in the area are obviously meant as a demonstration of force to exert pressure on, and serve as a warning to, Nicaragua. The inter-state tension created by such intimidation is fraught with serious consequences, as exemplified by the incident on 13 January 1984 when a US helicopter was forced by

Figure 14.4. Honduras and Nicaragua: a comparison of data for 1979–83



Nicaraguan forces to land near the Honduran border.[49] Since the Honduran government insists that US troops will be needed indefinitely unless the government of Nicaragua is overthrown,[50] a new form of permanent US military presence may be created in the region.

Nicaragua

The fight against the dictatorship of Somoza was more than a class struggle; virtually all sectors of Nicaraguan society had joined in an effort to bring about a change. In 1979 the anti-Somoza forces included 5 000 men of the Sandinista National Liberation Front (Frente Sandinista de Liberación Nacional, FSLN); and about 15 000 members of the 'militia',[51] a term employed in 1978–79 to designate loosely organized groups of youth (called Los Muchachos) who fought alongside the FSLN guerrillas, especially in the cities; and thousands more, organized in the Sandinista defence committees (Comités de Defensa Civil, CDC). Although the latter did not form part of the Sandinista guerrilla force, they did play an important role during the insurrection.

Against all these forces, the Somoza National Guard stood little chance of succeeding in the suppressive mission, even though its strength had increased from an estimated 8 000 in 1978 to over 15 000 in the days preceding the fall of the dictatorship.[52] After the defeat, 5 000 to 7 000 guardsmen were arrested, of whom almost all were later released,[53] while the rest fled to neighbouring countries and the USA.

The civil war, which culminated in the change of government, inflicted widespread damage on the economy of Nicaragua. About $500 million in industrial plants, equipment and material were lost. Damage to the social and physical infrastructure—housing, hospitals, transportation and communications—amounted to $80 million.[54] Economic activity, as measured by the GDP, fell by 26 per cent during 1979.[55] The external debt was $1 400 million, an equivalent of 96 per cent of the GDP,[56] while the rate of inflation rose to almost 50 per cent by the end of 1979. The flight of capital may have exceeded $1 500 million, while foreign reserves were a mere $3.5 million when the Sandinista government came to power in mid-1979.[57]

The reorganization of the economy led to a 10 per cent recovery in GDP in 1980, and to 9 per cent a year later.[58] However, as of mid-1982, the country ran out of hard currency reserves, and its GDP declined. The external public debt was estimated at $2 400 million at the end of 1982, and the debt service in the same year represented 40 per cent of exports of goods and services. Statistics for 1983 indicated a slight increase in the GDP, with the possibility of a modest growth in 1984–86.[59]

In addition, after the revolution Nicaragua was faced with enormous outside pressure of a political, economic and military nature—pressure that was soon compounded by new internal opposition. A state of national emergency was proclaimed and constitutional rights were suspended. All this contributed to a speedy militarization of the country.

Few reliable data are available on the present defence costs of Nicaragua and the strength of its armed forces. This is due in great part to the secretiveness of the Nicaraguan institutions.[60] Nevertheless, it is obvious that since the end of 1982 Nicaragua has been running a 'war economy', diverting its productive resources to defence.[61] According to some reports, military spending represents 20 to 25 per cent of the budget.[62]

Depending on the sources used, estimates of the Nicaraguan military personnel (Ejército Popular Sandinista, EPS) for 1983 varied from 22 000 to 25 000 men, supported by a militia of 50 000 to 200 000.[63] According to the chief of staff of the Nicaraguan regular army, Joaquín Cuadra, Nicaraguan armed forces have grown "four times as big and eight times as strong" as Somoza's National Guard.[64] Following the 1983 invasion of Grenada, and also in response to the military manoeuvres conducted by the USA jointly with Honduras on the Nicaraguan border, the Nicaraguan government mobilized an additional reserve force and stepped up its military preparedness.[65] Thirty per cent of the work force is involved in civil defence projects, including construction of bomb shelters and trenches.[66] In contrast to most other Latin American countries, the Nicaraguan armed forces include a high proportion of women—about 25 per cent—of whom some have senior and combat-related positions.[67] Women also make up a significant percentage of the militia.[68]

Nicaragua justifies the high degree of its militarization by the fact that it is exposed to continuous attacks along its borders, which are long and difficult to patrol because of dense jungles and mountainous terrain. An anti-Sandinista force of some 8 000 to 10 000 men is stationed in camps in Honduras, organized in the so-called Nicaraguan Democratic Front (Fuerza Democrática Nicaraguense, FDN). They are well trained, are equipped as regular infantry, and use US grenade launchers, US 30-mm machine-guns, sophisticated US light anti-tank weapons and bazookas, as well as Belgian-made FAL automatic rifles and US-made M16 rifles and helicopters.[69] Their raids are intended, among other things, to destroy the economic infrastructure of Nicaragua and they have already seriously destabilized the economy of the country.

The second important front of guerrillas fighting the Nicaraguan government is located in Costa Rica (as well as in El Salvador). The so-called Democratic Revolutionary Alliance (Alianza Revolucionaria Democrática, ARDE) led by Eden Pastora, a former Sandinista leader, is composed primarily of people who were formerly allied with the Sandinista movement. They number about 2 000–3 000 men[70] and are armed with light artillery weapons, small aircraft and small weapons of US and Israeli origin.[71] ARDE's attacks on Nicaraguan fuel storage facilities and other important targets have inflicted significant damage. The Nicaraguan government requested additional weapons from friendly countries to defend Nicaragua's shores and airspace.[72]

The 'Patriotic Military Service' law, adopted in 1983 to introduce two-year compulsory military service for all Nicaraguans between the ages of 18 and 40 years,[73] reflected an increased national security concern of the Nicaraguan government, especially with regard to US policy in the region. Indeed, since 1909 the United States has intervened militarily in Nicaragua on three occasions and interfered both economically and politically on many other occasions.[74] Nicaragua continues to live in fear of a new invasion; air raid shelters are ready in many backyards, trenches ring factories, and teachers urge children to be prepared to flee their homes at short notice.[75] As stated by the US Ambassador to Costa Rica in November 1983, a new invasion of Nicaragua "is not impossible", because the USA cannot tolerate a "subversive Marxist–Leninist régime in the region".[76] Nicaragua's hostile neighbours have denounced the Nicaraguan law on military service as further evidence of militarization. In fact, up to the end of 1983, there had been no law imposing compulsory military service in El Salvador, Guatemala or Honduras, but all three regimes had practised forced recruitment, mainly in the poverty stricken rural areas.[77] In February 1984, conscription was introduced in Honduras.[78]

Nicaragua's military equipment is a heterogeneous mix of weapon remnants of Somoza's National Guard, of FSLN light weapons acquired in the pre-1979 period of fighting, and of post-1979 acquisitions. The major logistical problems involved in maintaining this inventory stem from its diversity, the lack of trained operators and engineers, and the cut-off of US spare parts for weapons.[79]

The National Guard inventory was itself a mix of US and European weapons. US weapons such as M-4 tanks, scout cars, howitzers and B-26 bombers were of World War II or Korean War vintage, although some more recent weapons, such as light fixed-wing aircraft and helicopters, were acquired. As relations between the Somoza regime and the US Administration grew more strained, Somoza turned to other sources, including Israel (for aircraft and small arms) and the UK (for armoured cars).[80]

FSLN weapons used during the insurrection were also varied. Apart from arms captured from the Guard, they originated from the international arms markets and from sympathetic Latin American governments. After the victory, the Sandinistas were successful in retrieving several aircraft (military and civilian) from Honduras, as well as two patrol boats from the Colombian island of San Andrés.

According to its early announcements, the Sandinista government was interested in obtaining US military assistance, but its chances were even at that time practically non-existent, especially because of the close links established between the Sandinistas and the Cuban government. When attempts to smuggle weapons out of the USA also failed,[81] Nicaraguan authorities turned to other countries for arms. Some newly imported military equipment could already be seen during the July 1980 celebrations in Managua, in particular military W-50 trucks from the German Democratic Republic, as well as light anti-aircraft ZPU guns, SA-7 surface-to-air missile launchers and RPG-7 anti-tank grenades from the Soviet Union.[82]

Large transfers of weapons, from mid-1981, led to a US claim that Nicaragua had acquired an offensive military capability. In this context, reference was made to an estimated 25–50 Soviet-made T-54 and T-55 tanks which, indeed, were the first heavy tanks in Central America.[83] The main armament of these tanks consists of a 100-mm gun, a 7.62-mm machine-gun and a 12.7-mm anti-aircraft machine-gun; their maximum road speed is 48–50 km/h.[84] However, as suggested by a US expert, the rugged topography of the region and logistical problems make the T-54s and T-55s "less than an imposing piece of armour".[85] In fact, the land in Honduras rises to over 2 000 metres near the capital, and to 2 700 metres in the western part of the country. The only route the tanks could realistically use in an attack on Honduras would be the Pan American Highway, which in some sections has a gradient too steep for the T-54s and T-55s and on which a tank would be an easy target for the air force.[86]

Nicaragua also has 12 BTR-60 Soviet-made armoured personnel carriers which could accompany their tanks, but these can carry only two crewmen and eight troops.[87] Three US-made M-4A3 tanks and 20 UK-made Staghound armoured personnel carriers, the operational status of which is in doubt, are relics from the Somoza regime.[88] The Sandinistas have received military trucks from the Soviet bloc (about 800, according to US official sources) and from France, but the vehicles lack firepower.[89]

Since 1981 Nicaragua has obtained a considerable number of missiles, rockets, rocket launchers, anti-aircraft guns and howitzers. These weapons include unknown quantities of Soviet-made AT-1 Snapper and AT-3 Sagger surface-to-surface guided anti-tank missiles,[90] which can be mounted on the Soviet-made BTR-60 armoured personnel vehicles possessed by Nicaragua;[91] SA-6 Gainful surface-to-air anti-aircraft guided missiles; SA-7 Grail man-portable infra-red homing light anti-aircraft missiles;[92] 12 BM-21 122-mm artillery rocket launchers;[93] several D-20 152-mm gun howitzers; 24 120-mm mortars; and 48 ZSU-2 57-mm anti-aircraft guns, all Soviet-made. Shipments of Soviet arms to Nicaragua are estimated by the US Administration to have reached 11 000 tons in 1983, doubling the amount delivered in the previous year.[94]

In a controversial deal in 1981, which caused US "disappointment and concern",[95] France provided Nicaragua with 7 000 SS-11 surface-to-surface tactical guided missiles and SS-12 surface-to-surface anti-tank guided missiles.[96]

The Nicaraguan Air Force has about 16 aircraft, including four transport planes (one C212A from Spain, one Arava from Israel, and two C-47s from the USA); several training aeroplanes, including two or three T-33As and three T-28Ds, all US-made (nearly obsolescent and in need of spare parts); and three or four helicopters from France and at least six from the USSR.[97] In 1982, some 50–70 Nicaraguan military personnel were sent to Bulgaria to be trained as jet pilots, and the runways of at least three Nicaraguan airports have been extended to accommodate advanced Soviet-made fighter aircraft.[98]

The Nicaraguan Navy has four Dabur Class Soviet-built patrol boats and eight other light coastal patrol boats. Moreover, Nicaragua commissioned two French-built patrol boats in 1982, as part of the arms deal signed between both countries a year before.[99] The two new boats, with a crew of 20 men each, will have a speed of up to 28 knots and will be armed with two 20-mm guns. The importance of the naval forces was emphasized at the end of 1983 in the clashes between Nicaragua and Honduras on the

Atlantic coast and in a commando raid against a Nicaraguan diesel fuel installation at Corinto, a port on Nicaragua's Pacific coast, by Honduras-based rebels using small fast boats.[100]

Honduran sources reported that from 1979 to 1983, close to 30 new military installations had been built in Nicaragua, with Cuban–Soviet advisory assistance, to house military personnel and heavy equipment for transportation and logistic supplies.[101] According to US intelligence sources, an estimated 15 000 tons of east European arms and equipment reached the Sandinista army in 1983.[102] In April 1983, four Libyan planes, loaded with explosives, ammunition and weapons (instead of medical supplies as stated in the request for permission to land), were seized in Brazil on the way to Nicaragua.[103]

An issue which remains a point of friction between Nicaragua and its neighbours and the USA is the question of foreign military and security advisers in Nicaragua. US officials claim that there are no fewer than 2 000 Cuban military advisers, as well as several hundred Soviet, east European, Libyan and PLO (Palestine Liberation Organization) advisers, in Nicaragua.[104]

The Nicaraguan authorities admitted to having no more than 200 Cuban military advisers, stating that the remaining Cubans were teachers, medical personnel or civilian technicians.[105]

By way of comparison, the strength of US military personnel in Central America at the end of 1983 was, according to US official figures, about 14 568, broken down as follows:[106] Costa Rica, 12; El Salvador, 96; Guatemala, 23; Honduras, 255 plus 5 000 stationed in the country during the *Big Pine II* military manoeuvres; and Panama (the Canal Zone), 9 182.

In November 1983 the Nicaraguan government announced that it was prepared to send all foreign advisers home and stop buying arms if other Central American countries did the same.[107]

IV. Armed attacks

Ever since the Sandinistas came to power, tension between Honduras and Nicaragua has been high along their 700-km border. Each side has been accusing the other of supporting anti-government forces. There have been frequent clashes, including naval incidents and aircraft strafings. Each nation has concentrated about 5 000 troops in the border area.[108]

Against Nicaragua

The insurgents based in Honduras and in Costa Rica have been conducting hit-and-run raids against important targets in Nicaragua, in order to establish their presence on Nicaraguan territory and to prepare ground for the proclamation of a 'liberated zone'. In December 1983 the leaders of the FND stated that they had established a civilian and military command controlling some 8 000 km^2 of Nicaraguan territory and were planning to install a provisional government there.[109]

Across-the-border incidents between Nicaragua and Honduras and between Nicaragua and Costa Rica have been basically of two kinds: (*a*) attacks against civilians and sabotage actions by small groups, armed with light weapons and explosives, against military and civilian outposts, as well as against infrastructure facilities (bridges, communications lines, etc.); and (*b*) overflights by unmarked aircraft for reconnaissance and supply purposes.

There have been reports of over 400 attacks on Nicaraguan territory from Honduras in the period from 1981 to 1983.[110] During the same period, according to official Nicaraguan reports, US naval vessels violated Nicaraguan territorial waters on 34 occasions. Similar violations were committed 24 times by Honduras and 31 times by Costa Rica.[111] Forty cases of violation of Nicaraguan airspace by RC-135 aircraft of the US Air Force were reported from June 1981 to March 1982. The flights were carried out over the Pacific coast of Nicaragua and along its borders with Honduras and Costa Rica.[112] From March to August 1982, Nicaragua reported 38 new incursions by anti-Sandinista groups from Honduran territory, 36 attacks on its border posts, and 75 violations of Nicaraguan airspace, of which 29 were committed by the US Air Force. In 1983, Nicaragua reported 200 US reconnaissance flights over the country.[113]

Human losses were important. From December 1982 to November 1983, 786 Nicaraguans were killed, including civilians and members of the Sandinista armed forces; 529 workers, students and technicians were kidnapped; and 715 people were wounded. During the same period, the Nicaraguan armed forces killed 1 765 insurgents and wounded 280.[114]

The material damage suffered by Nicaragua is considerable. For example, during the first 10 months of 1983, the destruction of ports, production facilities and construction equipment, as well as of health centres, schools and day-care centres, represented a total of $108.5 million. This is equal to 3.5 per cent of Nicaragua's GNP for 1982, and almost one-quarter of the Nicaraguan annual investment, or five times more than Nicaragua had received in international donations for national reconstruction from 1979 until October 1983.[115]

During the first eight months of 1983, over $25 million worth of losses were suffered by the agricultural sector of Nicaragua. Another $20 million was lost in wood production by virtue of some 40 000 hectares of pine trees burnt down.[116] In the first week of October 1983, the Nicaraguan harbour of Corinto was attacked, and the storage tanks for petroleum and petroleum products were totally destroyed; the damage amounted to about $47 million. In addition, damage valued at $13.8 million was inflicted upon the liquid gas pumping system, the control tower for the port's container crane, docks, warehouses, and export and import products.[117] Other major acts of sabotage carried out by the anti-Sandinista forces included the bombing of Managua International Airport, of the customs and immigration installations at El Espino on the Honduran border and of the village of Peñas Blancas on the Costa Rican border. An important electric power transmission tower and telecommunications centres have also been destroyed.[118]

At the beginning of February 1984, Nicaragua complained to the UN Security Council that six A-37 aircraft flying from Honduras had bombed an oil storage and communications facilities in the western part of the country, causing the death of three Nicaraguan soldiers and wounding another three. The incident was considered by the Nicaraguan government as sufficiently grave to justify suspension of the preparations for national elections. (The suspension was lifted a few days later.) In February–March 1984, the main ports of Nicaragua were attacked by anti-Sandinista guerrillas in an attempt to cut off the country's supplies from the outside world. At El Bluff, a major port on the Atlantic coast, mines blew up two Nicaraguan fishing boats, and in the port of Sandino a Soviet tanker was damaged by a mine. In attacks on the Pacific port of Corinto, a freighter with a cargo of machinery was severely damaged and a Dutch dredger was holed. Motor launches and a helicopter gunship destroyed installations in the harbour of San Juan del Sur.[119]

Against Honduras

According to official Honduran reports, the Sandinista regime has been behind about 200 attacks and violations of the Honduran territory, airspace and seaspace since 1979. Unarmed civilians and soldiers were killed or wounded in these incidents. In both the Pacific and Atlantic territorial waters, the Sandinistas attacked Honduran fishing vessels with artillery fire and seized their crews.[120] Moreover, since June 1983, again according to Honduran sources, the Sandinistas have escalated their activities and deployed a total of 29 battalions along a 250-km border.[121]

Honduras accused the Sandinista government of engaging, since 1980, in arms traffic from Nicaragua to other countries in the region, in particular to El Salvador. On 17 January 1981, troops of the Honduran Army and of the Public Security Force confiscated a large shipment of arms and military supplies some 16 km from the city of Comayagua. The arms were concealed in a van-type vehicle that entered Honduran territory from Nicaragua and were assumed to be destined for the Salvadorean guerrillas. The items seized included M16, G-3 and FAL rifles, 50-mm machine-guns, Chinese RPG rockets, 81-mm mortars, ammunition, communications equipment and medicines. Five Hondurans and 12 Salvadoreans involved in this operation were captured.

Allegedly, Honduran territory was often used also to transfer armed units from Nicaragua to El Salvador. On 26 March 1983 a group of guerrillas crossing the territory of Honduras, on the way from Nicaragua to El Salvador, was stopped by a Honduran patrol in the south of the country. Two guerrillas were killed in the clash with the patrol; the equipment confiscated included M16 rifles, a Czech 7.65-mm machine-gun, ammunition, a portable two-way radio, as well as notebooks with information on the general route used to move military personnel and weapons through Honduras to El Salvador.[122]

Honduras reported to the UN Security Council that, from January 1982 to November 1983, members of the Sandinista armed forces had violated its territory, territorial waters and airspace 78 times, and perpetrated harassment, abductions, attacks and assaults on Honduran citizens.[123]

Moreover, Nicaragua was accused of being behind such terrorist acts as blowing up two electric power plants, which left 80 per cent of the Honduran capital without energy; detonating bombs in the offices of foreign airlines in Tegucigalpa; and placing explosive charges in the offices of the Honduran airline SAHSA in San José, Costa Rica and in Guatemala City.[124]

V. Peaceful endeavours

At different times since 1980, Honduras, Nicaragua and certain other states, directly or indirectly involved, have formulated proposals for a peaceful settlement of the conflict between these two countries. However, none of these proposals became the basis for actual negotiations. Neither the United Nations nor the Organization of the American States (OAS) could break the deadlock. All efforts to establish a direct dialogue between the hostile parties also failed. It was only a group of Latin American countries—Colombia, Mexico, Panama and Venezuela—having an acute interest in removing the source of disturbance in the region that proved capable of setting in motion a process of meaningful transactions.

This so-called Contadora Group, which took its name from the Panamanian island where it first met in January 1983, succeeded in arranging joint meetings with all the five states of the Central American isthmus, with a view to halting the spread of hostilities and establishing conditions for security in the region. The Group helped to reduce tension between Costa Rica and Nicaragua through setting up an international observer commission to guard against border violations. The good offices of the Contadora states received formal recognition and 'blessing' from the United Nations in May 1983, when in resolution 530 (adopted unanimously) the UN Security Council commended its efforts and urged it to keep the Council informed of its work. The interested states were asked to co-operate with the Group "through a frank and constructive dialogue".[125] In November 1983, the OAS expressed unanimous support for the Contadora Group and asked it to persevere in its efforts (appendix 14C). Subsequently, in February 1984, the heads of state of seven Latin American countries (Argentina, Bolivia, Colombia, Costa Rica, the Dominican Republic, Nicaragua and Panama), as well as the Prime Minister of Spain, signed the Declaration of Caracas fully supporting the efforts of the Contadora Group.[126]

In July 1983 the presidents of the countries members of the Contadora Group adopted the Cancún Declaration on Peace in Central America. The declaration drew up the general lines of a programme to be proposed to the countries of Central America. It required the conclusion of agreements leading to effective control of the arms race, elimination of foreign advisers, creation of demilitarized zones, prohibition of the use of the territory of some states for political and military destabilizing actions in other states, elimination of transit of and traffic in arms, and prohibition of other forms of aggression or interference in the internal affairs of any country in the area.

The envisaged agreements would include, among other obligations, commitments to put an end to all situations of belligerence; to freeze offensive weapons at their current levels; to negotiate the reduction of existing stocks of weapons and the establishment for that purpose of an appropriate supervisory machinery; to prohibit military installations belonging to other countries on their territories; to give prior notice of troop movements near the frontiers; to organize joint or international supervision of frontiers by groups of observers; to establish mixed security commissions with a view to preventing and resolving border incidents; to establish a national control machinery with a view to preventing the transit of weapons from the territory of any country in the region to the territory of another; to promote a climate of detente and confidence in the area; and to maintain systems of direct communications between governments with a view to preventing armed conflicts.[127]

Following the Cancún Declaration and in conformity with its framework, Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua agreed in September 1983 on a Document of Objectives, which contains the basic elements of future undertakings to achieve security, peaceful co-existence and co-operation. Among the objectives sought by the five states, the following are directly related to the current armed conflicts:

1. To stop the arms race in all its forms and begin negotiations for the limitation and reduction of the stocks of weapons and of the number of troops.

2. To prevent the installation of foreign military bases or any other type of foreign military interference.

3. To conclude agreements for the reduction of the presence of foreign military advisers and other foreign elements involved in military and security activities, with a view to their elimination.

4. To establish national control mechanisms to prevent the traffic in arms from the territory of any country in the region to the territory of another.

5. To eliminate such traffic in arms (whether within the region or from the outside) which is intended for persons, organizations or groups seeking to destabilize the governments of Central American countries.

6. To prevent the use of national territory by persons, organizations or groups seeking to destabilize the governments of Central American countries, and not to provide them with, or permit them to receive, military or logistical support.

7. To refrain from inciting or supporting acts of terrorism, subversion or sabotage in the countries in the area.

8. To establish and co-ordinate direct communications systems with a view to preventing or, where appropriate, settling incidents between states of the region.

Among the political objectives specified in the Document, the most significant are: (*a*) to adopt measures conducive to the establishment and, where appropriate, improvement of representative and pluralistic systems that will guarantee effective popular participation in the political decision-making process; and (*b*) to promote efforts for national reconciliation, wherever divisions have taken place within society, with a view to fostering full participation in democratic political processes in accordance with the law.[128]

The mediation attempts of the Contadora Group were subsequently slowed down by new points raised by Honduras, in particular those related to the proclaimed need to restrict the arms traffic in the region, remove foreign military advisers and introduce political reforms. El Salvador appeared reluctant to hold supervised elections open to all parties, while Guatemala did not seem inclined to sign an agreement which would commit it to carry out significant domestic reforms.[129] On the other hand, Nicaragua, yielding to outside pressures, decided to ease the censorship of its press, offer amnesty to disaffected Miskito Indians and invite exiles to return.[130] In November 1983, 2 000 or more Cuban civilian and military advisers left Nicaragua.[131] The Nicaraguan government undertook preparations for national elections to be held in November 1984.[132]

In October 1983 Nicaragua made public the text of draft treaties between itself and the United States, as well as between itself and Honduras. It also published proposals for a peaceful solution to the conflict in El Salvador and for a general agreement on peace and security among the republics of Central America. The "draft treaty of peace, friendship and co-operation" between Honduras and Nicaragua provides, among other things, for an undertaking by the parties not to give political, military, economic or any other kind of support to individuals or groups that advocate the overthrow or the destabilization of the government of the other side, as well as to impede the use of their territories for attacks, sabotage, kidnappings or criminal acts on the territory of the other state. All traffic in arms and war material that might be used against the other side would be similarly prohibited. The Contadora countries were to be asked to act as guarantors of the treaty.[133] However, a high US official was reported to have immediately stated that no such proposals were acceptable, because the USA cannot "coexist" with the Nicaraguan revolution.[134] Subsequently, the anti-Sandinista guerrilla proposed, with the support of the USA, direct negotiations with the Nicaraguan government for a political settlement of the crisis. In turn, this proposal was promptly rejected by the Sandinistas who refused to enter into a discussion with "traitors and assassins".[135]

On 7–8 January 1984, the foreign ministers of the Contadora Group held a joint meeting in Panama with the foreign ministers of the five Central American republics and agreed on "Measures to be taken to fulfil the commitments entered into in the Document of Objectives" (appendix 14D).

The measures in the field of security provide for the establishment, by 30 April 1984, of an inventory of arms, military installations and military personnel for each country in the area; a census of foreign military advisers and other foreigners participating in military and security-related activities, with a view to their reduction and eventual elimination; identification and abolishment of all support to "irregular forces" engaged in destabilization actions against Central American governments; identification of areas, routes and means used in the illegal traffic in arms, with a view to stopping it; and the setting in motion of a machinery for direct communications among the states in the region.

Of the political measures agreed upon, the following deserve special attention: the promotion of an internal dialogue in the states concerned, with a view to reaching national reconciliation, guaranteeing respect for human rights in accordance with international legal obligations, and carrying out democratic elections with effective popular participation.

The measures in the socio-economic area call for assistance to refugees, co-operation with Latin American financial and economic institutions, and promotion of projects for economic integration.

Three special commissions are to carry these undertakings into effect.[136] All these 'measures' are an expression of intent: they lack the force of a legal commitment. But even as a purely declaratory document, they appear to be considerably less preemptory than the Cancún Declaration or the Document of Objectives. Instead of including concrete provisions, as was expected, for halting the arms build-up in Central America, removing or substantially reducing foreign military presence, and stopping subversive activities against governments in power, they merely call for identification of the issues. The solution of these issues is dependent on further consideration and therefore remains uncertain.

Whatever its weaknesses, the agreement reached by the states concerned is a positive step in the direction of a peaceful settlement of the Central American crisis. The same cannot be said of the report by the US National Bipartisan Commission on Central America, the Kissinger Report, which was submitted a few days after the Contadora 'measures'. Mere economic aid, as proposed in the Report, even if provided on a massive scale, would not suffice, as exemplified by the fate of the 1961 US-launched Alliance for Progress for Latin America. In most cases it would simply benefit the local elites. Moreover, the Report postulates a programme of considerably increased military assistance to selected Central American countries, especially to El Salvador and Honduras (even though it makes such assistance conditional on progress towards democratic pluralism and respect for human rights).[137] In the light of these proposals, the Kissinger Commission's statement that it "fully" endorsed the Contadora Group's efforts appears unconvincing. The majority of the Commission opposed dismantling existing pressures on the Nicaraguan regime, thereby implicitly supporting continued US covert actions against that regime.

VI. Conclusions and recommendations

The roots of most conflicts in Central America lie in the underdevelopment and poverty of the countries as well as in the autocratic, unjust social and political systems. In such conditions, insurgencies culminating in revolutions are to be expected. External interference, which is common in this part of the world, aggravates and inflames the internal strife, leading to inter-state conflicts. As a result, the countries in turmoil readily become pawns in the superpower contest for world-wide influence. This is exemplified by the Honduras–Nicaragua conflict, which is damaging to the interests of the whole region. The main losers are the local populations, who continue to live in a wartime economy and to suffer endless tragedies. The principal victim of this conflict is Nicaragua, which is prevented from setting right the political, economic and social wrongs inflicted by decades of tyrannical dictatorship.

Neither the United States nor the Organization of American States has proved helpful in putting an end to the Honduras–Nicaragua confrontation. Indeed, the participation and the dominant position of the superpowers in these organizations render such help unlikely. Only a grouping of states which genuinely represents the interests of the region and is free of superpower interference, such as Contadora, could succeed in mitigating the dangers and reducing the risks of open hostilities. The Contadora Group carries a potential for even wider subregional co-operation in seeking stability in the face of attempts by powers outside the area to exercise pressure.

The Contadora proposals for solving the problems of the troubled Central American isthmus are comprehensive and reasonable. However, prompt and full implementation of these proposals seems unlikely in view of the known position of the United States, one of the main actors in the Central American crisis, as reflected in the Kissinger Report welcomed by the White House. For the USA continues to consider the area in question to be of critical importance for its security, and has not abandoned plans for restoring the *status quo ante* 1979. Therefore, it is not at all certain that the United States will accept the legitimation of the Sandinista regime, even through unquestionably free elections (and it is equally uncertain whether the Sandinistas would put up with an electoral defeat).

Nevertheless, a series of well-considered confidence-building measures in the military field, some of which were already envisaged by the Contadora Group, could perhaps pave the way towards realization of the Contadora goals. Such measures might include limitation of military manoeuvres and prohibition of troop concentrations in border areas; exchange of information on military spending, as well as on military manpower and equipment; co-ordination of programmes for arms acquisitions; exchange of military missions and observers; establishment of joint, third-party or international supervision of the disputed and troubled areas; and improvement of direct communications between the governments and military staffs.[138]

Once carried into effect, confidence-building measures of this type may well facilitate actual arms control. A possible agreement to this effect could build upon the 1923 Convention on the limitation of armaments of Central American states, which was ratified by Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua.[139]

It is clear that, for meaningful arms limitations in Central America to be carried into effect and to endure, far-reaching domestic reforms are needed in the political, economic and social fields. But the essential prerequisite for peace in the region is that outside powers should abstain from intruding and exploiting the situation there for their own political, economic and military purposes. It is preposterous to maintain that a change of regime in one or another Central American republic could, in itself, endanger the security of a great power or even threaten the strategic balance in the world. In the long run, even outsiders not directly affected by continuous warfare in Central America would profit from a durable peace in this region.

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Appendix 14A

UN Security Council resolution 530, 19 May 1983

The Security Council,

Having heard the statement of the Foreign Minister of the Republic of Nicaragua,

Having also heard the statements of various States Members of the United Nations in the course of the debate,

Deeply concerned, on the one hand, at the situation prevailing on and inside the northern border of Nicaragua and, on the other hand, at the consequent danger of a military confrontation between Honduras and Nicaragua, which could further aggravate the existing crisis situation in Central America,

Recalling all the relevant principles of the Charter of the United Nations, particularly the obligation of States to settle their disputes exclusively by peaceful means, not to resort to the threat or use of force and to respect the self-determination of peoples and the sovereign independence of all States,

Noting the widespread desire expressed by the States concerned to achieve solutions to the differences between them,

Commending the appeal of the Contadora group of countries, Colombia, Mexico, Panama and Venezuela, in its 12 May 1983 communiqué (S/15762) that the deliberations of the Council should strengthen the principles of self-determination and non-interference in the affairs of other States, the obligation not to allow the territory of a State to be used for committing acts of aggression against other States, the peaceful settlement of disputes and the prohibition of the threat or use of force to resolve conflict,

Considering the broad support expressed for the efforts of the Contadora Group to achieve solutions to the problems that affect Central American countries and to secure a stable and lasting peace in the region,

1. *Reaffirms* the right of Nicaragua and of all the other countries of the area to live in peace and security, free from outside interference;
2. *Commends* the efforts of the Contadora Group and urges the pursuit of those efforts;
3. *Appeals* urgently to the interested States to co-operate fully with the Contadora Group, through a frank and constructive dialogue, so as to resolve their differences;
4. *Urges* the Contadora Group to spare no effort to find solutions to the problem of the region and to keep the Security Council informed of the results of these efforts;
5. *Requests* the Secretary-General to keep the Security Council informed of the development of the situation and of the implementation of the present resolution.

Source: UN document S/RES/530 (1983), 19 May 1983.

Appendix 14B

UN General Assembly resolution 38/10, 11 November 1983

The General Assembly,

Recalling Security Council resolution 530 (1983) of 19 May 1983 in which the Council encouraged the efforts of the Contadora Group and appealed urgently to all interested States in and outside the region to co-operate fully with the Group, through a frank and constructive dialogue, so as to resolve their differences,

Reaffirming the purposes and principles of the Charter of the United Nations relating to the duty of all States to refrain from the threat or use of force against the sovereignty, territorial integrity or political independence of any State,

Also reaffirming the inalienable right of all peoples to decide on their own form of government and to choose their own economic, political and social system free from all foreign intervention, coercion or limitation,

Considering that the internal conflicts in the countries of Central America stem from the economic, political and social conditions obtaining in each of those countries and that they should not, therefore, be placed in the context of East–West confrontation,

Deeply concerned at the worsening of tensions and conflicts in Central America and the increase in outside interference and acts of aggression against the countries of the region, which endanger international peace and security,

Mindful of the necessity of promoting the achievement of peace on a sound basis, which would make possible a genuine democratic process, respect for human rights, and economic and social development,

Noting with deep concern that in recent weeks armed incidents, border clashes, acts of terrorism and sabotage, traffic in arms and destabilizing actions in and against countries of the region have increased in number and intensity,

Noting with great concern the military presence of countries from outside the region, the carrying out of overt and covert actions, and the use of neighbouring territories to engage in destabilizing actions, which have served to heighten tensions in the region,

Deeply concerned at the prolongation of the armed conflict in countries of Central America, which has been aggravated by increasing foreign intervention,

Bearing in mind the progress achieved in the meetings that the Ministers for Foreign Affairs of the Contadora Group have held with the Foreign Ministers of Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua in identifying issues of concern and proposing appropriate procedures for the consideration of those issues,

Recalling the Cancún Declaration on Peace in Central America issued by the Presidents of Colombia, Mexico, Panama and Venezuela on 17 July 1983, which contains an appeal for political commitments on the part of countries situated in and outside the region with the aim of achieving lasting peace in the area,

Bearing in mind the Cancún Declaration and the endorsement by the States of Central America of a Document of Objectives, which provides a basis for an agreement on the negotiations, that should be initiated at the earliest possible date with the aim of drawing up agreements and adopting the necessary procedures for formalizing the commitments and ensuring appropriate systems of control and verification,

Appreciating the broad international support expressed for the efforts of the Contadora Group to secure a peaceful and negotiated settlement of the conflicts affecting the region,

1. *Reaffirms* the right of all the countries of the region to live in peace and to decide their own future, free from all outside interference or intervention, whatever pretext may be adduced or whatever the circumstances in which they may be committed;

2. *Affirms* that respect for the sovereignty and independence of all States of the region is essential to ensure the security and peaceful coexistence of the Central American States;

3. *Condemns* the acts of aggression against the sovereignty, independence and territorial integrity of the States of the region, which have caused losses in human life and irreparable damage to their economies, thereby preventing them from meeting the economic and social development needs of their peoples; especially serious in this context are:

(a) The attacks launched from outside Nicaragua against that country's strategic installations, such as airports and seaports, energy storage facilities and other targets whose destruction seriously affects the country's economic life and endangers densely populated areas;

(b) The continued losses in human life in El Salvador and Honduras, the destruction of important public works and losses in production;

(c) The increase in the number of refugees in several countries of the region;

4. *Urges* the States of the region and other States to desist from, or to refrain from initiating, military operations intended to exert political pressure, which aggravate the situation in the region and hamper the efforts to promote negotiations that the Contadora Group is undertaking with the agreement of the Governments of Central America;

5. *Notes with satisfaction* that the countries of the region have agreed to take measures leading to the establishment and, where appropriate, the improvement of democratic, respresentative and pluralistic systems which will guarantee effective popular participation in decision-making and ensure the free access of various currents of opinion to honest and periodic electoral processes based on the full observance of civil rights, emphasizing that the strengthening of democratic institutions is closely linked to evolution and advances achieved in the sphere of economic development and social justice;

6. *Expresses its firmest support* for the Contadora Group and urges it to persevere in its efforts, which enjoy the effective support of the international community and the forthright co-operation of the interested countries in or outside the region;

7. *Welcomes with satisfaction* the Cancún Declaration of the Presidents of Colombia, Mexico, Panama and Venezuela and the Document of Objectives endorsed by the Governments of Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua, which contains the basis for the start of negotiations to ensure harmonious coexistence in Central America;

8. *Requests* the Secretary-General, in pursuance of Security Council resolution 530 (1983), to keep the Council regularly informed of the development of the situation and of the implementation of that resolution;

9. *Requests* the Secretary-General to submit a report to the General Assembly at its thirty-ninth session on the implementation of the present resolution;

10. *Decides* to keep under review the situation in Central America, threats to security which may occur in the region and the progress of peace initiatives.

Source: UN document A/RES/38/10, 21 November 1983.

Appendix 14C

OAS General Assembly resolution, 17 November 1983

The General Assembly,

Having seen the communication presented by the Ministers of Foreign Affairs of Colombia, Mexico, Panama, and Venezuela to this Assembly on the peace efforts they are making in Central America;

Noting the Declaration signed by the Presidents of Colombia, Mexico, Panama and Venezuela at Cancún, Mexico, on July 17, 1983;

Commending the Document of Objectives adopted last September under the auspices of the Contadora Group, by Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua;

Cognizant that the Document of Objectives contains a set of principles for addressing the most serious problems of the area and achieving peace, security, and the cooperation needed for the region's economic and social development;

Considering that the Contadora Group is engaged in a worthy effort aimed at achieving peaceful relations in the region, based on the creation and strengthening of a climate of international security in keeping with the principles established in international law, of democratic and pluralistic institutions, and of sustained economic and social development activities,

Resolves:

1. To reaffirm the importance of the principles and rules of American comity contained in the Charter of the Organization of American States, and particularly the obligation to settle disputes by peaceful procedures alone, to abstain from the use of force, not to interfere either directly or indirectly or for whatever reason in the internal or external affairs of any other state, and to respect the right of each state to lead its own cultural, political and economic life freely and spontaneously.

2. To reaffirm the right of all countries in the region to live in peace and security, free from any external interference.

3. To express its firmest support for the efforts of the Contadora Group and to urge it to persevere in its efforts.

4. To welcome with satisfaction the Declaration of Cancún on Peace in Central America issued by Presidents Belisario Betancur of Colombia, Miguel de la Madrid of Mexico, Ricardo de la Espriella of Panama, and Luis Herrera Campins of Venezuela.

5. To note with approval the adoption of the Document of Objectives approved by the Central American States at the proposal of the Contadora Group, which contains a set of basic principles and commitments to be negotiated for addressing the conflicts in the area and achieving peace, international security, democracy and the cooperation needed for the region's economic and social development.

6. To urge the Central American states to negotiate forthwith, on the basis of the principles enunciated in the Document of Objectives, agreements that will formalize the objectives arising from those documents, and devise monitoring and verification mechanisms that will secure their fulfillment.

7. To request all the states to abstain from any act that may heighten tensions, hamper the negotiation efforts the Contadora Group is making in mutual agreement with the Central American Governments, or impede the creation of a climate of dialogue and negotiation conducive to the restoration of peace in the region.

Source: OAS document OEA/Ser.P/AG/doc.1707/83, 17 November 1983.

Appendix 14D

Communiqué of the meeting between the Ministers of the Contadora Group and the Ministers of the Central American countries

On 7 and 8 January 1984, the Foreign Ministers of Colombia, Mexico, Panama and Venezuela, members of the Contadora Group, met with the Foreign Ministers of Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua at Panama City, Republic of Panama.

The meeting, which was the twelfth meeting of the Contadora Group and the fifth held with the Foreign Ministers of Central American States, marked the end of the one-year period which has elapsed since the Contadora Declaration initiated the regional peace-making process. The participants stressed the fundamental role played by the Contadora process in strengthening the dialogue between the States of Central America and in the quest for a political entente in order to reach peaceful and negotiated settlements of the disputes and to restore harmony and stability in the area.

The joint meeting of Foreign Ministers laid down some specific measures for the implementation of the Document of Objectives, adopted by the Central American Governments in September 1983, on the basis of the Cancún Declaration on Peace in Central America. To this end, it adopted the document annexed hereto, entitled "Measures to be taken to fulfil the commitments entered into in the Document of Objectives", which relates to questions of regional security, political matters and co-operation in the economic and social spheres.

Appendix to the Communiqué

Measures to be taken to fulfil the commitments entered into in the Document of Objectives of September 1983

The Governments of Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua,
Considering:

1. The adoption by the five Governments in September 1983 of the "Document of Objectives" as a frame of reference for the regional agreement to achieve peace,
2. The necessity of instituting measures designed to fulfil the commitments embodied therein,

Resolve:

I. *To adopt* the following measures for immediate application:

1. *Security questions:*

(a) The preparation by each of the Central American States of a register or inventory of military installations, weapons and troops, with a view to developing guidelines on a policy for their verification and reduction which sets ceilings and provides for a reasonable balance of forces in the region;

(b) The establishment of a list and timetable in each country with a view to reducing, and eventually eliminating, the presence of foreign military advisers and other outside elements participating in military or security activities;

(c) The identification and elimination of all forms of support or encouragement to and financing or toleration of irregular groups or forces engaged in destabilizing Central American Governments;

(d) The identification and disbandment of irregular groups or forces which, acting from or traversing the territory of a Central American State, participate in destabilizing actions against another Government of the region;

(e) The identification of areas, routes and channels used for illegal traffic in arms within and outside the region, so that such traffic may be stopped;

(f) The establishment of mechanisms of direct communication with a view to averting incidents between States and devising solutions in the event of the occurrence of such incidents;

2. *Political matters:*

(a) The promotion of national reconciliation on the basis of justice, freedom and democracy and the establishment for this purpose of machinery to facilitate dialogue between the countries of the region;

(b) The guaranteeing of full respect for human rights and, to this end, the securing of compliance with the obligations embodied in international legal instruments and the relevant constitutional provisions;

(c) The promulgation or review of legislation on the electoral process with a view to the holding of elections that guarantee the effective participation of the people;

(d) The establishment of independent electoral bodies to prepare reliable electoral registers and to ensure that the electoral process is impartial and democratic;

(e) The issue or, where appropriate, the updating of regulations guaranteeing the existence and participation of political parties which represent the different currents of opinion;

(f) The establishment of an electoral timetable and the adoption of measures designed to ensure that the political parties participate on an equal footing;

(g) Endeavours to bring about genuine political trust between the Governments of the area in order to promote détente;

3. *Economic and social questions:*

(a) The strengthening of programmes of assistance to Central American refugees and the promotion of voluntary repatriation, with the co-operation of the interested Governments, in liaison and/or co-ordination with national humanitarian bodies and competent international organizations;

(b) The extension of full co-operation to the Central American Integration Bank, ECLA, the Committee for Action in Support of the Economic and Social Development of Central America and the General Treaty on Central American Integration (SIECA);

(c) Joint negotiations to obtain external resources to help revitalize Central American integration processes;

(d) The encouragement of trade within the region and the promotion of greater and better access of Central American products to the international markets;

(e) The promotion of joint investment projects;

(f) The establishment of just economic and social structures which will reinforce an authentic democratic system and give the peoples full access to the judicial system, employment, education, health and culture;

II. *To authorize:* the Technical Group, as advisory body of the Joint Meeting of the Ministers for Foreign Affairs of Central America and of the Contadora Group, to follow up the measures provided for in this document on security, political and economic and social questions. The Technical Group will report to the meeting of Ministers on the progress made in carrying out these measures;

III. *To establish:* in the framework of the Contadora Group, three working commissions for the purpose of preparing studies, legal drafts and recommendations concerning security and political matters and economic and social questions and of making proposals for verifying and supervising the implementation of the measures agreed upon;

The working commissions will be governed by the following rules:

(a) They will be composed of representatives of the Governments of Central America, and each country may designate up to two advisers per commission;

(b) They will be convened by the Contadora Group, which will participate in their meetings in order that it may continue to collaborate actively in the study of the assigned topics and in the preparation of agreements;

(c) Recourse to external advisers, whether the latter are experts in their individual capacity or representatives of international organizations, must be approved in advance by consensus;

(d) The working commissions will be set up by 31 January 1984 at the latest, for which purpose the participating Governments will designate their representatives and advisers and will communicate their names in due course to the Ministry of Foreign Affairs of the Republic of Panama;

(e) Each commission will prepare and present its timetable and programme of work before 29 February 1984;

(f) The working commissions will carry out their tasks within the framework established by the "Document of Objectives". They will be co-ordinated by the Technical Group and will present their studies, legal drafts and recommendations to the Joint Meeting of Ministers for Foreign Affairs by 30 April 1984 at the latest.

Source: UN document A/39/71, S/16262, 10 January 1984.

Part III. Developments in arms control

Chapter 15. The Conference on Confidence- and Security-Building Measures and Disarmament in Europe

Introduction / Background—CSCE, Stockholm, confidence-building measures / The Stockholm Conference mandate / Opening positions / Bridging differences / Conclusions / Extracts from the concluding document adopted by the Second CSCE follow-up meeting in Madrid on 6 September 1983 / Proposal submitted by the delegations of Belgium, Canada, Denmark, France, the Federal Republic of Germany, Greece, Iceland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Turkey, the United Kingdom, and the United States of America on 24 January 1984 / Comparison of the NATO CSBM package with the Final Act CBMs / Proposal submitted by the delegation of Romania on 25 January 1984 / Proposal submitted by the delegations of Austria, Cyprus, Finland, Malta, San Marino, Sweden, Switzerland and Yugoslavia on confidence- and security-building measures / Notifications of military manoeuvres in 1983, in compliance with the Final Act of the CSCE

Chapter 16. Common security

Introduction / For and against deterrence / Common security and deterrence / Common security and the rest of the world / Confidence and common security / Concepts of security

Chapter 17. Multilateral arms control efforts

Test ban / Chemical disarmament / Outer space / UN General Assembly resolutions on disarmament, 1983

Chapter 18. Arms control agreements

Bilateral agreements: summaries / Multilateral agreements: summaries / Allegations of breaches / Status of the implementation of the major multilateral arms control agreements as of 31 December 1983

Chapter 19. Chronology of major events related to arms control issues

15. The Conference on Confidence- and Security-Building Measures and Disarmament in Europe

DAVID BARTON

Superscript numbers refer to the list of notes and references at the end of the chapter.

I. Introduction

The Conference on Confidence- and Security-Building Measures and Disarmament in Europe, of which the Stockholm Conference is the first phase, opened in Stockholm, Sweden on 17 January 1984. The conference was convened by the 35 states participating in the Conference on Security and Co-operation in Europe (CSCE).[1]

The Conference in Stockholm opened amid a flourish of diplomatic activity. A meeting between US Secretary of State Shultz and Soviet Foreign Minister Gromyko and numerous bilateral meetings between foreign ministers took place during the opening ceremonies. European security and the nuclear and conventional arms control negotiations were obvious topics of discussion. One of the only immediately evident and tangible results from this initial diplomatic activity was the fact that Soviet Foreign Minister Gromyko let it be known to the foreign ministers with whom he met that his country would return to the Mutual (Balanced) Force Reduction (MBFR) talks in Vienna in mid-March 1984.

II. Background—CSCE, Stockholm, confidence-building measures

The Stockholm Conference is part of the CSCE process which was started in 1973 and which completed its first phase when the Final Act was signed in Helsinki in 1975. The Final Act is meant to govern the co-existence of European states, and of Canada and the USA. The 35 states were to implement the Final Act provisions by finding ways to normalize and ameliorate their political, economic, social, human, cultural and military relations. The idea of holding a separate conference focused on disarmament in Europe was most notably suggested by France, as early as 1978 at the First Special Session on Disarmament at the UN, and in 1980 at the CSCE meeting in Madrid by France, Poland, Romania, Sweden and Yugoslavia. The neutral and non-aligned group of CSCE states worked hard at the Madrid review meeting between 1980 and 1983 to secure a consensus agreement to hold the Conference and to draft a mandate acceptable to all states yet meaningful in establishing a framework for agreement on steps to lessen the military confrontation and promote disarmament in Europe.

The Swedish Foreign Minister Ola Ullsten offered to host the Conference in Stockholm in a speech in November 1980 in which he said: "If we are to reach an agreement on the convening of a European disarmament conference, it will be necessary to devise a mandate which combines elements of common interest to all CSCE states. It is also essential that we strive for concrete and substantive results rather than propagandistic ones ... Europe needs disarmament, not just a disarmament conference."[2]

In Helsinki in 1975 the 35 CSCE states decided to notify each other of large military manoeuvres. The purpose of these notifications was to reduce the danger of armed conflict by sharing among the participating states timely and clear information about military activities which might, under certain circumstances, appear provocative and cause misunderstanding. The notifications were to provide information about the military manoeuvres such as their designation, purpose, duration, area, numbers of troops and composition of forces. One of the original ideas was to provide a more conducive setting for substantive arms control and disarmament by undertaking political and military measures which would strengthen trust among the participating states.

Since 1975 all 35 states have in general respected the provision which obliges them, on a voluntary basis, to provide a 21-day advance notification of their major military manoeuvres involving 25 000 troops or more (although there have been a few complaints of inadequate notification by the USSR). There have been in all some 130 notifications of 100 manoeuvres involving several million troops during this nine-year period. Observers were invited to almost all NATO manoeuvres and to about one-half of those of the Warsaw Treaty Organization (WTO) and neutral and non-aligned states. Some countries announced manoeuvres below the 25 000 specified troop level and others gave more than 21-days' notice.[3]

This good record on notifications is a positive sign for future compliance with new measures by these states. After all, each notification expresses a political willingness, not a legal obligation, by that state to comply with a process of building confidence. The problem is that this process has not been expanded. Neither air and naval manoeuvres nor regular military movements (troop rotations, alerts, and so on) have been notified. The treatment of observers and their access to witness the full scope, duration and variety of the military exercises conducted during manoeuvres have varied. One of the tasks of the Stockholm Conference will be to expand the existing set of confidence-building measures in ways which fulfil the mandate by being "militarily significant, politically binding, and adequately verifiable".

III. The Stockholm Conference mandate

The mandate for the Stockholm Conference is contained in the final document of the CSCE review meeting in Madrid which was finally signed in September 1983 after nearly three years of discussions (see appendix 15A). The general aim of the whole process of the negotiations—including the second phase envisaged after 1986—is stated as follows: "to undertake, in stages, new, effective and concrete actions designed to make progress in strengthening confidence and security and in achieving disarmament, so as to give effect and expression to the duty of States to refrain from the threat or use of force in their mutual relations". But, despite this overall aim to achieve disarmament measures and despite strong public sentiment in favour of disarmament in several European states, most of the 35 governments have limited their expectations for the conference to the detailed mandate set at Madrid for the first phase in Stockholm "devoted to the negotiation and adoption of a set of mutually complementary confidence- and security-building measures designed to reduce the risk of military confrontation in Europe." These confidence- and security-building measures (CSBMs) "will cover the whole of Europe as well as the adjoining sea area [including ocean areas adjoining Europe] and air space . . . will be of military significance and politically binding and will be provided with adequate forms of verification which correspond to their content".[4] Most of the participating states interpret this first phase as meaning the expansion of the existing set of notifications of military manoeuvres established when the CSCE Final Act was signed nine years ago in Helsinki. Those confidence-building measures do not attempt to limit or reduce military forces in Europe.

The mandate also states that the results of the Stockholm Conference will be assessed by the participatory states at the next review meeting of the CSCE in Vienna in November 1986 before proceeding to the next stage. This raises the question of just how far the first stage of the conference can go in the direction of disarmament, since many interpretations separate out specific consideration of disarmament from the first stage of the conference.[5]

Therefore, it seems safe to predict that between the opening of the conference in 1984 and the review of the first stage, in Vienna in November 1986, there will be several years in Stockholm of posturing, shuffled proposal papers, and discarded compromises. Perhaps the most that can be expected from the Stockholm Conference is a modest expansion of the existing set of confidence-building measures, some declaratory statements, and some fertile groundwork such as establishing a compliance committee which would be needed for these first-stage measures. It could then be built on for the second stage, which could undertake actual disarmament steps and expand or incorporate progress achieved in any of the other conventional and nuclear arms negotiations.

IV. Opening positions

According to the CSCE rules of procedure the negotiations in Stockholm should take place outside the framework of the military alliances. However, in reality, consensus has usually been sought between three groupings of states—NATO, WTO, and neutral and non-aligned—and it has normally been each grouping which presents a common position or proposal. In past experience with the CSCE process it has frequently been the neutral and non-aligned group which has played the mediating role.[6]

NATO position

The NATO group was first to table a specific proposal, on 24 January 1984.[7] The NATO position stresses the importance of achieving greater transparency, openness and predictability for military activities and military forces in Europe. It seeks an exchange of military information relating to the structure of air and land forces in the geographical area of application and an annual preview of all military activities which should be notified in advance. The NATO position states that if the new set of measures is implemented and verified and if other international commitments are respected by all the CSCE states then that could open up prospects for new progress in disarmament, but only after the Vienna review meeting in 1986.

NATO wants notifications to be issued 45 days in advance for out-of-garrison activities involving over 6 000 troops or a specified number of armoured vehicles, mobilizations of more than 25 000 troops or three divisions, and amphibious exercises involving over 3 000 troops or more than three battalions. NATO also wants observers, inspections and other forms of verification to be used in order to ensure direct observation of all pre-notified military activities and compliance with the new notification requirements. In addition, NATO recommends inspection on request and national technical means as verification tools. The NATO position also suggests that the means of communication between the 35 states be improved, especially for crisis contingencies. A comparison with the Helsinki provisions is set out in appendix 15C.

The criteria "formally established" at Madrid as US pre-conditions for the Conference give an indication of some of the negotiating problems ahead. These criteria were: (*a*) that the conference must remain an integral part of the CSCE process in order to maintain the appropriate balance between human rights and security concerns; (*b*) that the first stage would be limited to CSBMs which do not directly affect the size, weaponry, or structure of a state's military forces, and that, as France proposed, nuclear issues would not be negotiated at the conference; (*c*) that the conference must not interfere with any other arms control negotiations; and (*d*) that the CSBMs must be militarily significant, politically binding, verifiable, and applicable to the whole of Europe from the Atlantic Ocean to the Ural Mountains.[8]

Ambassador James Goodby, chief US delegate to the Stockholm Conference, has stressed these pre-conditions. He has also expressed the view that CSBMs should precede any declaratory measures, and that declaratory measures are meaningless when not accompanied by actions.[9] NATO will therefore probably not wish to consider any regional arrangements for CSBMs, or any constraints on nuclear weapons—even tactical battlefield nuclear weapons.

In addition, the US and NATO stress on transparency and verification may throw up one of the most difficult and traditional stumbling blocks to negotiations with the USSR and the WTO. The USSR and the WTO have come to accept inspections in addition to national technical means when actual reductions are involved.[10] However, the NATO position foresees reduction measures only in the second stage. Certainly the NATO stress on transparency may have provoked the comment in Foreign Minister Gromyko's speech to the Conference that "any attempts at the conference to advance unacceptable demands right from the start and, rather than build confidence, look for a crack in the fence to peep at one's neighbors could only impede its productive work."[11] Also, Ambassador Goodby has suggested that all disarmament measures be delayed until after a full review meeting in Vienna and that continuation of the Conference be contingent on a judgement at Vienna of how the Soviet and other WTO states have performed on other provisions of the Helsinki Final Act, such as those concerned with human rights.[12] Human rights debates in past CSCE meetings have delayed consideration of other issues. Therefore, judging from past experience, there might be a significant delay in consideration of disarmament measures if the view prevails that the Conference must wait for a full review in Vienna before entering into the disarmament stage.

WTO position

In the early weeks of the Stockholm Conference the WTO group had not tabled a specific proposal. Romania tabled its own proposal on 25 January 1984, but that proposal does not adequately represent the WTO position.[13] When questioned about the WTO position the member states, with the exception of Romania, pointed to the speech of Foreign Minister Gromyko at the Stockholm Conference opening ceremonies, the speech of President Brezhnev on 6 October 1979 in Berlin and recent WTO declarations. These speeches and declarations do outline a position which gives clear priority to pledges, and to "declaratory measures" of no-first-use of nuclear weapons and of non-aggression. Further development of CSBMs is mentioned but seems to have a low priority. This low priority seems also to be evidenced by the fact that the WTO has not tabled a proposal despite decisions taken at the Helsinki preparatory meeting, held from 25 October to 11 November 1983, urging the participatory states to introduce CSBM proposals as early as possible after the opening of the Conference in its first session.[14]

At the opening of the Conference, Gromyko stated that his country's priority was to prevent nuclear war and that the most important measures for the Conference to undertake would be pledges of no-first-use of nuclear weapons and of mutual non-use of conventional and nuclear military force in addition to a pledge to halt the arms race and achieve disarmament. He also mentioned his country's desire to see initiatives taken in Stockholm to make northern Europe a nuclear weapon-free zone and to make all of Europe nuclear- and chemical-weapon free.[9]

Gromyko also stated his country's willingness to consider a wide spectrum of new CSBMs with more scope and significance than the existing useful CBMs. He stated the Soviet desire to see agreements on new measures not only concluded but implemented before the Vienna review meeting in 1986. The specific improvements he mentioned for CSBMs were development of the use of prior notification, addition of military movements and redeployments to the notification procedures which apply now only to manoeuvres, and inclusion of air and naval manoeuvres in the sea, ocean and airspace adjoining Europe. It must be assumed that these and perhaps other expansions of the existing set of CBMs will form part of the WTO position, when and if it is tabled, in addition to a priority emphasis on the declaratory measures. However, in order for progress to be achieved in the work of the Conference the WTO should table a proposal of CSBMs and it would be helpful if it included suggested parameters for the new measures. Insistence that there should first be an agreement on declaratory measures and unwillingness to table a specific CSBM proposal will certainly block progress.

Romania tabled a proposal on 25 January which suggested geographical and numerical limits on military forces, armaments and activities, a nuclear weapon-free corridor between East and West, nuclear weapon-free zones in northern Europe and the Balkans, and a freeze on foreign troops, foreign bases and military expenditures in Europe. Such far-reaching proposals are unlikely to become part of a general WTO proposal.[13]

Neutral and non-aligned position

During the opening weeks of the Stockholm Conference it became clear that the neutral and non-aligned states would be obliged to continue the mediating role that they have played successfully in the past. They maintain a strong commitment to make the CSCE process work. But, they also presented their own proposals on 9 March 1984.[21]

Early working papers prepared by Sweden, Switzerland and Yugoslavia formed the basis for the eventual neutral and non-aligned proposal which is rather more ambitious than the NATO proposal. They suggest an enlargement of the existing set of confidence-building measures but they also underline a new factor in the mandate: security-building measures which seek to actually constrain military activities and capabilities including troop deployments and military equipment. While they appear to accept that disarmament measures will be first considered in a second stage after the Vienna review meeting in 1986, they also envisage a broad range of new CSBMs in the first stage to prepare fertile ground for that next stage of disarmament measures.[15]

The neutral and non-aligned position, as suggested in these working papers, seeks to expand the existing set of confidence-building measures by including smaller military manoeuvres, amphibious and airborne manoeuvres, and major military activities in the air and at sea which affect European security, troop movements and troop mobilizations. It also recommends the exchange of an annual listing of planned major military activities, the sharing of information on the current location of major military units, the improvement of the notified manoeuvre descriptions, the invitation of observers to all notified manoeuvres, and the drafting of guidelines for those observer missions. It will be difficult for the neutral and non-aligned states to define clearly all of the military activities involved and to reach a common understanding in their joint proposal, but such background work will assist them in achieving a final consensus and common interpretation of the new CSBMs.

The new measures mentioned in the neutral and non-aligned proposal are measures to place ceilings on the total number of troops involved in manoeuvres and in amphibious and airborne exercises, and to constrain the deployment in certain areas of troops or equipment with durable offensive capabilities. In both the expanded set of old CBMs and the new measures, the neutral and non-aligned states have not, so far, specified numbers for the size of the military manoeuvres and movements. They have only indicated parameters. This is probably designed to assist in the final negotiations to achieve consensus.

In addition, the neutral and non-aligned proposal suggests adequate arrangements to facilitate the exchange of information and verification. It also suggests that CSCE states share information on their military expenditures according to United Nations guidelines. The three working papers differed somewhat in their approach to declaratory measures but a similarity emerges in their proposal which reaffirms declarations either in the UN Charter or the Helsinki Final Act.

The final neutral and non-aligned proposal differs only slightly from the working papers. The shared ideas prevailed and the differences were reconciled.

V. Bridging differences

One of the most important differences which must be bridged is the emphasis the NATO position places on transparency of military activities and the priority the WTO position gives to declaratory measures. Each side has chosen to stress a subject which it knows the other side dislikes. Nevertheless, compromise is always possible and the neutral and non-aligned proposal clearly indicates possible solutions in their support for reaffirming certain declarations in the Helsinki Final Act and the UN Charter which deal with the mutual non-use of military force for aggressive and threatening purposes.[15] Such repetitions of existing declarations should not be too painful for the NATO side if some movement were to result in other areas. For example, it should be possible to bridge the gap between the 1983 statements by the WTO and NATO on the non-use of military force.[16] The Swedish working paper includes a suggestion for the military information and verification concerns. It proposes a consultative committee. This might facilitate the information exchange and any verification needs other than national technical means by having a CSCE committee which could be a non-intrusive repository for military information, a co-ordinator for observer missions, a processor of complaints, and perhaps even eventually a monitor of inspection on request to verify shared military information and compliance with CSBMs. However, there is a good chance that these particular WTO and NATO positions will remain hardened at least until after the US presidential election in November 1984.

Proposals for broadening the current criteria for notifications include decreasing the size specification of major military manoeuvres below the 25 000 level, expanding the types of military activity covered to include such activities as out-of-garrison movements and routine troop rotations, extending the notifications to all mobilizations of reserves including emergency or alert exercises, lengthening the notification period beyond the current 21 days, formalizing the exchange of observers with guidelines to allow them comprehensive access to manoeuvres and movements of troops and equipment, and expanding the mandate for notifications to cover air, naval and amphibious manoeuvres.

Judging from the past history of the CSCE notifications, the opening positions of the 35 states at the Stockholm Conference and their opinions on CBMs expressed to the Secretary-General of the UN and elsewhere, it is possible to envisage a consensus agreement among the 35 states to expand the existing system of notifications. When the Secretary-General of the UN received reports he solicited from European states on suggestions for CBMs most of the states stressed the need for improvements in the existing CSCE system of notifications. They gave priority to notifications of smaller military manoeuvres, movements, and air and naval manoeuvres. For example, five WTO states recommended prior notification of major air and naval manoeuvres.[17]

Naval and air manoeuvres have not been notified under the CSCE system. The treatment of observers to manoeuvres has also been judged by several states as unsatisfactory. These are just two of several areas which could become the focus for the Stockholm Conference. The working groups could propose guidelines for observer missions and for notifications of air, naval and amphibious manoeuvres. The presence of military expertise can assist the groups in successfully negotiating specific parameters and limits for the proposed expansion of the existing set of CBMs. Since there appears to be some basic agreement on the direction in which changes should be made, agreement on specific details should not be impossible.

There are other issues which may pose more serious problems, such as the ceiling on the size of manoeuvres, desired by the WTO states and opposed in the past by the NATO states, the inclusion of amphibious manoeuvres, which the WTO states have not yet mentioned, and the exact definition of when air and naval manoeuvres are to be included. But, again, compromise is always possible. For example, military manoeuvres and movements could be limited to 60 000 troops with an escape clause which would permit larger manoeuvres if a special notification were made perhaps at least 90 days in advance, or if they are part of the annual preview of military activities proposed by NATO. After all, in the nine-year history of CSCE notifications of 100 manoeuvres, only five NATO manoeuvres and one WTO manoeuvre have exceeded the 60 000 troop level.[5]

When amphibious manoeuvres have been part of major land manoeuvres they have been included in the notifications. It is when they are conducted independently that there is still some concern about their offensive nature even at levels of a few thousand troops. The neutral and non-aligned states are particularly interested in including the amphibious exercises and they have presented previous proposals at the Belgrade and Madrid review meetings to include them.[18] The working papers also contain some specific guidelines which could form the basis of an agreement.[15]

It seems that all three groups would like to include air and naval manoeuvres when they are connected to land manoeuvres. The difficulty will be agreement on when and how to include air and naval exercises when they are conducted independently of land exercises but do affect European security. Again, it would seem that most exercises conducted in European air, sea and ocean space do involve European security and the Conference should be able to deal with this matter even though definitions of European sea and ocean space may be difficult to agree upon.

Another problem has arisen about the geographical area of applicability. The CSCE agreed to extend the area of applicability from the Atlantic to the Urals thereby including more territory of the USSR. But now, some interpretations of the mandate seem to indicate that any new CSBMs considered at Stockholm must be applicable to all of Europe. Narrow interpretation of this criterion could eliminate all serious consideration of zonal or sub-regional arrangements such as thinning out conventional or nuclear forces along certain East–West borders, and nuclear weapon-free areas in the Baltic, northern Europe, the Mediterranean and the Balkan states. Several CSCE states view zonal arrangements as critically important to their security—so much so, for example, that Malta blocked the final consensus in Madrid in order to extract some concession to focus attention on the Mediterranean. Mediterranean non-participating states were invited to present their views and proposals for CSBMs in the Mediterranean during the second week of the conference.

Therefore, a new set of CSBMs should be within reach of the Stockholm Conference if the neutral and non-aligned states continue to play a unified and skilful mediating role, if the conference can solve the detailed problems of limits and parameters for the new measures and set guidelines for the inclusion of new manoeuvres and movements, and if a consultative committee can be established to set guidelines, monitor and serve as an intermediary for the exchange of information, verification and observation missions.

VI. Conclusions

The achievement of results at the Stockholm Conference will be a difficult task. Political leadership and skilful mediation will be required from the neutral and non-aligned states and also from the European states within the NATO and WTO groups to pressure both the USA and the USSR to step away from their recently soured bilateral nuclear arms negotiating experience. The USA brings to the Conference a set of pre-conditions "formally established" in its position in Madrid which could hinder progress in Stockholm.[19] The USSR brings to the Conference bilateral arms negotiations grievances, undoubtedly a set of pre-conditions for the resumption of those negotiations in Geneva, and a reluctance to exchange military information and to begin negotiating new CSBMs. These hidden and extracurricular agendas must be set aside. Differences cannot be bridged and working groups cannot be established until all the main proposals are tabled and until there is some agreement on the main items to appear in the final document.

The narrow interpretations of the mandate for the Conference given by many of the 35 states help to explain the pessimism of many observers. To spend two or three years achieving at best only a modest expansion of the existing CBMs would hardly be a major achievement. There are a number of ideas for 'second-generation' confidence-building measures which deserve examination—much fuller examination, of course, than can be given here. There is the suggestion of border zones with thinned-out military forces, other force limitations and reductions, and the rear-basing of certain types of military equipment. There is the idea of establishing verification and inspection systems modelled after either the successful Quadripartite Agreement implementation or the Sinai early-warning, monitoring and verification system. An experimental early-warning, inspection and verification zone in central Europe could be the central feature of a new approach which, by demonstrating practical improvements in European security in an experimental setting, might encourage the 35 states to adopt more ambitious CSBMs and disarmament measures.[20]

Agreement in Stockholm on a new set of CSBMs, even though modest and fairly insignificant militarily, would be better than no agreement at all, particularly since there are few signs of progress in other arms control negotiations. Also, the establishment of effective working groups and a consultative compliance committee would be good groundwork accomplishments that would be very useful for the second stage of the conference. The results of the first stage will be assessed at the CSCE Vienna review meeting starting in 1986. Judging from past experience that review meeting might easily last two or three years because it will also evaluate all the other elements of the CSCE process—human rights, economic, social and international problems. It would be very unfortunate if, as a result of the Vienna review, there was a hiatus of two or three years in which no further progress was made towards the consideration of actual disarmament proposals. A way might possibly be found by which the Conference on Confidence- and Security-Building Measures and Disarmament in Europe could move on to the second stage while the Vienna review was proceeding. In that second stage there would be a much greater need than in the first for co-ordination with other negotiations, such as the MBFR negotiations at Vienna.

Notes and references

[1] There are three groups of CSCE states: (NN) neutral and non-aligned states; (W) Western states, members of NATO and/or the European Community; and (E) Eastern states, members of WTO. They are Austria(NN), Belgium(W), Bulgaria(E), Canada(W), Cyprus(NN), Czechoslovakia(E), Denmark(W), Finland(NN), France(W), German DR(E), FR Germany(W), Greece(W), Holy See, Hungary(E), Iceland(W), Ireland(W), Italy(W), Liechtenstein(NN), Luxembourg(W), Malta(NN), Monaco, the Netherlands(W), Norway(W), Poland(E), Portugal(W), Romania(E), San Marino(NN), Spain(W), Sweden(NN), Switzerland(NN), Turkey(W), UK(W), USA(W), USSR(E), Yugoslavia(NN).
[2] Lindskog, L., *Facts about the Stockholm Conference*, paper published by the Swedish Institute of International Affairs, Stockholm, Sweden, December 1983.
[3] See tables and notifications of military manoeuvres in compliance with the Final Act of the CSCE, in SIPRI, *World Armaments and Disarmament, SIPRI Yearbooks 1975 . . . 83* (Almqvist & Wiksell, Stockholm, 1975 . . . 77, and Taylor & Francis, London, 1978 . . . 83). A table of military manoeuvres in 1983 is given in appendix 15F.
[4] For the text of the mandate see appendix 15A.
[5] Opening statements by foreign ministers of the 35 CSCE states presented during the first week of the Stockholm Conference in January 1984.
[6] See the proposal submitted by the delegations of Austria, Cyprus, Finland, Liechtenstein, San Marino, Sweden, Switzerland and Yugoslavia in 1981, in SIPRI, *World Armaments and Disarmament, SIPRI Yearbook 1983* (Taylor & Francis, London, 1983), p. 609.
[7] *Confidence- and Security-Building Measures (CSBMs)*, Proposal submitted by the delegations of Belgium, Canada, Denmark, France, Federal Republic of Germany, Greece, Iceland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Turkey, UK and USA, 24 January 1984; see appendix 15B for the full text. (The NATO group is also referred to as the Western group.) For a table comparing the NATO proposal to the Helsinki Final Act CBMs, see appendix 15C.
[8] *Conference on Disarmament in Europe*, GIST, Bureau of Public Affairs, US Department of State, January 1984.
[9] Goodby, J., Three-part interview with Ambassador James Goodby, chief US delegate to the Conference on Confidence- and Security-Building Measures and Disarmament in Europe. USA Document, US Information Service, 8 December 1983, Stockholm, Sweden.
[10] Barton, D. and Pöllinger, S., 'Negotiations for conventional force reductions and security in Europe', in *SIPRI Yearbook 1983* (note 6), pp. 595–608.
[11] Statement by Andrei A. Gromyko, Member of the Politbureau, CPSU Central Committee, First Deputy Chairman, USSR Council of Ministers, Minister for Foreign Affairs of the USSR at the Conference on Confidence- and Security-Building Measures and Disarmament in Europe, Stockholm, 18 January 1984, p. 15.
[12] See note 9, particularly Part I, pp. 6–8.
[13] *Confidence- and Security-Building Measures (CSBMs)*, proposal submitted by the delegation of Romania, Stockholm, 25 January 1984 (see appendix 15D for full text); Statement by the Minister for Foreign Affairs of the Socialist Republic of Romania, Mr Stefan Andrei, at the Conference on Confidence- and Security-Building Measures and Disarmament in Europe, Stockholm, Sweden, 20 January 1984.
[14] Helsinki Preparatory Meeting document CSCE/HPM/1/Rev. 1, 11 November 1983.
[15] Swedish working paper, 31 January 1984, presented to neutral and non-aligned group; Swiss working paper, 6 February 1984; Yugoslav working paper, 29 December 1983. It should be noted that the assessments of negotiating positions in this chapter are taken as of March 1984.
[16] Political Declaration of WTO States, Prague, 5 January 1983; NATO Defense Ministers Communique, Brussels, 2 June 1983.
[17] Report to the UN General Assembly, 34th Session, General and Complete Disarmament, Confidence Building Measures, Report to the Secretary-General A/34/416, 5 October 1979. Reports on confidence-building measures to the Secretary-General of the UN were mandated by UN Resolution 33/91B of 16 December 1978.
[18] See the proposal submitted to the Madrid Conference by the delegations of Austria, Cyprus, Finland, Liechtenstein, San Marino, Sweden, Switzerland and Yugoslavia on Confidence-Building Measures on 12 December 1980, in SIPRI, *World Armaments and Disarmament, SIPRI Yearbook 1981* (Taylor & Francis, London, 1981), pp. 498–500.
[19] See notes 8 and 9.
[20] For further information about the Quadripartite Agreement and its applicability for CSBM

use in central Europe see: Krause, C., 'How effective are military confidence-building measures?', paper for Friedrich Ebert-Stiftung, Bonn, July 1982. For further information about the Sinai as a paradigm for verification use in central Europe see: Barton, D., *The Sinai Experience*, study in progress.

[21] *Confidence- and Security-Building Measures* (*CSBMs*), Proposal submitted by the delegations of Austria, Cyprus, Finland, Malta, San Marino, Sweden, Switzerland and Yugoslavia, 9 March 1984; see appendix 15E for full text.

Appendix 15A

Extracts from the concluding document adopted by the Second CSCE follow-up meeting in Madrid on 6 September 1983

Conference on Confidence- and Security-building Measures and Disarmament in Europe

The participating States,

Recalling the provisions of the Final Act according to which they recognize the interest of all of them in efforts aimed at lessening military confrontation and promoting disarmament.

Have agreed to convene a Conference on Confidence- and Security-building Measures and Disarmament in Europe.

The aim of the Conference is, as a substantial and integral part of the multilateral process initiated by the Conference on Security and Co-operation in Europe, with the participation of all the States signatories of the Final Act, to undertake, in stages, new, effective and concrete actions designed to make progress in strengthening confidence and security and in achieving disarmament, so as to give effect and expression to the duty of States to refrain from the threat or use of force in their mutual relations.

Thus the Conference will begin a process of which the first stage will be devoted to the negotiation and adoption of a set of mutually complementary confidence- and security-building measures designed to reduce the risk of military confrontation in Europe.

The first stage of the Conference will be held in Stockholm commencing on 17 January 1984.

On the basis of equality of rights, balance and reciprocity, equal respect for the security interests of all CSCE participating States, and of their respective obligations concerning confidence- and security-building measures and disarmament in Europe, these confidence- and security-building measures will cover the whole of Europe as well as the adjoining sea area* and air space. They will be of military significance and politically binding and will be provided with adequate forms of verification which correspond to their content.

As far as the adjoining sea area* and air space is concerned, the measures will be applicable to the military activities of all the participating States taking place there whenever these activities affect security in Europe as well as constitute a part of activities taking place within the whole of Europe as referred to above, which they will agree to notify. Necessary specifications will be made through the negotiations on the confidence- and security-building measures at the Conference.

Nothing in the definition of the zone given above will diminish obligations already undertaken under the Final Act. The confidence- and security-building measures to be agreed upon at the Conference will also be applicable in all areas covered by any of the provisions in the Final Act relating to confidence-building measures and certain aspects of security and disarmament.

The provisions established by the negotiators will come into force in the forms and according to the procedure to be agreed upon by the Conference.

* In this context, the notion of adjoining sea area is understood to refer also to ocean areas adjoining Europe.

Taking into account the above-mentioned aim of the Conference, the next follow-up meeting of the participating States of the CSCE, to be held in Vienna, commencing on 4 November 1986, will assess the progress achieved during the first stage of the Conference.

Taking into account the relevant provisions of the Final Act, and having reviewed the results achieved by the first stage of the Conference, and also in the light of other relevant negotiations on security and disarmament affecting Europe, a future CSCE follow-up meeting will consider ways and appropriate means for the participating States to continue their efforts for security and disarmament in Europe, including the question of supplementing the present mandate for the next stage of the Conference on Confidence- and Security-building Measures and Disarmament in Europe.

A preparatory meeting, charged with establishing the agenda, time-table and other organizational modalities for the first stage of the Conference, will be held in Helsinki, commencing on 25 October 1983. Its duration shall not exceed three weeks.

The rules of procedure, the working methods and the scale of distribution for the expenses valid for the CSCE will, *mutatis mutandis*, be applied to the Conference and to the preparatory meeting referred to in the preceding paragraph. The services of a technical secretariat will be provided by the host country.

Source: Madrid Conference document, 6 September 1983.

Appendix 15B

Proposal submitted by the delegations of Belgium, Canada, Denmark, France, the Federal Republic of Germany, Greece, Iceland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Turkey, the United Kingdom and the United States of America on 24 January 1984

Confidence- and Security-Building Measures (CSBMs)

Recalling that the Conference on Confidence- and Security-Building Measures and Disarmament in Europe is an integral part of the process initiated by the Conference on Security and Co-operation in Europe and that, according to the Madrid Concluding Document, the objective of the first stage of the Conference is to adopt a set of mutually complementary confidence- and security-building measures;

The above-named States are determined to work for the adoption of measures that would create greater openness and more predictability in military activities in order to reduce the risk of surprise attack, diminish the threat of armed conflict in Europe resulting from misunderstanding and miscalculation, and inhibit the use of force for the purpose of political intimidation;

Implementation and verification of such measures, as well as respect for existing international commitments, would enhance stability, contribute to the preservation of peace and could open up prospects for new progress in disarmament;

With these goals in mind and in conformity with the mandate for the Conference the above-mentioned States propose the following confidence- and security-building measures:

I. MEASURES OF INFORMATION

Measure 1: Exchange of Military Information

At the start of each calendar year, the participating States agree to exchange information on the structure of their ground forces and land-based air forces in the zone of application for agreed CSBMs as agreed in the mandate for the Conference.

Information will also be given on the existing regulations in the CDE zone for accredited military personnel.

Clarification of information may be sought by appropriate means.

The information thus exchanged will form a basis for further measures dealing with military activities.

II. MEASURES DESIGNED TO ENHANCE STABILITY

Measure 2: Exchange of Forecasts of Activities Notifiable in Advance

The participating States will exchange annual forecasts of all military activities in the CDE zone which would be notifiable in advance under any other CSBM. Amendments to the forecast need not be given if a notifiable activity is either an addition to or a change from the forecast; such information will be provided in the actual notification for that activity.

Clarification of information contained in the annual forecast may be sought by appropriate means.

Measure 3: Notification of Military Activities

Notification will be given by the participating States 45 days in advance of the following activities in the CDE zone:

Out-of-garrison land activities.
When one or more ground force divisions or equivalent formations or 6 000 or more ground troops not organized into a division, or forces comprising more than a specified number of main battle tanks, or armoured personnel carriers/mechanized infantry combat vehicles are carrying out a common activity under a single command, whether independent or combined with air and/or amphibious support.

Mobilization activities.
When 25 000 or more troops or the major combat elements of three or more divisions are involved.

Amphibious activities.
When three or more battalions or 3 000 amphibious troops carry out a landing in the CDE zone.

When a notifiable out-of-garrison land activity, mobilization activity or amphibious activity is carried out on short notice as an alert activity, it will be notifiable at the time it begins, that is, when troops are ordered to carry out the activity.

All notifications will be made in a standardized format to be agreed on.

Compliance with the arrangements agreed under this measure will be subject to various forms of verification including the invitation of observers and inspection. Questions concerning compliance with the arrangements agreed under this measure can be dealt with by appropriate means.

III. OBSERVATION AND VERIFICATION MEASURES

Measure 4: Observation of Certain Military Activities

The participating States agree to invite observers from all other participating States to all pre-notified activities and to alert activities of longer than a specified period conducted in the CDE zone on their territory. The host State shall ensure that observers are provided the opportunity to form a judgement, supported by direct observation in the area of activity, as to the routine nature of the activity.

Measure 5: Compliance and Verification

A. National Technical Means.
Participating States agree not to interfere with national technical means. In using their national technical means for the purpose of verification, participating States will respect generally recognized principles of international law.

B. Monitoring of Compliance.
Subject to limitations and modalities to be agreed, participating States may request inspection concerning compliance with agreed CSBMs.

These provisions provide partipating States with the opportunity to monitor and thus verify whether notified activities are non-threatening and correspond to the details given in notifications, and that all notifiable activities are properly notified.

Measure 6: Development of Means of Communication

Arrangements should be made which will enhance the means of communication between participating States.

Source: Stockholm Conference Document CSCE/SC.1, 24 January 1984.

Appendix 15C

Comparison of the NATO CSBM package with the Final Act CBMs

NATO CSBM package		Final Act equivalent
Measure one:		
Exchange of military information	Yearly exchange of information on the location and command organization of ground forces and land-based air formations down to division and major combat units	None
Measure two:		
Exchange of forecasts of activities notifiable in advance	Annual forecast of all notifiable activities in the CDE zone	None
Measure three:		
Notification of military activities		
Activities notified	Manoeuvres, movements, mobilizations, amphibious activities and alerts	Manoeuvres (movement notifications discretionary)
Level notified	One or more divisions, 6 000 ground troops not organized into a division (mobilization—25 000; amphibious activities—3 000), or *X* tanks or *X* armoured personnel carriers	25 000 troops (smaller scale notifications discretionary)
Time of notification	45 days in advance	21 days in advance
Area of application	Europe to Urals plus adjoining sea area and airspace	European states plus a 250-km zone inside western border of Soviet Union
Measure four:		
Observation of certain military activities	Invitation of observers to all notifiable activities *mandatory*	Invitation voluntary
	Procedures and conditions of participation stated	None
Measure five:		
A. Verification of implementation of national technical means	Recognizes NTM as legitimate means of verification	None
B. Monitoring of compliance	Provides each state with *X* inspections per year—on demand to further determine the non-threatening nature of notified activities and to ensure all activities are properly notified	None
Measure six:		
Development of means of communication	Enhance communication between participating states	None

Source: US delegation to the Stockholm Conference.

Appendix 15D

Proposal submitted by the delegation of Romania on 25 January 1984

Confidence- and Security-Building Measures (CSBMs) (Outline)

In accordance with the aim of the Conference on Confidence- and Security-Building Measures and Disarmament in Europe, as agreed upon by the second CSCE follow-up meeting, which is for this Conference, "as a substantial and integral part of the multilateral process initiated by the Conference on Security and Co-operation in Europe, with the participation of all States signatories of the Final Act, to undertake, in stages, new effective and concrete actions designed to make progress in strengthening confidence and security and in achieving disarmament, so as to give effect and expression to the duty of States to refrain from the threat or use of force in their mutual relations;"

In accordance, also, with the provision of the Concluding Document of the Madrid Meeting, which states that "the Conference will begin a process of which the first stage will be devoted to the negotiation and adoption of a set of mutually complementary confidence- and security-building measures designed to reduce the risk of military confrontation in Europe;"

In view of the prevailing conditions in Europe;

Romania considers that the goal of the first stage of the Conference could be achieved by the negotiation and the adoption of effective measures aimed at:

elimination of suspicions and the sense of insecurity caused by certain military activities;

diminution of military activities in the border areas; restraint of military activities generating mistrust and tension; limitation of the geographical area of military activities causing the risk of confrontation;

extension of information, communication and consultations between States, especially in critical situations.

Such measures should be so formulated as to respond to the criteria provided in the Concluding Document of the Madrid Meeting, which, in turn, are to be so applied as to ensure the attainment of maximum efficiency of these measures. The negotiations could be conceived as a gradual process, aimed at the adoption of an increasingly larger set of measures, in keeping with the relevant provisions of the Concluding Document.

Proceeding from these considerations, Romania proposes the following measures:

I

Notification at least 30 days in advance of military manoeuvres in which take part:

land or combined forces in excess of (18,000–20,000) troops;

special forces, such as paratroops and amphibious, in excess of (5,000) troops;

more than (10–12) surface battle-ships having a total displacement of (50,000–60,000) tons;

airforce units with more than (45–50) aircraft fighters.

Notification will contain information on the purpose and duration of the manoeuvre, the type of armed forces engaged, numerical strength, armament, combat technique and means of transport, the area of deployment, as well as any other useful information.

Notification at least 30 days in advance of major military movements involving:

two or more divisions or their equivalent;
major transportation of heavy armaments and other war material with which two or more divisions or their equivalent could be equipped.
Notification will contain similar information as above.

Prior notification, or as soon as possible in emergency situations, of the placing in a state of alert of national or foreign armed forces or of important components of such forces.

II

Limitation of the armed forces participating in military manoeuvres to a maximum of (40,000–50,000) land troops and establishment of ceilings for the number of battle-ships and aircraft fighters.

Renunciation of multinational military manoeuvres within a zone along each side of the borders between States (width to be determined).

Creation along the borders between States of security zones (width to be determined) in which there would be no manoeuvres, movements or concentrations of armed forces and armaments and no placing in a state of alert of important components of such forces; limitation of the armed forces, armaments and military activities in such regions, as a step towards the establishment of demilitarized zones.

Establishment along the borders between the countries members of NATO and the countries participating in the Warsaw Treaty of a corridor free of nuclear weapons and other weapons of mass destruction (width to be determined) and, in a longer perspective, of any armaments and military activities, except for order and border forces.

Prohibition of manoeuvres and movements of ships and aircraft with nuclear weapons on board within a zone along the land and maritime borders with other States (width to be determined).

Non-stationing of additional troops and non-deployment of additional military bases on the territory of other States, as well as cessation of the extension and modernization of the existing ones.

Encouragement of, and support for the establishment of zones of peaceful co-operation and good neighbourliness, free of nuclear weapons, in the Balkans, in the North of Europe and in other regions of the continent.

III

Establishment of a system of information, communication and consultations among States on problems relating to their security, and prevention and management of crises. Such a system could include:

consultations between governmental representatives on regular basis and wherever necessary;
setting-up of a standing consultative body which would meet periodically and in emergency sessions;
establishment of a system of telephone connections for consultations between the heads of State and government and organization of summit meetings in emergency situations.

Adoption of measures to prevent nuclear conflict by error or accident, including:

creation of a mechanism of rapid communication between governmental representatives;
adoption of emergency procedures and development of technical means.

Conclusion of an *all-European Treaty on the non-use or threat of force,* containing concrete provisions and measures designed to give practical effect to the duty of States to refrain from the use or threat of force in their mutual relations. Such a treaty will constitute a corollary of the efforts being deployed at the Stockholm Conference.

Freezing of the military expenditures of States at the level of 1984 until further agreement is reached on their gradual reduction.

Such measures should be accompanied by the prohibition of war propaganda and the encouragement of peaceful relations between States. Systematic information of the public opinion on the progress achieved in the negotiations on confidence- and security-building measures would also contribute to the creation of a favourable climate for the work of the Stockholm Conference.

Source: Stockholm Conference Document CSCE/SC.2, 25 January 1984.

Appendix 15E

Proposal submitted by the delegations of Austria, Cyprus, Finland, Malta, San Marino, Sweden, Switzerland and Yugoslavia on confidence- and security-building measures

The above mentioned states ...

SUBMIT THE FOLLOWING CONSIDERATIONS:

(A) The situation in Europe and the equal respect for the legitimate security interests of every participating State require determined efforts by all of them to build mutual confidence, lessen military confrontation, strengthen security for all and promote disarmament.

(B) The measures to be negotiated and adopted in Stockholm should, with the added dimension of security, constitute important progress with respect to the confidence-building measures contained in the Final Act and thereby promote the subsequent negotiations on disarmament.

(C) The aim of this Conference is, as a substantial and integral part of the multilateral process initiated by the Conference on Security and Co-operation in Europe, with the participation of all the States signatories of the Final Act, to undertake, in stages, new, effective and concrete actions designed to make progress in strengthening confidence and security and in achieving disarmament, so as to give effect and expression to the duty of States to refrain from the threat or use of force in their mutual relations.

(D) The Conference has thus begun a process of which the first stage will be devoted to the negotiation and adoption of a set of mutually complementary confidence- and security-building measures designed to reduce the risk of military confrontation in Europe.

(E) The negotiations should be conducive to dialogue and the improvement of communication among the participating States in general, thereby making the Conference in itself a factor of confidence-building and reduction of tensions. Common efforts to increase confidence contribute to achieving security for all participating States.

(F) The provision of the Final Act, according to which security in Europe is to be considered in the broader context of world security and is closely linked with security in the Mediterranean area as a whole, should be borne in mind.

(G) A balanced set of mutually complementary measures to be negotiated and adopted should—in conformity with the relevant provisions of the mandate—include the further development and enlargement of the confidence-building measures contained in the Final Act and their adaptation to the mandate, as well as qualitatively new confidence- and security-building measures, including *inter alia* constraints on certain military activities.

Concrete measures, such as the following, should be actively considered:

(1) Prior notification of major military manoeuvres.
Substantially improved parameters as compared to those laid down in the Final Act, including earlier prior notification, more detailed information,

inter alia on the purpose of the manoeuvres, on the units involved and on the level of command as well as parameters relating to the organizational level and/or the number of troops.

(2) Prior notification of smaller-scale military manoeuvres which are carried out close to each other in time and space, if the total forces engaged exceed the levels agreed upon under item 1.

(3) Prior notification of military manoeuvres involving amphibious, sea-transported, air-borne, air-mobile forces or combinations thereof.
The parameters should be significantly lower than for major military manoeuvres and relate to the organizational level, the number of troops and the capacity of their specialized means of transport.

(4) Prior notification of major military movements.
The parameters should relate to the organizational level, the number of troops and/or the capacity of their specialized means of transport.

(5) Prior notification of major military activities, including manoeuvres, in the adjoining sea area and air space, whenever these activities affect security in Europe as well as constitute a part of activities taking place within the whole of Europe and within all other areas covered by any of the provisions of the Final Act relating to confidence-building measures and certain aspects of security and disarmament, which the participating States will agree to notify.

(6) Invitation of observers to military manoeuvres and movements subject to prior notification at levels to be determined; improved and standardized conditions for observers.

(7) Prior notification of redeployment of major military units as well as of major rotations of military personnel.
The parameters should relate to the organizational level, the number of troops and/or the capacity of their specialized means of transport.

(8) Notification of certain other major military activities.

(9) Exchange of annual calendars of preplanned major military activities.

(10) Ceiling for the forces engaged in a major military manoeuvre or in manoeuvres which are carried out close to each other in time and space.
The parameters should relate to the organizational level and/or the number of troops.

(11) Ceiling for amphibious, air-borne, air-mobile forces or combinations thereof engaged in military manoeuvres.
The parameters should be significantly lower than under item 10 and relate to the organizational level, the number of troops and the capacity of their specialized means of transport.

(12) Constraints on the deployment in areas to be determined of military units and/or equipment of vital importance for sustained offensive operations.

(H) A wide range of confidence- and security-building measures should be subject to negotiation already from the outset. The measures will include adequate verification provisions which correspond to their content.
The negotiations could initially focus on a combination of mutually complementary measures—as illustrated in paragraph (G)—on which early agreement might be reached.

(I) Such concrete confidence- and security-building measures serve, by their very nature, to give effect and expression to the duty of the participating States to refrain from the threat or use of force in their mutual relations as well as in their international relations in general. They thereby create conditions for considering a reaffirmation, in appropriate ways and forms, of this obligation and the commitment to the peaceful settlement of disputes, undertaken in the United Nations Charter and the Final Act.

(J) The Conference could also consider other measures, in conformity with the relevant provisions of the mandate, which are conducive to lessening the risk of military confrontation and the possibility of surprise attack, and to exerting genuine efforts towards containing an increasing arms build-up as well as to strengthening confidence and security and promoting disarmament.

(K) Arrangements for dealing with information, notification and rapid exchange of views with regard to measures that may be adopted could be envisaged.

(L) The negotiations should take due account of the mandate, according to which the provisions established by the negotiators will come into force in the forms and according to the procedure to be agreed upon by the Conference.

(M) A meaningful contribution to the building of confidence would be the undertaking by the participating States to apply the standardized reporting system on military expenditure elaborated by the United Nations.

(N) Negotiations should aim at timely and substantial progress in order to provide the Vienna CSCE Follow-up Meeting with sufficient new elements when considering the question of supplementing the present mandate for the next stage of the Conference on Confidence- and Security-Building Measures and Disarmament in Europe in order to deal also with disarmament.

Appendix 15F

Notifications of military manoeuvres in 1983, in compliance with the Final Act of the CSCE

State giving notification	Date of notification	Duration of manoeuvre	Designation of manoeuvre	Number of troops involved[a]	Area of manoeuvre
Norway	18 Feb	11–17 Mar	*Kald Vinter 83*	10 000	Troms and Nordland
Norway	18 Feb	11–17 Mar	*Viking 83*	10 000	Hedemark and South Trondelag
USSR	8 Jun	29 Jun–4 Jul		50 000	Kaliningrad–Baranovitji–Vitebsk–Tallin and eastern Baltic
USSR	4 Jul	25–30 Jul		26 000	DDR: Magdeburg–Jena–Dresden–Frankfurt am Oder
Yugoslavia	5 Aug	13–15 Sep	*Unity 83*	22 000	South Yugoslavia[b]
USSR	15 Aug	5–10 Sep	*Dnjestr*	23 000	Odessa military district
France	23 Aug	16–24 Sep	*Moselle 83*	22 000	North-east France
Sweden	25 Aug	25 Sep–5 Oct	*Ostkust*	20 000	Eastern military district
FR Germany	29 Aug	19–23 Sep	*Wehrhafte Löwen*	50 000	FR Germany[b]
Netherlands	30 Aug	20–29 Sep	*Atlantic Lion*	41 000	Netherlands and FR Germany[b]
FR Germany	30 Aug	20–29 Sep	*Atlantic Lion*	41 000	Netherlands and FR Germany[b]
FR Germany	30 Aug	20–29 Sep	*Confident Enterprise*	62 000	FR Germany
Denmark	31 Aug	20–24 Sep	*Ample Express*	10 000	Sjaelland
UK	3 Oct	24 Oct–5 Nov	*Eternal Triangle*	21 000	FR Germany
FR Germany	3 Oct	24 Oct–5 Nov	*Eternal Triangle*	21 000	FR Germany

[a] It is not advisable to add together the number of troops in different manoeuvres taking place during the same period of time, as some troops may participate in more than one manoeuvre.
[b] Foreign observers invited to attend.

16. Common security

EMMA ROTHSCHILD, *member of the SIPRI Governing Board*

Superscript numbers refer to the list of notes and references at the end of the chapter.

I. Introduction

In September 1983 SIPRI held an International Conference on Common Security. The idea of common security was described in the 1982 report of the Independent Commission on Disarmament and Security Issues, and has since been discussed in the United Nations and by other international groups.[1] The object of the SIPRI conference was to examine critically both the concept of common security and the policies which it may imply. In bringing together a diverse group of scholars and political leaders, SIPRI also hoped to stimulate a more general discussion of security policies and the concepts by which they are inspired or organized.

The 1980s seem to be a time of worsening insecurity. Many—although not all—the participants at the SIPRI conference expressed some dissatisfaction with the circumstances of international life. Much of the conference discussion was indeed overshadowed by ominous current events: by the shooting down of a Korean airliner by Soviet armed forces (which took place the day before the conference opened), by the expected deployment of new US nuclear missiles in Europe, and by the continuing violence in Central America. Several participants were dissatisfied with the security policies which had led to such events. Some went on to question the conceptual foundations of present policies; they saw a need for new concepts as well as for new policies.

Common security, as described by the Independent Commission, is founded on the overwhelming common interest in avoiding nuclear war. "Nations must begin to organise their security policies in cooperation with one another . . . Acceptance of common security as the organizing principle for efforts to reduce the risk of war, limit arms and move towards disarmament means, in principle, that cooperation will replace confrontation in resolving conflicts of interest." The recognition that no country could win a nuclear war required new ways of thinking about security and the use of force in international relations. The Commission explicitly contrasted common security and deterrence: "A doctrine of common security must replace the present expedient of deterrence through armaments. International peace must rest on a commitment to joint survival rather than a threat of mutual destruction."[2]

Much of the conference discussion was concerned with the 'doctrine' of deterrence and with deterrence policies. The Independent Commission was opposed to deterrence in a rather general sense, as the expression of the continuing importance of military force in international life. Several conference participants were especially concerned with nuclear deterrence, and with nuclear weapon policies.

II. For and against deterrence

The conference reflected what Stanley Hoffman described as the "complete dissolution of consensus about what deterrence means". Certain ideas of deterrence were nonetheless fairly warmly received. Thomas Schelling, defining deterrence as "a state of affairs in which sensible leaders of major countries will hardly even contemplate going to war", argued that it is "alive and well" and unlikely to be replaced within this century.[3] Deterrence was said to have prevented conflict in Europe over three decades; the present "technological and doctrinal crisis of deterrence" was indeed for Jean-Pierre Cot the most serious threat to European security.[4] "Classical deterrence", Richard Perle suggested, "inevitably involves and is built upon an element of fear." But "a certain amount of fear, the fear that induces caution, care and deliberation, is probably a healthy thing in international affairs"; the postwar period of peace in Europe "has been marked by quite extraordinary caution on the part of powers in possession of tremendous military power".[5]

Some participants distinguished between pure or minimal deterrence and the more extensive or 'credible' deterrence which both superpowers now observe: deterrence "by the ability to destroy the enemy's forces". They argued for "reversing the evolution of deterrence [and] restoring the original distinction between deterrence through the threat of retaliation and deterrence through war-fighting"[6]—for "dependence on deterrence" in the form of what Jerome Wiesner described as "a modest number of nuclear weapons properly safeguarded [which] will be a complete deterrent against much larger forces".[7]

Others saw a more extensive, political role for deterrence. "Defensive security"—defined as *dissuasion*, deterrence, *Abratung* rather than *Abschreckung*—meant for Alois Mertes that "the risk of a nuclear war was nearly zero", and Europe "one of the safest places in the world". The suitable deployment of nuclear forces could also protect against political influence (or against the susceptibility to political influence). "A credible strategic balance between the Soviet Union and the USA" remained of central political importance in that it could avert an atmosphere of "anticipatory compliance" or "preventive good behaviour" by the

Federal Republic of Germany towards the Soviet Union in the 1980s and 1990s.[8]

Those who opposed deterrence were concerned with similar issues. "Out of a degree of mutual distrust that would once have seemed pathological", Sissela Bok argued, "nuclear powers now compete with one another in perfecting the means to global catastrophe. But paradoxically, in so doing they are forced to rely on an equally unrealistic degree of trust in the rationality and competence of all who are in control of the weapons." To expect that "nuclear weapons are not likely to be used in the foreseeable future requires a vast leap of inductive faith".[9] Deterrence, another participant argued, "in the end threatens you with the questionable value of revenge", and "a revenge that includes self-annihilation". Such a threat is in the long run neither credible nor sustainable in a democratic society.[10]

Several participants were sceptical about the usefulness of distinguishing minimal deterrence from deterrence as actually practised. Policies whose objective was minimal deterrence would be criticized as imprudent and incredible. For Egon Bahr, the "deterrence doctrine" in its military aspect "connects war prevention with the capacity to fight wars": "you must have all the options of the opposite party, if possible better ones, with a competitive edge in order to be able to fight a war in the event that deterrence should fail". In this sense "deterrence and armaments are twins".[11] Others suggested that policies of credible nuclear deterrence have always required the ability to fight wars, and that the notion of a "stable nuclear balance" was illusory.[12]

There was extensive discussion of the political and psychological aspects of deterrence. Krister Stendahl argued that "deterrence—which is the attempt to maximize the usefulness of fear in human relations, deterrence based on an adversary model of reality—is not only creating fear but fear feeds on fear, a fear that blinds". This condition tended to bring out the less estimable characteristics of human beings; it also reinforced the propensity of the USA and the USSR to "divide everything else into East and West".[13] Some suggested that nuclear weapons had transformed the relationship between war and politics. For Vadim Zagladin, "On the one hand, war preparations and the arms race no doubt remain a tool and continuation of politics, a means of bringing pressure to bear by some countries on others, an instrument of blackmail. On the other hand, actual use of nuclear weapons, that is, an attempt to launch nuclear war, is in fact pointless, for nuclear war is incapable of solving any political problem."[14] Others argued that preparations for war were rather an instrument of political dominion within the nuclear blocs: "Deterrence, the idea of war, the reiterated memory of World War II, represents a powerful form of ideological conditioning . . . Mutual survival, not of people but of blocs, in fact, may depend on the threat but not the actuality of mutual destruction."[15]

III. Common security and deterrence

Some of the disagreement between proponents and opponents of deterrence rests, no doubt, on questions of definition. If the existence of nuclear weapons (at least other people's nuclear weapons) *requires* policies of nuclear deterrence, then the discussion of alternatives to deterrence becomes trivial.[16] There is little chance of nuclear disarmament "within this century", and countries will presumably continue to try, through military and other policies, to prevent the use of nuclear weapons against them. Those countries which possess nuclear weapons will presumably continue to have some policies for deciding which weapons they can get rid of, which they should modernize, what function the weapons should have in military planning and how the weapons should be used.

All nuclear policies, on the NATO side, have been justified by the requirements of 'deterrence' (just as virtually identical policies on the WTO side have been justified by an opposition to deterrence). If deterrence is *defined* as the sum of past and present nuclear weapon policies, then the discussion of alternatives can again appear trivial: to replace deterrence is to jettison previous policies and practices. Discussion of the relationship between deterrence and peace can be similarly unedifying, at least in the absence of historical reasoning about the political and psychological causes of war. (The existence of nuclear weapons might well have induced caution in international affairs—although it is open to question whether, compared with other countries, the recent world-wide behaviour of the United States and the Soviet Union has been notably cautious.)

The importance of considering alternatives to deterrence—and common security in particular—is above all a matter of prescriptions or concepts. Would some other 'concept' provide a better way of thinking about nuclear and other security policies? Would it be more likely to minimize the chances of nuclear war and maximize the chances of nuclear disarmament? Would it avoid some of the moral and political inconveniences of deterrence? The idea of a 'concept of security' itself, of course, requires further exploration. The English historian Michael Howard only hinted at such an exploration when in a recent essay he proposed the "concept of reassurance" as a new "term of art in strategic analysis".[17] Deterrence has been burdened—by its proponents and opponents—with an unsustainable load of practical and prescriptive expectations. Other concepts could lead to different analysis and different prescriptions.

Common security and deterrence are in some respects complementary, as several conference participants argued. The concept of common security could be taken to imply a particular choice of arms limitation policies; it was suggested in one conference paper (by the present author) that the common interest in avoiding war and perpetual military competition should lead the superpowers to emphasize confidence-building measures and efforts to prevent new "qualitative" developments in military technology.[18] Such policies are obviously compatible with deterrence, extended deterrence or with the Soviet doctrine of "equal security". In the Independent Commission report, the transition to common security from deterrence through force (including non-nuclear force) was a process for the fairly long term.

The discontinuity between common security and deterrence appears in the choice of objectives or ways of thinking about security. The influence of concepts on security policy comes in part through popular opinion. Common security, one participant said, "provides an inkling of a view of a world in which the present adversary organization of reality does not apply".[19] The enmity between nations and international ideals is founded on deep political and historical differences. But it may be made worse by the existence of nuclear weapons, and by concepts of security which justify those weapons as a means to deter the enemy. A way of thinking which emphasizes common interests could promote political rather than military competition. It could promote the end towards which deterrence is in theory a means. One important distinction is perhaps between preventing nuclear war and deterring nuclear attack. The two are not identical, as various homely metaphors suggest (preventing tooth decay is not, for example, the same as deterring bacteria); they may also require, or imply, different security policies.

IV. Common security and the rest of the world

There was extensive discussion at the conference of whether the concept of common security applied only to the nuclear powers. Some participants argued that, by emphasizing the common interest in preventing nuclear war, proponents of common security tended to reinforce the centrality of US–Soviet relations in international life. The preoccupation with nuclear dangers could perpetuate injustice and even make conventional wars more likely; it ignored the "reality of common insecurity".[20]

The immediate interest of common security derives from the existence of nuclear arsenals: from the perception that no country could win a nuclear war. But concepts of security which recognize the (military) uselessness of nuclear force could tend to reduce the centrality of superpower relations. They could suggest an interest of all countries in avoiding not only nuclear war but also other disputes between the nuclear powers. Common security seems to imply, for example, that nuclear weapon policies should constitute a small subset of policies for preventing nuclear war. Under these circumstances, non-nuclear weapon countries within the nuclear blocs might be expected to play a much greater role in collective security.

Third World and neutral countries have an evident interest in helping to prevent nuclear war. "The bloc division of the world is a constant factor destabilizing security", Lazar Mojsov argued: "World War III could be unleashed in the regions of the Third World unless a stop is put to bloc rivalries."[21] Common security, it was suggested, did not mean that the superpowers should agree to preserve the *status quo* in a given region. It meant rather that the countries of that region should try to resolve conflicts without involving the superpowers. They would thereby reduce the threat of escalation to nuclear war, the increased violence associated with conventional arms transfers and the rhetorical violence of world-wide political confrontation. For Central America, Rodrigo Carazo argued, common security should mean an end to military supplies and aid for belligerents, an opportunity for economic and social justice, support for the efforts of the regional Contadora Group, a region which was no longer "the mournful playground of foreign interests".[22]

Existing concepts of security, several participants argued, ignore the social, economic and cultural aspects of security. Their proponents seek (often unsuccessfully) the security of "governments, not people". Common security, which minimizes the importance of military force, could stimulate discussion of broader and more satisfactory concepts. Development, defined as "the constant improvement of the well-being of the whole of the population of any country", was described as a precondition for security;[23] military spending threatened economic security and economic insecurity in turn increased military and political tensions. "Instability is a bad advisor anywhere in the world", Raul Prebisch said.[24]

The cumulative pressures of military, political and social tensions were dangerous for Europe as well as for the Third World. Bruno Kreisky described the political repression and economic insecurity which—more than pacifism or appeasement—led to World War II; he expressed concern about the political consequences for Europe of social protest against unpopular nuclear weapon policies. Democracy, he said, "cannot forego the struggle for people's understanding" or "its working hypothesis, which is to convince people of its aims".[25]

V. Confidence and common security

The conference considered an extremely broad range of security policies (in its general meetings and in working groups on the US–Soviet relationship, European security, security in the Third World and on the concept of common security). One of the principal themes of these discussions was the effort to define 'confidence' and the policies which could build or destroy it. There seemed to be a particular affinity between common security and the process of creating confidence: as Johan Jørgen Holst suggested, "the potentially catastrophic consequences of 'spirals of reciprocal fear' " reinforce the "shared interests" of adversaries in avoiding military actions "they would prefer to forego if they could have confidence in the willingness and ability of the adversary to show equal restraint".[26]

Much of the discussion of specific confidence-building measures was concerned with Europe. Holst proposed a plan for "crisis stability" which could include a zone free of battlefield nuclear weapons, restraints on main battle tanks, bridging equipment and certain forms of airpower, and a chemical weapon-free zone. Sverre Lodgaard discussed a series of "disengagement zones" for Europe, to be accompanied by reciprocal moves towards non-provocative conventional defence; such a process would change "threat perceptions" on both sides and thus create the conditions for force reductions.[27] Karlheinz Lohs suggested that a chemical weapon-free zone in central Europe could not only increase confidence but also "provide a show case for testing the interface of national and international verification systems".[28]

The political consequences of such efforts could be substantial. They would, for example, require increased autonomy for individual countries within the military blocs, particularly those close to the zone of potential confrontation. There is also an eventual tension between confidence-building measures and deterrence, to the extent that building confidence means reducing the threat of military force, while deterrence means making the threat credible. Alois Mertes expressed this tension clearly in discussing measures to "raise the nuclear threshold": "If one wishes to build a wall between conventional and nuclear warfare, one must expect that this wall will be strong enough to let a conventional war appear feasible, but pervious enough, if a conventional war were to break out, to not be able to prevent the transition to nuclear warfare."[29]

Several participants suggested that the achievement of "parity" in nuclear or other forces (as endorsed by the Independent Commission) might contribute less to international confidence than would explicit confidence-building measures. Vitalij Zhurkin argued that "strategic stability of our time, built as it is on the parity of forces, imparts a new dimension to the international political situation, namely, contributing towards lessening the danger of war".[30] But for others, a "balance of power . . . cannot secure peace on a permanent basis as force is immanent in it and presupposes a constant struggle for achieving superiority".[31] Martin Saeter, who like several participants emphasized the connection between common security and detente (in Europe and elsewhere), argued that "the concept of parity . . . is explicitly linked to the continued maintenance of the military blocs in Europe, where the process of detente is aimed at the building down of blocs. A policy of parity will unavoidably tend to stress the military factors in East/West relations at the cost of the political and economic ones".[32]

The conference also considered broader questions of confidence. "It is essential", Olof Palme said, "to begin to understand what confidence can mean, even between countries with deep political conflict or different military capacities". Policies of "qualitative" restraint could help: "the effort to limit the technological arms race is itself a way of increasing confidence: confidence in the future".[33] Sissela Bok described the effects of distrust and secrecy in undermining negotiations and stimulating military competition, with debilitating national and international repercussions; she urged explicit efforts against "confidence-destroying measures".[34]

Lasting confidence also involved social, economic or cultural co-operation. Several Nordic participants suggested that the pattern of stability and security established over several decades in the Nordic region—where military relations were of relatively minor importance—was an expression of the idea of common security.[35] Nordic co-operation, Karin Söder said, "could be one example of how to build up common security among small nations".[36] It seemed to constitute a case of "positive and irreversible processes" toward regional confidence.

VI. Concepts of security

The SIPRI conference welcomed a fairly dense collection of changing and competing ideas: "equal security" and "collective security", a "common dilemma", "common insecurity" and *Unsicherheitspartnerschaft*. It showed that common security provides a way of thinking about and understanding the search for security. In so doing, it began to explore the concepts which lie behind present security policies and present insecurity. It explored the concept of a "concept of security", and the popular ideas on which security depends. It was a response, of sorts, to Albert Einstein's premonition of three decades ago: "The unleashed power of the atom has changed everything except our modes of thinking, and we thus drift toward unparalleled catastrophes."

Notes and references

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17. Multilateral arms control efforts

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Superscript numbers refer to the list of notes and references at the end of the chapter.

Again in 1983, multilateral arms control and disarmament measures were considered in the 40-nation Committee on Disarmament (CD), which is a negotiating body, based in Geneva; and in the United Nations General Assembly, which deliberates arms control primarily in its First (Political) Committee.[1] (The CD changed its name to the Conference on Disarmament, beginning with its 1984 session.)

The three measures which were high on the agendas of these bodies in 1983 were a comprehensive nuclear test ban, chemical disarmament and arms control in outer space. Some advance, though a modest one, was made towards a convention banning the production and possession of chemical weapons. However, in the other two areas there was no progress at all. New proposals were submitted for a comprehensive test ban treaty, but the United States indicated that such a treaty was only a long-term goal of its policy. So far as outer space is concerned, there was not even agreement to set up a working group to discuss relevant arms control measures.

The following sections of this chapter describe the problems that were discussed in each of these areas of arms control.

I. Test ban

On 14 June 1983, Sweden submitted to the CD a revised and expanded version of its 1977 draft treaty[2] banning nuclear weapon test explosions in all environments. The new draft[3] developed in great detail the points made in the tripartite report of 30 July 1980 on the status of the negotiations (which have since been adjourned *sine die*) between the UK, the USA and the USSR on a comprehensive test ban treaty.[4] It also took into account the "basic provisions" of such a treaty,[5] proposed by the Soviet Union on 16 February 1983, and based on the tripartite report, as well as progress made in recent years in the detection and identification of seismic events.

The Swedish draft

In addition to the main undertaking not to carry out nuclear weapon test explosions in any environment, the Swedish draft treaty included the following obligations to be assumed by the parties: (*a*) to refrain from encouraging, assisting or in any other way participating in the carrying out of such explosions anywhere; and (*b*) not to carry out any nuclear explosion for peaceful purposes until international arrangements for conducting them are worked out which would be consistent with this treaty and other relevant international treaties—such arrangements precluding acquisition of military benefits might take the form of a special agreement or agreements.

To verify compliance, the parties would use the so-called national technical means of verification, and engage in an international exchange of seismological data and data on atmospheric radioactivity. Each party would be entitled to request information from any other party, as well as request on-site inspection on the territory of another party in order to ascertain whether or not a specified event was a nuclear explosion. If the request for inspection were not granted, the reason for refusal would have to be stated. To avoid unfounded accusations, the party conducting a large non-nuclear explosion may itself invite inspection.

To oversee the implementation of the treaty and of the international verification arrangements, a consultative committee, assisted by a technical expert group and a permanent secretariat, would be established.

The treaty would enter into force upon the deposit of 20 ratifications, including those by the governments of the UK, the USA and the USSR. It would be of unlimited duration, but if it were not adhered to by all the permanent members of the UN Security Council five years after its entry into force, each party would have the right to withdraw from it with immediate effect.

Three protocols would be annexed to the treaty as an integral part of it. Protocol I would deal with international co-operative measures to facilitate verification. These measures include designated national seismological stations, a seismological data exchange system and especially established international data centres. The stations selected for participation in the international exchange would have the same basic equipment and would be operated, calibrated and maintained according to agreed specifications. Data from each station would be routinely reported through an appropriate national body designated by each party participating in the exchange. Additional seismological data would be provided upon requests submitted through international data centres. For the transmission of data the Global Telecommunication System of the World Meteorological Organization (WMO/GTS) or other agreed communication channels could be used.[6]

The international centres would receive the seismological data, process them without interpreting the nature of events, and make the processed data available to all participants. A similar exchange would be established regarding data on atmospheric radioactivity. With a view to improving the verification of the treaty, negotiations on additional measures would be undertaken by the parties and an agreement on such measures would be annexed to this protocol.

Protocol II would lay down the procedures for international on-site inspections and the manner of their conduct, including the rights and functions of the inspecting personnel. The purpose of such inspections is to be merely fact-finding; the inspection team should not make an assessment of the nature of the inspected event, but present a factual report of its observations. The suggested inspection techniques include visual inspection, measurement of radioactivity, seismological measurements, measurement of temperature anomalies, as well as drilling.

Protocol III would set out the functions and rules of procedure of the bodies to be established upon the entry into force of the treaty: the consultative committee, the technical expert group and the secretariat. In addition to its main task of overseeing the implementation of the treaty, the consultative committee, open to all parties, would prepare conferences reviewing the operation of the treaty; review the verification arrangements; decide on changes in the equipment and technical procedures used to verify compliance; serve as a forum where parties could make inquiries and receive information as a result of such inquiries, where they could request international on-site inspection, and where the factual results of such inspections would be presented; supervise the work of the technical expert group and the secretariat; and decide on the budget of the secretariat and elect its director and deputy director. The committee would work on the basis of consensus in reviewing the overall operation of the treaty and of its verification arrangements, and in deciding on changes in the equipment and technical procedures used to verify compliance. Decisions on the budget of the secretariat and on its directorship and deputy directorship would be taken by a majority of the members present and voting.

The technical expert group, open to governmental experts from all parties, would evaluate the technical performance of the international verification measures, propose changes in the equipment and technical procedures, undertake studies that may be requested by the consultative committee, and serve as a forum for technical discussions of events for which parties may seek clarification. It would try to reach decision by consensus, failing which it would present reports reflecting the views of all the participants.

The secretariat would support the work of the consultative committee and the technical expert group. It would also see to it that the participating seismological stations were operated, and data were reported, in accordance with the provisions of protocol I; supervise and review the data exchange; supervise the operation of the international data centres; compile and present operational statistics and reports on the experience of the international data exchange; maintain lists of international experts available for conducting on-site inspections and of the equipment necessary for such inspections; and organize and conduct these inspections and report the results obtained to the consultative committee.

Peaceful nuclear explosions

In the discussion of the Swedish proposal, the most controversial problem proved to be that of peaceful nuclear explosions (PNE).

In the 1980 tripartite UK–US–Soviet report, the negotiating parties agreed that a treaty prohibiting nuclear weapon test explosions would be accompanied by a protocol on PNEs, which would be an integral part of the treaty. The protocol would establish a moratorium: the parties would refrain from carrying out PNEs until arrangements for conducting them were worked out which would be consistent with the treaty being negotiated as well as with the 1963 Partial Test Ban Treaty (PTBT) and the 1968 Treaty on the Non Proliferation of Nuclear Weapons (NPT). The relevant formulations of the Swedish draft were close to those of the tripartite report. Nevertheless, the United Kingdom, one of the signers of the report, decided to oppose a separate regime for PNEs and advocated an outright ban on all nuclear explosions, without exception.[7] The reasoning presented can be summarized as follows.

There may be differences in detail between the design of a nuclear weapon and that of a nuclear explosive device intended for peaceful purposes, but the basic technology is the same; any nuclear explosive device ostensibly developed for peaceful purposes is inherently capable also of being used as a weapon. If PNEs remained unconstrained under a test ban treaty, nuclear weapon states could use them for testing the continued serviceability of stockpiled warheads or for testing new warheads, while non-nuclear weapon states could use them to develop nuclear explosive technology. All this would render the treaty ineffective. No fool-proof system of verification could be devised and established to ensure that military benefits were not being derived by states carrying out PNEs. Even with the most intensive form of control, information of a military nature could be obtained from such explosions. In other words, the development and use of PNEs would be incompatible with the objectives of a comprehensive test ban treaty.

The Netherlands also insisted that a test ban should cover PNEs. In its view, the hypothetical economic value of such explosions cannot outweigh their negative effect on the system of verification of a test ban treaty and for the cause of non-proliferation of nuclear weapons.[8] This position was supported by several other Western states, including the USA, and by Japan. It was viewed by them as consistent with the provisions of the PTBT, which postulated the permanent banning of "all nuclear test explosions". Australia suggested that a comprehensive test ban treaty should contain a clause prohibiting the carrying out of any nuclear weapon test explosion or "any other nuclear explosion".[9]

Several Third World countries, in particular Argentina, Brazil, India and Pakistan, maintained that the Western attitude towards PNEs was not in keeping with the obligations concerning peaceful uses of nuclear energy assumed under arms limitation agreements, and that it introduced an element of discrimination against the non-nuclear weapon states, which was unacceptable. They proposed that a general-purpose criterion should be applied, as in the case of defining chemical and biological warfare agents, which would mean that the *purpose* of the explosion should determine whether it is to be treated as peaceful or military. Insisting that a test ban should apply only to nuclear weapons, these states considered the question of PNEs to be a matter peripheral to the central issue of curtailing the nuclear arms race.

The Soviet Union and other Socialist states suggested that a moratorium be established on PNEs until appropriate arrangements for conducting them were worked out. They shared the view that this question should not be used to divert attention from the urgent need for a treaty banning nuclear weapon tests but could be settled after the conclusion of the treaty.

Participation in the treaty

France and China refused to take part in the discussions on nuclear tests. France reiterated its position, which coincided with the provisions of the Final Document of the UN First Special Session on Disarmament, that the cessation of tests must take place within the framework of an effective nuclear disarmament process and that, consequently, any commitments France might enter into in the matter of tests should be linked with those it would be prepared to undertake as regards the limitation of its own nuclear forces. But France would be able to embark on this process only when the two largest powers had reduced their nuclear arsenals so as to narrow markedly the gap between those arsenals and the nuclear means possessed by France.[10] Similarly, China held the view that the cessation of nuclear tests was merely one aspect of the overall problem of nuclear disarmament. Therefore, only when the USA and the USSR, the states with the largest arsenals, had taken the lead in ceasing the testing, improvement and manufacture of nuclear weapons and had reduced their nuclear armaments by 50 per cent would China undertake the commitment to cease the development and manufacture of nuclear weapons, and would join these powers in the reduction and eventual total destruction of these weapons.[11]

In this connection, there was an exchange of views in the CD regarding participation of the nuclear weapon states in a nuclear test ban treaty. Certain delegations, in particular India, considered it essential that all such states should become parties from the outset. Others agreed with the Swedish proposition that adherence only by the UK, the USA and the USSR among the nuclear weapon states should be sufficient for the treaty to enter into force, on the understanding, however, that the remaining two nuclear weapon states would join the treaty within a specified period of time.

Verification

At its 1983 sessions the *Ad Hoc* Group of Scientific Experts, established by the CD in 1976 to consider international co-operative measures to detect and identify seismic events, discussed the conduct, under the communication arrangements provided by the WMO, of a new experiment with the exchange and analysis of Level I seismological data. (These are selected, processed data, as distinct from the more complete Level II data from actual seismic measurements.) The experiment should result in the further elaboration of operational procedures.[12]

A number of points were made and discussed in the CD, regarding both technical and institutional problems of verification of a test ban.

The United Kingdom pointed out that, while there was general agreement within the scientific community that available seismic methods allowed seismic events with body wave magnitudes of about 4 or more to be detected with a high probability, there was no unanimity about the relationship between the magnitude of a seismic signal and the yield of the nuclear explosion which produced it. Studies by British scientists showed that a seismic signal of magnitude 4.5 can be related to about a three-kiloton explosion which is close coupled with surrounding hard or water-saturated rock. For explosions in close contact with dry and soft rock in a stratum of sufficient thickness, a seismic magnitude of 4.5 equates to a yield of about 30 kt, and for explosions detonated in a sufficiently large cavity in a geologic formation (assuming that the formation is able to support a large cavity) it equates to a yield of up to 300 kt. The British assessment is that a nuclear weapon state able to test without producing seismic signals in excess of the detection and identification threshold could realize a very significant military advantage through an undetected breach of a comprehensive test ban treaty. The possibility of conducting clandestine tests could be exploited to affect the balance between the nuclear weapon states, since testing even at low yield levels allows a state to guard existing weapon stockpiles against ageing effects and also to develop new warhead designs. The United Kingdom is therefore of the view that the correct path towards a test ban treaty, "however long it may prove to be", leads through detailed consideration of the verification issues.[13]

Mexico and a number of other countries reiterated the conviction that the means of verification at present available were sufficient to provide a reasonable assurance of compliance with a nuclear test ban treaty. The opinion of known US seismologists was quoted to the effect that clandestine explosions could be identified even if extreme measures were taken to evade detection.[14] Reference was also made to the 1972 statement by the UN Secretary-General that all the technical and scientific aspects of the problem had been so fully explored that only a political decision was necessary in order to achieve final agreement.[15] However, others were of the view that adequacy of means of verification could only be defined by each state on the basis of its own national requirements.

Speaking of the international exchange of seismic data, which it considered to be one of the most effective means of verification for a nuclear test ban, Japan stressed that a system of such an exchange should be able to verify the absence of underground nuclear explosions at as low a level as possible with a high degree of confidence. The desirable initial target mentioned was seismic magnitude 4.0 and 90 per cent confidence.[16]

Sweden elaborated on the proposal, included in its draft treaty, for international surveillance of airborne radioactivity (ISAR). A system for ISAR would consist of some 50–100 fully equipped sampling stations and about half a dozen regional measurement laboratories (one on each continent), which could form part of the data centres already envisaged for the collection, analysis and handling of seismic data in connection with the monitoring of a comprehensive test ban treaty. At each sampling station air would be continuously blown by a pump through a glass fibre filter. The filters would be changed once or twice a week and sent for analysis to the regional measurement laboratories. A fully equipped sampling station would cost some $20 000 to establish and about half that sum per year to operate.[17] The Swedish proposal was received with understanding by a number of Western countries. They argued that once a comprehensive test-ban treaty entered into force and an efficient international seismic monitoring system were in operation, it could become tempting to continue nuclear testing outside the underground environment. However, Argentina, Cuba, India and the Soviet Union were critical, contending that the system proposed would further and unnecessarily complicate the problem of verification.

Institutional arrangements

As one of the institutional arrangements for a comprehensive test ban treaty, Australia suggested the establishment of an international management panel, the role of which would be to ensure the smooth functioning of the monitoring and verification arrangements. The panel would be set up immediately upon entry into force of the treaty, and would be composed of 15 experts appointed by the depositary of the treaty on the recommendation of the consultative committee, on which all parties would be represented. The panel would decide procedural questions related to the organization of its work by consensus when possible, but otherwise by a majority of those present and voting; there would be no voting on matters of substance. One of the tasks of the panel would be to conduct international on-site inspections, but both the party requesting an inspection and the party accepting it would be entitled to appoint an expert, *ex officio*, to the panel for the duration of its consideration and implementation of the inspection request.[18]

(A complete list of official documents and working papers related to the nuclear test ban and produced in the course of the 1983 session of the CD can be found in the CD report of 1 September 1983.[19])

The working mandate of the CD

The task given to the CD *Ad Hoc* Working Group on a nuclear test ban was "to discuss and define, through substantive examination, issues relating to verification and compliance with a view to making further progress toward a nuclear test ban".[20] However, in the absence of an agreement on the substance of the ban, examination of purely technical details of a control mechanism or of the composition or administrative procedures of auxiliary verification bodies, which are matters of secondary importance, is unlikely to bring the CD closer to a treaty. It is generally recognized that the form and modalities of verification to be provided for in any specific agreement should be determined by the purposes, scope and nature of the agreement.[21] The work of the Group under a mandate precluding elaboration of actual treaty provisions cannot be considered a negotiation, to which the three nuclear weapon powers have been committed for years. In any event, the USA has made it clear that its participation in the Working Group should not be understood as indicating an intent to begin "immediately" the negotiation of such a treaty.[22]

A large number of CD member states held that the task of the Working Group should be broadened. Reference was made to the 1981 proposal by non-aligned states to consider all aspects, that is, not only verification of compliance but also the scope and the final clauses of a test ban treaty,[23] as well as to the more general 1982 proposal by the German Democratic Republic to negotiate a treaty prohibiting all nuclear weapon tests, taking into account the existing proposals and future initiatives.[24] Accordingly, one UN General Assembly resolution, adopted in 1983, urged the CD to proceed "promptly" to negotiations with a view to elaborating a multilateral treaty on the prohibition of nuclear weapon tests,[25] while another resolution, reiterating a request made a year before,[26] asked the CD to consider a revision of the Working Group's mandate.[27] The Assembly also called upon the UK, the USA and the USSR, by virtue of their special responsibilities under the PTBT and the NPT and as a provisional measure, to bring to a halt all nuclear test explosions, either through a trilaterally agreed moratorium or through three unilateral moratoria.[28]

Conclusion

With each nuclear blast (and there have been on average about 45 explosions a year since the signing of the PTBT), prospects for curbing the nuclear arms race diminish, while the dangers of nuclear weapon proliferation increase. In spite of some valuable contributions to the debate on a comprehensive test ban made in 1983, the positions of the main protagonists—the USA and the USSR—were even further apart than three years before when the two powers presented to the CD, together with the UK, a report on their trilateral negotiations.

A major obstacle to any agreement on the cessation of tests, be it a formal treaty or a declared moratorium, is the attitude of the US government, which has now decided to regard such a measure as a long-term goal of its policy rather than a high priority objective of arms control efforts, as most countries do. Since testing continues to be indispensable for the nuclear weapon powers to carry into effect their nuclear armament programmes, only a political decision to constrain further development of warhead designs and to freeze the nuclear stockpiles at their present qualitative level could break the deadlock in discussions on the cessation of nuclear tests.

II. Chemical disarmament

In 1983 the *Ad Hoc* Working Group of the CD which deals with the ban on chemical weapons, a priority item on the CD's agenda, continued its work. The three most comprehensive papers before the Group were the 1980 joint US–Soviet report on the bilateral negotiations on the prohibition of chemical weapons;[29] the "basic provisions" for a chemical weapons convention, proposed in 1982 by the USSR;[30] and the "detailed views" on the contents of such a convention, submitted in February 1983 by the USA.[31] The problems most extensively discussed in the CD are reported in this section along with the points made and specific proposals put forward by individual delegations. (A complete list of official documents and working papers related to chemical weapons, produced in the course of the 1983 session of the CD, can be found in the CD report of 1 September 1983.[32])

Destruction/elimination of stockpiles[33]

The USA proposed that the convention prohibiting chemical weapons should cover supertoxic lethal, other lethal, and other harmful chemicals, such as incapacitating chemicals (a classification based on the criterion of toxicity), as well as the precursors (chemicals used in their production),[34] but not riot-control agents or herbicides. Toxins (synthetically produced) would be included implicitly since they are toxic chemicals. The reason given for the omission of riot-control agents and herbicides was that these chemicals would remain available in significant quantities for legitimate purposes.

The process of eliminating chemical weapons by destroying them should begin not later than six months after the convention has entered into force, and be completed not later than 10 years after that date. It should be carried out according to an agreed schedule, employing procedures which permit systematic international on-site verification. Such verification would have to take place on a continuous basis until destruction was completed. The depositary of the convention would be notified annually about the implementation of the parties' plans for elimination of chemical weapon stocks; the parties would also have to certify to the depositary that their stocks had been eliminated, not later than 30 days after the elimination process had been completed.[35]

In a working document of July 1983, the USA emphasized that verification procedures for destruction of declared stocks should be designed to confirm the identity and quantity of the materials destroyed, and to confirm that the materials had actually been destroyed. The principles defined by the USA to guide verification of chemical agent destruction include: a detailed engineering review of the disposal facility by international verification personnel, including on-site inspection, before destruction operations begin; continuous inspection during periods in which destruction operations are under way; confirmation by the inspectors of the validity of all data used for verification purposes; minimizing interference with the operation of the destruction facility, while providing effective verification; and close co-operation between international verification personnel and host state operating personnel.[36]

To facilitate verification, Yugoslavia proposed that a declaration of existing stocks of chemical warfare agents and chemical weapons should be made immediately or as soon as possible after the entry into force of the convention, say within 30 days. The declaration should specify the existence and location of stocks and the type and quantity of agents and weapons, and should contain proposals regarding the manner in which the stocks were to be destroyed and information about when the destruction would begin and how it would be verified. At this stage, the parties would also have to declare stocks of precursors.[37]

The Soviet Union proposed that the parties should declare, also within 30 days after the convention entered into force, their stocks of chemical weapons, both filled and unfilled, their precursors and the components of binary weapons, by their chemical names and by the toxicity of the chemicals, in metric tons, and their stocks of chemical munitions by types and calibres. It considered, however, that the requirement to declare locations of the stocks was unrealistic, because it did not take into account the possible general use of such places where chemical weapons were kept and might affect defence interests not connected with chemical weapons. Instead, the USSR suggested that provision should be made for the creation of store-houses at the specialized facilities for the destruction of these stocks, the location of which would be declared concurrently with the declaration of the destruction facilities. At such places of storage, international verification would be permitted on a 'quota' basis, that is, through an agreed number of annual international inspections. The frequency of inspection visits would depend on the quantity of the stocks to be destroyed at a facility, the capacity of the facility, the toxicity of the chemicals and other relevant factors.[38]

The German Democratic Republic suggested that binary chemical weapons be destroyed first. Their destruction should start within six months of the convention entering into force, and be completed within two years, while the destruction of other chemical weapons should begin within eight years and be completed within 10 years after entry into force of the convention. The GDR also reiterated the Warsaw Treaty Organization's proposal for a Europe free of chemical weapons and expressed readiness to enter into negotiations with states interested in creating a chemical weapon-free zone in central Europe.[39]

The United States considered the proposal to single out binary chemical weapons for special treatment as "extraordinarily one-sided", and as intended to preserve Soviet chemical weapon capabilities while eliminating those of the USA.[40] As regards chemical weapon disengagement in Europe, the opinion of the Federal Republic of Germany was that removal of chemical ammunition would not protect the European zone from being attacked with the same kind of ammunition from the outside, by ordnance or from aeroplanes.[41]

Italy requested that the destruction of stocks of chemical weapons should be accompanied by extensive environmental and security measures, which could affect both the methods of destruction and the duration of the operations in question. In this connection, it suggested that a clause be included in the convention permitting the transfer of stocks of chemical weapons for purposes of destruction under appropriate international control. This would be, in the opinion of Italy, the most reliable way of eliminating certain stocks.[42]

Agreement could not be reached on the following questions:

1. Should the location of chemical weapon stocks be declared as part of the initial declaration?
2. What information should be provided about the stocks in such a declaration?
3. Should the declared stocks be subject to prompt and systematic international on-site inspections and, if so, on what basis?
4. Should the declared stocks be subject to systematic international on-site monitoring until they are eliminated and, if so, on what basis?
5. Could some stocks, as an alternative to their destruction, be eliminated by being used for non-hostile purposes and, if so, which chemicals could be so used, in which quantities, and under which verification provisions?
6. What specific measures are required for systematic international on-site verification?
7. What should be the deadline for beginning the elimination of stocks?
8. How should the general schedule for stockpile destruction be defined?
9. What should be the nature of the provisions regarding transfer of declared stocks from one party to another for the purpose of destruction, and regarding chemical weapons found after the initial declaration has been made?

Destruction/elimination of the means of production

According to a US proposal, each party should cease immediately all activity at any chemical weapon production or filling facility; close each facility according to agreed procedures which would render the facility inoperative; permit systematic international on-site inspection promptly after declaration, and subsequently at agreed intervals until the facility is destroyed; permit the monitoring of each facility by appropriate types of sensor; destroy each facility by razing it, employing agreed procedures which permit systematic international on-site verification; begin destruction of the chemical weapon production and filling facilities not later than six months after the date on which the convention entered into force and complete the destruction not later than 10 years after that date; permit systematic international on-site verification of the destruction of such facilities; undertake not to construct any new facilities, or modify existing ones, for purposes proscribed by the convention; annually notify the depositary of the convention regarding implementation of the plan for the destruction of facilities; and certify to the depositary that the facilities have been destroyed, not later than 30 days after the destruction process has been completed. A chemical weapon production or filling facility could be temporarily converted for destruction of chemical weapons, but it would have to be destroyed as soon as it was no longer in use.[43]

According to a Yugoslav proposal, the declaration of production facilities should specify the location of the facility and its owner; complete documentation on the technological processes, the facility's capacity and the raw materials used, apparatus, measuring instruments, ventilation systems, etc.; as well as include a proposal for the destruction of the facility. In the case of production facilities for precursors, the declaration should also describe the technological process, capacity and technical documentation, and contain a proposal for destroying or dismantling the facility. Filling facilities for chemical weapons should be similarly declared and closed within 30 days of the entry into force of the convention. The declaration of these facilities should specify their location and capacity; the agents used for filling, and the type and kind of the weapons produced; measuring instruments; as well as plans for destruction.[44]

The Soviet Union proposed that elimination of chemical weapon production facilities should start not later than eight years after the convention has entered into force, and that the declaration of their location should be made one year before that date. Consequently, the initial declarations of the parties would refer only to the existing capacities for the production of chemical weapons.[45]

Thus, the differences which remained concerned the contents and the timing of the declaration of chemical weapon plants and the specification of their location, as well as the methods of their elimination and verification.

Non-production of chemical weapons in the chemical industry

To make sure that the substances listed as key precursors were not being used for the production of chemical weapons, it would be necessary, in the view of the United Kingdom, to subject to inspection the facilities which produce these substances. An appropriate verification regime for declared facilities would comprise the following components: (*a*) declarations of facilities producing chemicals specified in an agreed list, and of facilities designed, constructed or used for such purposes in the past; (*b*) periodic random selection of a number of such declared facilities for on-site inspections; and (*c*) on-site inspections by a team of inspectors. The objectives of on-site inspection would be to ensure that the quantities of a particular substance being produced at the facility under inspection were compatible with the declared use; that any stockpiling was carried out in a manner and quantity compatible with the declared civil use; and that the production facilities had not been modified in such a way that they could be used to produce chemical warfare agents. All such measures would apply to key precursors for supertoxic chemicals. As regards dual-purpose chemicals which have a wide civil use but are also important in chemical warfare, there would have to be a requirement for a declaration of all facilities producing these chemicals above a pre-determined quantity, and of their civil uses. In the opinion of the United Kingdom, inspections would affect few facilities and could be so designed as to cause as little disruption as possible to the chemical industry; the number of routine inspections would be kept to a minimum and the inspection procedures could be both simple and confidential; they would not involve intrusion into research activities or into the details of production.[46]

Sweden noted that routine monitoring of non-production of supertoxic lethal chemicals and key precursors on the basis of agreed on-site visits according to a random selection system would help to avoid the "politically cumbersome" verification by challenge.[47] Also, the Netherlands and the United Kingdom thought that routine monitoring would be preferable, because it may be difficult to acquire enough information to justify a request for a challenge inspection, and because a challenge could create distrust and lead to recriminations.[48] Nevertheless, in the opinion of Sweden, verification by challenge would be necessary when the destruction period had expired and when the parties could not resolve a controversy through consultations. Since verification can be arranged in such a way as to preclude disclosure of unrelated sensitive information to the challenging party, turning down a request for on-site inspection would be perceived as a tacit admission of violation.[49] However, the Soviet Union expressed the view that one cannot demand from a state to which a request was addressed that it should automatically accept verification.[50]

Yugoslavia suggested that the production of key precursors for chemical weapons should be prohibited along with the weapons themselves. If their application in civilian industry were proven, their production should be carried out under strict control. States producing precursors for chemical weapons should be obliged to submit an annual report on the capacity of their production and on the further processing of these chemicals.[51]

Important differences remained with respect to possible restrictions on supertoxic chemicals for permitted purposes. These are defined as industrial, agricultural, research, medical and other peaceful purposes, as well as law enforcement and protective purposes, and military purposes (such as the use of chemicals as rocket fuels) which are not related to chemical weapons. In particular, there were no identical views on whether there should be a limit on the amount of supertoxic lethal chemicals and key precursors which a party might have for all permitted purposes, including protective purposes and, if so, what the agreed amount should be and what the agreed production/capacity limit of a small-scale facility producing supertoxic lethal chemicals for permitted purposes should be. Neither was there agreement on the development of lists of chemical substances meeting the criteria of key precursors. The topics to be further discussed in order to develop procedures for verifying non-production of key precursors for chemical weapon purposes include information to be exchanged concerning the production facility location and capacity, the production level, civil use, and so on.

Prohibition of transfer

In the view of the United States, not only transfer of chemical weapons but also transfer to anyone "other than another party" of supertoxic lethal chemicals or key precursors produced or otherwise acquired for protective purposes should be prohibited. Permitted transfers would be limited to a maximum of 100 grams in any 12-month period. Advance notification of any transfers of such supertoxic lethal chemicals or key precursors would be necessary.[52]

There was agreement that transfers, except for elimination purposes, would be restricted, but the allowable circumstances and amounts for such transfers required further consideration.

Verification institutions

It is generally assumed that a consultative committee will be established by the parties to the chemical weapons convention. The tasks of the committee, as viewed by the USA, would be: to develop and revise, as necessary, provisions for exchange of information, declarations and technical matters related to implementation of the convention; to review new scientific and technical developments which could affect the operation of the convention; to provide a forum for timely discussion of questions regarding compliance; to conduct systematic on-site inspections of the declared stockpiles, of the destruction of stocks, of the closure and destruction of declared production and filling facilities, of permitted small-scale production and facilities for supertoxic lethal chemicals for protective purposes, and of production for permitted purposes of specified types of chemicals which are deemed to pose a particular risk; to conduct *ad hoc* on-site inspections for fact-finding purposes; and to participate in such inspections agreed between two or more parties, if requested to do so by one of the parties involved. The consultative committee should not take any decision as to whether or not a party was in compliance with the provisions of the convention.

In order to facilitate prompt implementation of the provisions of the convention after its entry into force, the USA proposed that a preparatory commission should be set up soon after the convention was opened for signature. The commission would prepare studies, reports and recommendations for consideration by the consultative committee, and would remain in existence until the first meeting of the committee.

Within 30 days after entry into force of the convention, the depositary would have to establish a fact-finding panel. This panel would conduct a prompt fact-finding inquiry, including any necessary *ad hoc* inspections, make appropriate findings of fact, and provide expert views on any problem referred to it by the depositary upon request by a party. The fact-finding panel would be composed of not more than 15 members representing the parties.[53]

It was emphasized by the Federal Republic of Germany that national technical means were insufficient for verifying a chemical weapon ban and that, consequently, "decisive" importance was attached to an international committee of experts with autonomous competence, including the right to carry out on-site inspections.[54] Indeed, on-site inspection, possibly strengthened by remote sensors, is considered by many states to be the key to achieving a chemical weapons convention.[55]

Brazil insisted that the composition of the international body charged with verification should not be discriminatory. Nor should the solution of disputes concerning compliance be referred to the UN Security Council whose rules permit a few parties to block all action.[56] To inspire confidence in the credibility of the convention, and to encourage thereby the largest possible number of states to accede to it, Egypt suggested that, in addition to a stipulation concerning the convening of the consultative committee to consider matters relating to a violation of the convention, specific provision should be made for a commitment on the part of all parties to assist any state whose security was endangered or which was otherwise prejudiced as a result of the violation.[57]

Non-use of chemical weapons

A number of countries, especially the non-aligned, have for many years insisted on the necessity to incorporate in the future chemical weapons convention a prohibition on the use of these weapons. Such a clause, it was argued, would make the convention truly comprehensive; it would also strengthen the 1925 Geneva Protocol which had banned the use of asphyxiating, poisonous and other gases, but allowed for ambiguity on the chemicals covered, left open the possibility of recourse to chemical weapons under certain circumstances, was applicable to "war" rather than to any armed conflict, and did not provide for verification. As a matter of fact, it was mainly because of the need for a provision to investigate the alleged use of chemical weapons that the proposal was made to include the prohibition of use in the convention.

The Soviet Union and its allies strongly opposed this proposition, claiming that it would prejudice the 1925 Geneva Protocol rather than strengthen it. But in 1983 they finally agreed to extend the scope of the negotiated convention, and suggested that the procedures to verify compliance with a no-use provision should envisage the use of the verification mechanism of the convention, including on-site inspection on a voluntary basis. Should any state not become party to the convention, it would not be released from its obligations under the Geneva Protocol, while the parties to the convention would be bound by the obligation not to use chemical weapons under both international agreements.[58]

In the discussions that followed, Belgium made a reservation as to the appropriateness of including the Geneva Protocol prohibition in the convention under consideration. One question raised was whether such a prohibition, repeated solely in the context of chemical weapons, would not create a lacuna with regard to bacteriological weapons, which were equally prohibited by the Protocol.[59] Nevertheless, a convergence of views seems to have emerged on the following issues: the contemplated prohibition clause should apply with respect to use against all states, not only parties to the convention; the prohibition should also apply in *any* armed conflict (to be further defined in an agreed understanding); verification of alleged use of chemical weapons should be provided for in the convention; there should be a clause of non interference with the relevant international treaties; the convention should contain the 'traditional' withdrawal clause; and there should be a reference to the obligations set forth in the 1925 Geneva Protocol.

Consensus could not be reached on whether the prohibition on use should apply to riot-control agents and herbicides; a solution will obviously depend on the definitions to be formulated in the convention. Neither was it possible to agree on how to uphold in law the deterrence value of remaining stocks of chemical weapons in the period preceding their destruction, or how states could preserve, should they choose to do so, the right to retaliate during this period. There was no common view as to the extent to which the 1925 Geneva Protocol had been subsumed in customary international law and how this should be reflected in the convention.

It will be recalled that in 1982 France suggested that "provisional" procedures for the verification of compliance with the Geneva Protocol should be worked out to apply until the conclusion of the chemical weapons convention. The United Nations then adopted a resolution requesting the UN Secretary-General to investigate, with the assistance of qualified consultant experts, information brought to his attention concerning activities that may constitute a violation of the Geneva Protocol, or of the relevant rules of customary international law. Procedures for the timely and efficient investigation of such information were to be devised.[60] The Soviet Union refused to co-operate with the Secretary-General in this work because, in its view, a mechanism for the verification of compliance with the Geneva Protocol should be elaborated by the parties to the Protocol, on the basis of consensus, and not by the United Nations.[61] However, France maintained[62] that the aim of the resolution was to establish speedily a means of investigation in order to uphold the authority of, and to ensure respect for, the Geneva Protocol pending future commitments. (For a discussion of the recommended procedures, see *SIPRI Yearbook 1983*.[63])

In October 1983 a group of experts, set up in pursuance of the mentioned UN resolution, submitted its report.[64] It suggested that, in deciding whether or not to initiate an investigation, the Secretary-General should be guided by the following criteria: (*a*) Has the state, which is reporting information concerning a possible violation, requested an investigation? (*b*) Does the report allege that chemical or biological warfare agents have been used, or that there has been an incident involving the use of a substance that can be construed as being a chemical or biological agent? (*c*) Does the report allege that the use occurred in the course of armed conflict or that the agent was used in a deliberately hostile manner? (*d*) Does the report contain sufficient information and was it submitted promptly enough, so that there is a good possibility that evidence of value to an investigation remains? Information contained in the allegation should include a description of the event with such details as the means of delivery, duration of the attack, effects on humans, animals and plants, and physical evidence, as well as the exact time and location of the alleged use.

Once the above criteria have been met, investigation should be initiated as rapidly as possible, ideally within 24 hours. If access to the territory of the country where the incident reportedly occurred is not possible, either because the government of that country will not permit it or because the security of the team and/or the necessary logistic support cannot be assured, or if any other obstacles to the investigation should arise, a neighbouring country or countries would be selected where evidence may be available through refugees or other persons crossing the border, and which would permit access to the team. If no possibility exists for visiting either the country where the incident reportedly occurred or a neighbouring country, the Secretary-General, with the assistance of experts, will evaluate such evidence as may be available while continuing to seek opportunities for conducting on-site investigation in the region where the alleged attack occurred. He will report to the UN member states and to the General Assembly when the analysis of the available information has been completed.

The report contains guidance for the conduct of an investigation, including guidance for the UN Secretariat for the grouping of experts according to their field of expertise, and for the classification of laboratories according to the type of analyses they can conduct. It also specifies the standards concerning the collection and handling of samples. An illustrative list of types of equipment to be stockpiled by the Secretariat and to be made available to the investigating team includes such items as protective equipment, kits for detection of chemical and biological warfare agents, sampling and packing equipment, and medical supplies for members of the team. Furthermore, criteria have been formulated for selection of members of the team to carry out fact-finding and evaluation. Methods have been prescribed for preservation of samples, and procedures have been recommended for the transmission and analysis of samples. On-site investigation itself would include a meeting with the local authorities to establish the programme of inspections and arrangements for logistic support and security for the team, examination of the site of the alleged attack, interviews with and medical examination of alleged victims, interviews with eyewitnesses, and interviews with military personnel, civil defence staff and social workers who participated in relief activities following the alleged attack.

The report of the team of experts should indicate the extent to which the alleged events have been substantiated, and possibly assess the probability of their having taken place. Individual opinions dissenting from the majority would also be recorded.

Because of the complexity of the subject matter and the shortage of time, it was not possible for the group to review thoroughly such aspects as the legal problems involved in the transportation of samples, requirements for logistic support and security arrangements, and materials needed in the course of an investigation. Neither was the group in a position to proceed with the assembling and systematic organization of documentation relating to the identification of signs and symptoms associated with the use of prohibited agents, as requested by the UN resolution.

Although consensus was reached in the CD that the negotiated convention prohibiting chemical weapons should include procedures to verify the ban on the use of such weapons, the interest in establishing an investigation mechanism within the framework of the United Nations, as a transitional measure, did not subside. Consequently, by a resolution adopted with 97 votes against 20, with 30 abstentions,[65] the General Assembly asked the Secretary-General to pursue his action and to complete during 1984 the task entrusted to him under the terms of the 1982 resolution.

Conclusion

In 1983, consideration of the question of chemical weapons prohibition helped to reduce the points of disagreement among states on a number of technical matters as well as on certain procedures for verification. The remaining divergencies are not without significance, but the area of converging views now seems to be sufficiently wide to render possible the drafting of actual treaty provisions. This is the view of the overwhelming majority of the United Nations, which in the General Assembly resolutions of 20 December 1983 urged the CD to intensify negotiations on a chemical weapons convention,[66] and to proceed immediately to drafting such a convention.[67] Indeed, the very process of drafting, which implies trade-offs among the negotiators, may be conducive to overcoming the outstanding obstacles.

Further discussion of technical details, especially when they are of secondary importance and are related to obligations which have not yet been agreed upon, can hardly speed up progress. In any event, it is impossible to foresee all eventualities and formulate a treaty text accordingly. This is especially true of a chemical weapons convention in view of the complexity of the issues involved. It is therefore of paramount importance that an efficient mechanism be set up under the convention to deal, on a continuous basis and through consultations among the parties, with all the controversies that may arise. For the signing of the convention would merely mark the beginning of a lengthy process of chemical weapons elimination, which itself may create new problems.

III. Outer space

Most members of the CD were conscious of the threat of an arms race in outer space, which, in their view, had considerably increased. It was pointed out that this race was no longer of concern only to the two principal space powers, even though, by reason of their military capabilities, they have a special responsibility in this respect. The need for a working group to deal with the problems of outer space was recognized, but important differences arose with regard to the mandate of such a group: whether or not concrete measures should be discussed and, if so, what would be their nature, and whether a treaty should be drafted or just a study made of the problems involved.

The dispute over a mandate

The non-aligned countries (supported by China) insisted on having a working group with a mandate to undertake negotiations for the "conclusion of an agreement or agreements" to prevent an arms race in outer space in all its aspects,[68] as requested by the United Nations in its 1982 resolution.[69]

The USA, which was at first sceptical of the usefulness of a working group, subsequently decided, together with the other Western nations, to agree to its establishment on the condition that the mandate would be restricted to "identifying", through substantive examination, issues relevant to the prevention of an arms race in outer space.[70] According to the UK, the examination was to provide answers to the following questions: (*a*) Which aspects of military activity in space were already controlled by bilateral and multilateral agreements, had the agreements been observed, and had they stood the test of time? (*b*) Could these agreements be extended, what further arms control measures might be envisaged and were there developments presenting an immediate threat? (*c*) Was there scope for confidence-building measures and other more general undertakings?[71] The non-aligned delegations were prepared to accept such a mission for the working group during the first part of the 1984 CD session, as a necessary initial stage in its work, but maintained that the mandate should spell out the ultimate objective, namely, the reaching of an agreement or agreements. Absence of any time limit for the initial stage could, in their opinion, "plunge" the group into unnecessarily prolonged discussions on a number of unspecified issues. Nevertheless, referring to the "urgent need of initiating action", the non-aligned countries decided not to prevent the adoption of the mandate as suggested by the Western countries, if all the other delegations were willing to accept it.[72]

The Soviet Union was opposed to the suggested "examination" of the existing agreements[73] and, together with other Socialist states, requested a comprehensive treatment of the arms race in space to cover the whole spectrum of space weapons.[74] It proposed that the working group should negotiate a "text of an international treaty".[75] The only text then in existence was the 1981 draft treaty submitted by the Soviet Union and prohibiting the stationing of weapons of any kind in outer space.[76] The Socialist countries appeared willing to accept[77] the original non-aligned proposal for the working group mandate, but refused to go along with the

Western formula which, after lengthy hesitations, had been approved by the non-aligned countries. A contact group, set up to reconcile the diverging views, failed to reach agreement.

Substantive proposals

France emphasized that the efforts of the international community ought to be aimed at (*a*) not allowing outer space to become a base for military actions; and (*b*) protecting space vehicles and, in particular, ensuring the immunity of satellites.[78]

The Netherlands pointed out that systems capable of destroying satellites are by their very nature destabilizing and that satellites should therefore be declared inviolable. This means that parties should undertake not to damage, destroy or remove satellites, and not to interfere with their functioning. To reinforce the declaration of inviolability, testing, stationing and use of specific anti-satellite weapons would have to be prohibited.[79]

Sweden suggested concentrating on the so-called killer satellites and space-based ballistic missile defence systems, because these are devices designed "actively" to interfere with the adversary's military capabilities, as distinct from devices for passive military use.[80]

Sri Lanka proposed a prohibition on the stationing in orbit around the Earth, or any celestial body or at any other location in outer space of any weapon which had been designed to inflict injury or cause any other form of damage "on the Earth, in the atmosphere or on objects placed in space." The testing, production, deployment or use of any space-, air- or ground-based weapon system, designed to damage, destroy or interfere with the functioning of any spacecraft of any nation, were to be banned. Adequate and effective measures for verifying compliance would have to be negotiated. Another proposal by Sri Lanka was to examine the feasibility of extending article IV of the 1967 Outer Space Treaty (prohibiting the placing in orbit around the Earth of objects carrying nuclear weapons or other weapons of mass destruction) to include a ban on all kinds of weapons from space, including weapons based in space for use against any target, and all anti-satellite weapons regardless of where they are based.[81]

In August 1983, the Soviet Union produced a new draft treaty. The new document was submitted first to the United Nations and later to the CD.[82] A prohibition would be imposed upon the use or threat of force in outer space and the atmosphere and on the Earth through the utilization, as instruments of destruction, of space objects in orbit around the Earth, on celestial bodies or stationed in space in any other manner. It would be further prohibited to resort to the use or threat of force against space objects in orbit around the Earth, on celestial bodies or stationed in outer space in any other manner. Accordingly, the parties would undertake the following commitments:

1. Not to test or deploy by placing in orbit around the Earth or stationing on celestial bodies or in any other manner any space-based weapons for the destruction of objects on the Earth, in the atmosphere or in outer space.
2. Not to utilize space objects in orbit around the Earth, on celestial bodies or stationed in outer space in any other manner as means to destroy any targets on the Earth, in the atmosphere or in outer space.
3. Not to destroy, damage, disturb the normal functioning or change the flight trajectory of space objects of other states.
4. Not to test or create new anti-satellite systems and to destroy any anti-satellite systems that they may already have.
5. Not to test or use manned spacecraft for military, including anti-satellite, purposes.

For the purpose of assuring compliance, the parties would use the national technical means of verification at their disposal, and would undertake not to interfere with such means of verification of other states.

The USSR stated[83] that it would not be the first to deploy in outer space anti-satellite weapons of any kind; it thereby declared a unilateral moratorium on such launches for as long as other states would refrain from deploying such weapons.

Conclusion

In its resolution of 15 December 1983, the United Nations requested the CD to consider as a "matter of priority" the question of preventing an arms race in outer space, and to establish to this end an *ad hoc* working group with a view to undertaking "negotiations" for the conclusion of an agreement or agreements.[84] However, whatever procedure is adopted to discuss arms control measures related to outer space, the chances for achieving a meaningful treaty prohibiting attacks against satellites are slim, or even non-existent, as long as programmes of space-based defences against ballistic missiles are pursued, for the technologies required for such defences are analogous to those used in anti-satellite weapon systems.

Notes and references

[1] For a full description of the arms control deliberating and negotiating machinery, see Goldblat, J., *Agreements for Arms Control*, SIPRI (Taylor & Francis, London, 1982) chapter 7.
[2] Conference of the Committee on Disarmament document CCD/526 and Rev. 1.
[3] Committee on Disarmament document CD/381.
[4] Committee on Disarmament document CD/130. For the text and analysis of the tripartite report, see chapter 11 of *SIPRI Yearbook 1981*.

[5] Committee on Disarmament document CD/346.
[6] The WMO subsequently agreed that the Global Telecommunication System of the World Weather Watch (WWW) should be used for the transmission of specific data for the detection and identification of seismic events. See Committee on Disarmament working paper no. 99.
[7] Committee on Disarmament document CD/383.
[8] Committee on Disarmament documents CD/PV.207 and CD/PV.235.
[9] Committee on Disarmament document CD/405.
[10] Committee on Disarmament document CD/PV.176.
[11] Committee on Disarmament document CD/PV.182.
[12] Committee on Disarmament documents CD/348 and CD/399.
[13] Committee on Disarmament document CD/402.
[14] Sykes Lynn, R. and Evernden, J. F., 'The verification of a comprehensive nuclear test ban', *Scientific American*, Vol. 247, No. 4, October 1982.
[15] Conference of the Committee on Disarmament document CCD/PV.545.
[16] Committee on Disarmament document CD/389.
[17] Committee on Disarmament document CD/403.
[18] Committee on Disarmament document CD/400.
[19] Committee on Disarmament document CD/421.
[20] Committee on Disarmament document CD/291.
[21] UN General Assembly resolution S/10-2.
[22] Committee on Disarmament document CD/PV.209.
[23] Committee on Disarmament document CD/181.
[24] Committee on Disarmament document CD/259.
[25] UN General Assembly resolution 38/72.
[26] UN General Assembly resolution 37/72.
[27] UN General Assembly resolution 38/63.
[28] UN General Assembly resolution 38/62.
[29] Committee on Disarmament document CD/112.
[30] Committee on Disarmament document CD/294.
[31] Committee on Disarmament document CD/343.
[32] Note 19, pp. 56–60.
[33] Those delegations favouring a complete destruction of the stocks of chemical weapons usually employ the term 'destruction', while others, who envisage the possibility of both destruction and diversion of the stocks to non-hostile purposes, often use the term 'elimination'.
[34] There was no agreed definition of 'precursors'.
[35] Note 31.
[36] Committee on Disarmament document CD/387.
[37] Committee on Disarmament document CD/393 and CD/PV.226.
[38] Committee on Disarmament document CD/PV.235.
[39] Committee on Disarmament document CD/PV.192.
[40] Committee on Disarmament document CD/PV.236.
[41] Committee on Disarmament document CD/PV.197.
[42] Committee on Disarmament document CD/PV.227.
[43] Note 31.
[44] Committee on Disarmament document CD/393.
[45] Committee on Disarmament document CD/PV.235.
[46] Committee on Disarmament document CD/353.
[47] Committee on Disarmament document CD/PV.201.
[48] Committee on Disarmament document CD/PV.207 and note 40.
[49] Note 47.
[50] Committee on Disarmament document CD/PV.211.
[51] Committee on Disarmament document CD/401.
[52] Note 31.
[53] Note 31.
[54] Committee on Disarmament document CD/PV.190.
[55] Note 39.
[56] Committee on Disarmament document CD/PV.202.
[57] Committee on Disarmament document CD/PV.232.
[58] Committee on Disarmament document CD/PV.196.
[59] Committee on Disarmament document CD/PV.206.
[60] UN General Assembly resolution 37/98D.
[61] Notes 50 and 58.

[62] Note 47.
[63] Goldblat, J., 'Arms control efforts in the UN and the CD', SIPRI, *World Armaments and Disarmament, SIPRI Yearbook 1983* (Taylor & Francis, London, 1983), pp. 565–67.
[64] UN document A/38/435.
[65] UN General Assembly resolution 38/187C.
[66] UN General Assembly resolution 38/187B.
[67] UN General Assembly resolution 38/187A.
[68] Committee on Disarmament document CD/329.
[69] UN General Assembly resolution 37/83.
[70] Committee on Disarmament document CD/413.
[71] Committee on Disarmament document CD/PV.219.
[72] Committee on Disarmament document CD/418.
[73] Committee on Disarmament document CD/PV.220.
[74] Committee on Disarmament document CD/PV.203.
[75] Committee on Disarmament document CD/272.
[76] Committee on Disarmament document CD/274.
[77] Committee on Disarmament document CD/410.
[78] Committee on Disarmament document CD/375.
[79] Committee on Disarmament document CD/PV.207.
[80] Committee on Disarmament document CD/PV.213.
[81] Committee on Disarmament document CD/PV.212.
[82] UN document A/38/194 and Committee on Disarmament document CD/420.
[83] Note 40.
[84] UN General Assembly resolution 38/70.

Appendix 17A

UN General Assembly resolutions on disarmament, 1983

I. UN member states and year of membership

The following list of names of the 158 UN member states is provided for convenience in reading the record of votes on the UN General Assembly resolutions listed in section II. The countries marked with an asterisk are also members of the Geneva-based Committee on Disarmament (CD).

Afghanistan, 1946
Albania, 1955
*Algeria, 1962
Angola, 1976
Antigua and Barbuda, 1981
*Argentina, 1945
*Australia, 1945
Austria, 1955
Bahamas, 1973
Bahrain, 1971
Bangladesh, 1974
Barbados, 1966
*Belgium, 1945
Belize, 1981
Benin, 1960
Bhutan, 1971
Bolivia, 1945
Botswana, 1966
*Brazil, 1945
*Bulgaria, 1955
*Burma, 1948
Burundi, 1962
Byelorussia, 1945
Cameroon, 1960
*Canada, 1945
Cape Verde, 1975
Central African Republic, 1960
Chad, 1960
Chile, 1945
*China, 1945
Colombia, 1945
Comoros, 1975
Congo, 1960
Costa Rica, 1945
*Cuba, 1945
Cyprus, 1960
*Czechoslovakia, 1945
Denmark, 1945
Djibouti, 1977
Dominica, 1978
Dominican Republic, 1945
Ecuador, 1945
*Egypt, 1945
El Salvador, 1945
Equatorial Guinea, 1968
*Ethiopia, 1945
Fiji, 1970
Finland, 1955
*France, 1945
Gabon, 1960
Gambia, 1965
*German Democratic Republic, 1973
*FR Germany, 1973
Ghana, 1957
Greece, 1945
Grenada, 1974
Guatemala, 1945
Guinea, 1958
Guinea-Bissau, 1974
Guyana, 1966
Haiti, 1945
Honduras, 1945
*Hungary, 1955
Iceland, 1946
*India, 1945
*Indonesia, 1950
*Iran, 1945
Iraq, 1945
Ireland, 1955
Israel, 1949
*Italy, 1955
Ivory Coast, 1960
Jamaica, 1962
*Japan, 1956
Jordan, 1955
Kampuchea, 1955
*Kenya, 1963
Kuwait, 1963

Lao People's Democratic Republic, 1955
Lebanon, 1945
Lesotho, 1966
Liberia, 1945
Libya, 1955
Luxembourg, 1945
Madagascar, 1960
Malawi, 1964
Malaysia, 1957
Maldives, 1965
Mali, 1960
Malta, 1964
Mauritania, 1961
Mauritius, 1968
*Mexico, 1945
*Mongolia, 1961
*Morocco, 1956
Mozambique, 1975
Nepal, 1955
*Netherlands, 1945
New Zealand, 1945
Nicaragua, 1945
Niger, 1960
*Nigeria, 1960
Norway, 1945
Oman, 1971
*Pakistan, 1947
Panama, 1945
Papua New Guinea, 1975
Paraguay, 1945
*Peru, 1945
Philippines, 1945
*Poland, 1945
Portugal, 1955
Qatar, 1971
*Romania, 1955
Rwanda, 1962
Saint Christopher and Nevis, 1983
Saint Lucia, 1979
Saint Vincent and the Grenadines, 1980
Samoa, 1976
Sao Tome and Principe, 1975
Saudi Arabia, 1945
Senegal, 1960
Seychelles, 1976
Sierra Leone, 1961
Singapore, 1965
Solomon Islands, 1978
Somalia, 1960
South Africa, 1945
Spain, 1955
*Sri Lanka, 1955
Sudan, 1956
Suriname, 1975
Swaziland, 1968
*Sweden, 1946
Syria, 1945
Tanzania, 1961
Thailand, 1946
Togo, 1960
Trinidad and Tobago, 1962
Tunisia, 1956
Turkey, 1945
Uganda, 1962
*UK, 1945
Ukraine, 1945
United Arab Emirates, 1971
Upper Volta, 1960
Uruguay, 1945
*USA, 1945
*USSR, 1945
Vanuatu, 1981
*Venezuela, 1945
Viet Nam, 1977
Yemen Arab Republic, 1947
Yemen, People's Democratic Republic of, 1967
*Yugoslavia, 1945
*Zaire, 1960
Zambia, 1964
Zimbabwe, 1980

II. Resolutions

Only the essential parts of each resolution are given here. The texts have been abridged, but the wording is close to that of the resolution.

The resolutions are grouped according to disarmament subjects, irrespective of the agenda items under which they were discussed in the General Assembly.

Nuclear weapons

38/183 A 20 December 1983

Urges the governments of the Soviet Union and the United States to make every effort to reach an agreement at their bilateral negotiations at Geneva, or at least to agree, on a provisional basis, that no medium-range missiles are deployed and the number of existing missiles is reduced, while the negotiations would continue in order to achieve positive results in conformity with the security interests of all states; calls upon all European states as well as all interested states to do their utmost in order to assist the process of negotiation and its successful conclusion.

In favour 88
Against 30: Afghanistan, Australia, Belgium, Bulgaria, Byelorussia, Canada, Cuba, Czechoslovakia, France, FRG, GDR, Hungary, Iceland, Israel, Italy, Japan, Lao People's Democratic Republic, Luxembourg, Mongolia, Netherlands, New Zealand, Norway, Poland, Portugal, Turkey, UK, Ukraine, USA, USSR, Viet Nam
Abstaining 25: Angola, Austria, Bahamas, Barbados, Burma, Cameroon, Chad, Chile, Gambia, Guatemala, Haiti, Honduras, India, Ivory Coast, Lebanon, Mauritius, Morocco, Nepal, St Vincent, Senegal, Spain, Suriname, Swaziland, Uruguay, Democratic Yemen
Absent: Albania, China, Comoros, Djibouti, Equatorial Guinea, Grenada, Guinea, Kampuchea, Mozambique, St Christopher and Nevis, Samoa, Sao Tome and Principe, Seychelles, Solomon Islands

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38/183 P 20 December 1983

Urges the governments of the Soviet Union and the United States to continue, without preconditions, their bilateral negotiations at Geneva so long as it is necessary in order to achieve positive results in accordance with the security interests of all states and the universal desire for progress towards disarmament.

In favour 99
Against 18: Afghanistan, Angola, Bulgaria, Byelorussia, Cuba, Czechoslovakia, GDR, Hungary, Lao People's Democratic Republic, Mongolia, Mozambique, Poland, Romania, Syria, Ukraine, USSR, Viet Nam, Democratic Yemen
Abstaining 24: Austria, Bahamas, Barbados, Bhutan, Bolivia, Burma, Cameroon, Cape Verde, China, Ecuador, El Salvador, Guinea-Bissau, Haiti, Honduras, India, Indonesia, Ivory Coast, Mauritius, Nepal, Peru, St Vincent, Suriname, Uruguay, Venezuela
Absent: Albania, Burundi, Comoros, Equatorial Guinea, Ethiopia, Grenada, Iran, Kampuchea, Kuwait, Libya, Malta, St Christopher and Nevis, Samoa, Sao Tome and Principe, Seychelles, Solomon Islands

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38/183 N 20 December 1983

Urges the governments of the Soviet Union and the United States to examine, as a way out of the present impasse, the possibility of combining into a single forum the two series of negotiations which they have been carrying out and of broadening their scope so as to embrace also 'tactical' or 'battlefield' nuclear weapons; reiterates the request to the two negotiating parties that they bear in mind that not only their national interests but also the vital interests of all the peoples of the world are at stake in this question; and requests both parties to keep the United Nations appropriately informed of the progress achieved in their negotiations.

In favour 122
Against 1: USA

Abstaining 25: Angola, Australia, Bahamas, Barbados, Belgium, Canada, Chile, Dominica, France, FRG, Honduras, Iceland, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, St Lucia, St Vincent, Spain, Turkey, UK
Absent: Albania, Comoros, Equatorial Guinea, Grenada, Kampuchea, St Christopher and Nevis, Samoa, Seychelles, Solomon Islands

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38/183 J 20 December 1983

Requests the Secretary-General to prepare, with the assistance of qualified government experts a report, to be submitted to the General Assembly at its thirty-ninth session, on ways and means that seem advisable for stimulating the adoption of unilateral nuclear disarmament measures which, without prejudice to the security of states, would come to promote and complement bilateral and multilateral negotiations in this sphere.

In favour 132
Against 2: UK,[c] USA
Abstaining 14: Australia, Belgium, Canada, France, FRG, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Turkey
Absent: Albania, Central African Republic, Comoros, Equatorial Guinea, Grenada, St Christopher and Nevis, Samoa, Seychelles, Solomon Islands

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38/73 E 15 December 1983

Urges once more the Soviet Union and the United States, as the two major nuclear weapon states, to proclaim, either through simultaneous unilateral declarations or through a joint declaration, an immediate nuclear arms freeze, which would be a first step towards the comprehensive programme of disarmament. The freeze would embrace: a comprehensive test ban of nuclear weapons and their delivery vehicles; the complete cessation of the manufacture of nuclear weapons and their delivery vehicles; a ban on all further deployment of nuclear weapons and their delivery vehicles; and the complete cessation of the production of fissionable material for weapons purposes. The freeze would be subject to all relevant measures and procedures of verification which have already been agreed by the parties in the SALT I and SALT II treaties, as well as those agreed upon in principle by them during the preparatory trilateral negotiations on the comprehensive test ban. It would be of an initial five-year duration, subject to prolongation in the event of other nuclear weapon states joining in such a freeze.

In favour 124
Against 13: Belgium, Canada, France, FRG, Israel, Italy, Japan, Luxembourg, New Zealand, Portugal, Turkey, UK, USA
Abstaining 8: Australia, Bahamas, Iceland, Netherlands, Norway, St Lucia, Spain, Zaire
Absent: Albania, China, Comoros, Dominica, Equatorial Guinea, Guinea-Bissau, Kampuchea, St Christopher and Nevis, St Vincent, Samoa, Somalia, Thailand

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38/76 15 December 1983

Urges all nuclear weapon states to proceed to freeze, under appropriate verification, all nuclear weapons in their possession both in quantitative and qualitative terms, namely: to cease the buildup of all components of nuclear arsenals, including all kinds of nuclear weapon delivery systems and all kinds of nuclear weapons; not to deploy nuclear weapons of new kinds and types; to establish a moratorium on all tests of nuclear weapons and on tests of new kinds and types of their delivery systems; and to stop the production of fissionable materials for the purpose of creating nuclear weapons. Calls upon the Soviet Union and the United States to freeze, in the first place and simultaneously, their nuclear weapons on a bilateral basis by way of example to the other nuclear states; believes that all the other nuclear weapon states should subsequently and as soon as possible freeze their nuclear weapons.

In favour 108
Against 18: Belgium, Canada, Denmark, France, FRG, Iceland, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Turkey, UK, USA
Abstaining 20: Australia, Chad, China, Costa Rica, Dominican Republic, Guatemala, Honduras, Ivory Coast, Lebanon, Liberia, Malawi, Morocco, Paraguay, Philippines, St Lucia, Somalia, Swaziland, Sweden, Uruguay, Zaire
Absent: Albania, Comoros, Djibouti, Dominica, Equatorial Guinea, Guinea-Bissau, Kampuchea, Malta, St Christopher and Nevis, St Vincent, Samoa

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38/73 B 15 December 1983

Once again calls upon all nuclear weapon states to agree to a freeze on nuclear weapons, which would, *inter alia*, provide for a simultaneous total stoppage of any further production of nuclear weapons and a complete cut-off in the production of fissionable material for weapon purposes.

In favour 124
Against 15: Belgium, Canada, France, FRG, Israel, Italy, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Turkey, UK, USA
Abstaining 7: Australia, China, Ghana,[a] Iceland, Japan, St Lucia, Zaire
Absent: Albania, Comoros, Dominica, Equatorial Guinea, Guinea-Bissau, Kampuchea, Malta, St Christopher and Nevis, St Vincent, Samoa, Somalia

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38/188 E 20 December 1983

Requests the Conference on Disarmament, at an appropriate stage of its work on the item entitled "Nuclear weapons in all aspects", to pursue its consideration of the question of adequately verified cessation and prohibition of the production of fissionable material for nuclear weapons and other nuclear explosive devices and to keep the General Assembly informed of the progress of that consideration.

In favour 124
Against 0
Abstaining 23: Afghanistan, Angola, Argentina, Brazil, Bulgaria, Byelorussia, China, Cuba, Czechoslovakia, France, GDR, Hungary, India, Lao People's Democratic Republic, Mongolia, Mozambique, Nicaragua, Poland, UK, Ukraine, USA, USSR, Viet Nam
Absent: Albania, Botswana, Comoros, Equatorial Guinea, Grenada, St Christopher and Nevis, Samoa, Sao Tome and Principe, Seychelles, Solomon Islands

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38/183 C 20 December 1983

Reaffirms its request to the Conference on Disarmament to start without delay negotiations within an appropriate organizational framework with a view to concluding a convention on the prohibition of the development, production, stockpiling, deployment and use of nuclear neutron weapons.

In favour 74
Against 12: Belgium, Canada, France, FRG, Israel, Italy, Japan, Luxembourg, Portugal, Turkey, UK, USA
Abstaining 57: Argentina, Australia, Austria, Bahamas, Bangladesh, Bhutan, Bolivia, Brazil, Burma, Chad, Chile, Colombia, Costa Rica, Denmark, Djibouti, Dominica, Dominican Republic, Egypt, El Salvador, Gambia, Greece, Guatemala, Guyana, Haiti, Honduras, Iceland, Ireland, Ivory Coast, Jamaica, Lebanon, Liberia, Malawi, Maldives, Morocco, Nepal, Netherlands, New Zealand, Niger, Norway, Oman, Pakistan, Paraguay, Peru, Philippines, St Lucia, St Vincent, Senegal, Singapore, Spain, Sri Lanka, Sudan, Suriname, Swaziland, Sweden, Thailand, Venezuela, Zaire
Absent: Albania, China, Comoros, Equatorial Guinea, Gabon, Grenada, Kampuchea, Kuwait, Malta, St Christopher and Nevis, Samoa, Seychelles, Solomon Islands, Somalia

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Nuclear tests

38/62 15 December 1983

Reiterates once again its grave concern that nuclear weapon testing continues unabated against the wishes of the overwhelming majority of states; reaffirms its conviction that a treaty to achieve the prohibition of all nuclear test explosions by all states for all time is a matter of the highest priority; urges the three depositary powers of the Partial Test Ban Treaty and of the Non-Proliferation Treaty to abide strictly by their undertakings to seek "to achieve the discontinuance of all test explosions of nuclear weapons for all time" and "to continue negotiations to this end"; urges also all states that have not yet done so to adhere to the Partial Test Ban Treaty and, meanwhile, to refrain from testing in the environments covered by that Treaty; reiterates its appeal to all states members of the Conference on Disarmament to initiate immediately the multilateral negotiation for the prohibition of all nuclear weapon tests and calls upon the states depositaries of the above-mentioned treaties, by virtue of their special responsibilities and as a provisional measure, to bring to a halt without delay all nuclear test explosions, either through a trilaterally agreed moratorium or through three unilateral moratoria.

In favour 119
Against 2: UK, USA
Abstaining 26: Argentina, Australia, Belgium, Brazil, Burma, Canada, Chile, China, Denmark, France, FRG, Greece, Iceland, India, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Solomon Islands, Spain, Turkey, Zambia
Absent: Albania, Comoros, Dominica, Equatorial Guinea, Guinea-Bissau, Kampuchea, St Christopher and Nevis, St Vincent, Samoa, Vanuatu

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38/72 15 December 1983

Urges all states to exert efforts for the speediest elaboration of a multilateral treaty on the prohibition of nuclear weapon tests by all states, and urges the Conference on Disarmament to proceed promptly to negotiations with a view to elaborating such a treaty as a matter of the highest priority, taking into account all existing drafts, proposals and future initiatives, and for that purpose to assign to its subsidiary body a negotiating mandate.

In favour 118
Against 4: China, France, UK, USA
Abstaining 24: Australia, Belgium, Canada, Denmark, FRG, Guatemala, Iceland, Israel, Italy, Japan, Lebanon, Luxembourg, Malawi, Netherlands, New Zealand, Norway, Paraguay, Peru, Portugal, St Lucia, Solomon Islands, Spain, Turkey, Venezuela
Absent: Albania, Comoros, Dominica, Equatorial Guinea, Guinea-Bissau, Kampuchea, Malta, Morocco, St Christopher and Nevis, St Vincent, Samoa

38/63 15 December 1983

Reaffirms its conviction that a treaty to achieve the prohibition of all nuclear test explosions by all states for all time is a matter of greatest importance; expresses the conviction that such a treaty would constitute a vital element for the success of efforts to halt and reverse the nuclear arms race and the qualitative improvement of nuclear weapons, and to prevent the expansion of existing nuclear arsenals and the spread of nuclear weapons to additional countries; requests the Conference on Disarmament (*a*) to resume its examination of issues relating to a comprehensive test ban and to take up the question of a revised mandate for the *Ad Hoc* Working Group during its 1984 session, (*b*) to determine, in the context of its negotiations on a test ban treaty, the institutional and administrative arrangements necessary for establishing, testing and operating an international seismic monitoring network as part of an effective verification system, and (*c*) to initiate investigation of other international measures to improve verification arrangements under such a treaty, including an international network to monitor atmospheric radioactivity; and urges all members of the Conference, in particular the nuclear weapon states, to co-operate in fulfilling these tasks.

In favour 117
Against 0
Abstaining 29: Afghanistan, Argentina, Bulgaria, Byelorussia, China, Cuba, Czechoslovakia, France, GDR, Hungary, India, Israel, Lao People's Democratic Republic, Mexico, Mongolia, Mozambique, Nicaragua, Nigeria, Peru, Poland, Uganda, UK, Ukraine, USA, USSR, Venezuela, Viet Nam, Democratic Yemen, Zambia
Absent: Albania, Belize, Comoros, Dominica, Equatorial Guinea, Guinea-Bissau, Iran, St Christopher and Nevis, St Vincent, Samoa,[a] Vanuatu[a]

Atomic radiation

38/78 15 December 1983

Taking note with appreciation of the report of the UN Scientific Committee on the Effects of Atomic Radiation, commends the Committee for the valuable contribution it has been making in the course of the past 28 years, since its inception, to wider knowledge and understanding of the levels, effects and risks of atomic radiation and for fulfilling its original mandate with scientific authority and independence of judgement; and requests it to continue its work.

Adopted without vote

Non-use of nuclear weapons and prevention of nuclear war

38/68 15 December 1983

Recommends that the Conference on Disarmament should continue negotiations with a view to reaching early agreement and concluding effective international arrangements to assure non-nuclear weapon states against the use or threat of use of nuclear weapons, taking into account the widespread support for the conclusion of an international convention and giving consideration to any other proposals designed to secure the same objective.

In favour 141
Against 0
Abstaining 6: Argentina, Brazil, India, Philippines, UK, USA
Absent: Albania, Bhutan, Comoros, Dominica, Equatorial Guinea, Guinea-Bissau, St Christopher and Nevis, St Vincent, Samoa, Solomon Islands

38/73 G 15 December 1983

Reaffirming the declaration that the use of nuclear weapons would be a violation of the Charter of the United Nations and a crime against humanity, contained in its resolutions 1653(XVI) of 24 November 1961, 33/71 B of 14 December 1978, 34/83 G of 11 December 1979, 35/152 D of 12 December 1980 and 36/92 I of 9 December 1981, reiterates its request to the Conference on Disarmament to commence negotiations, as a matter of priority, in order to achieve agreement on an international convention prohibiting the use or threat of use of nuclear weapons under any circumstances, taking as a basis the draft Convention annexed to this resolution.

In favour 126
Against 17: Australia, Belgium, Canada, Denmark, France, FRG, Iceland, Italy, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Turkey, UK, USA
Abstaining 6: Austria, Greece, Ireland, Israel, Japan, Philippines
Absent: Albania, Comoros, Dominica, Equatorial Guinea, Guinea-Bissau, St Christopher and Nevis, St Vincent, Samoa

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38/67 15 December 1983

Requests the Conference on Disarmament to continue negotiations with a view to concluding an international instrument of a legally binding character to assure non-nuclear weapon states against the use or threat of use of nuclear weapons.

In favour 108
Against 17: Australia, Belgium, Canada, Denmark, France, FRG, Iceland, Italy, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Turkey, UK, USA
Abstaining 18: Argentina, Austria, Bahamas, Belize, Brazil, Burma, India, Ireland, Israel, Ivory Coast, Japan, Malaysia, Paraguay, Philippines, St Lucia, Singapore, Sweden, Uruguay
Absent: Albania, Bhutan, China, Comoros, Dominica, Equatorial Guinea, Guinea-Bissau, Kampuchea, Morocco, St Christopher and Nevis, St Vincent, Samoa, Solomon Islands, Somalia

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38/75 15 December 1983

Resolutely, unconditionally and for all time condemns nuclear war as being contrary to human conscience and reason, as the most monstrous crime against peoples and as a violation of the foremost human right—the right to life; condemns the formulation, propounding, dissemination and propaganda of political and military doctrines and concepts intended to provide "legitimacy" for the first use of nuclear weapons and in general to justify the "admissibility" of unleashing nuclear war; and calls upon all states to unite and redouble their efforts aimed at removing the threat of nuclear war, halting the nuclear arms race and reducing nuclear weapons until they are completely eliminated.

In favour 95
Against 19: Australia, Belgium, Canada, Denmark, France, FRG, Iceland, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Turkey, UK, USA
Abstaining 30: Austria, Bahamas, Chad, China, Colombia, Costa Rica, Dominican Republic, Fiji, Finland, Gambia, Guatemala, Haiti, Honduras, Ireland, Ivory Coast, Lebanon, Liberia, Malawi, Morocco, Papua New Guinea, Paraguay, Philippines, Rwanda, St Lucia, Senegal, Singapore, Solomon Islands, Suriname, Sweden, Zaire
Absent: Albania, Comoros, Djibouti, Dominica, Equatorial Guinea, Guinea-Bissau, Kampuchea, Malta, St Christopher and Nevis, St Vincent, Samoa, Somalia, Trinidad and Tobago

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38/183 B 20 December 1983

Considers that the solemn declarations by two nuclear weapon states made or reiterated at the Second Special Session of the General Assembly devoted to disarmament, concerning their respective obligations not to be the first to use nuclear weapons, offer an important avenue to decrease the danger of nuclear war; and expresses the hope that those nuclear weapon states which have not yet done so would consider making similar declarations.

In favour 110
Against 19: Australia, Belgium, Canada, Denmark, France, FRG, Iceland, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Turkey, UK, USA
Abstaining 15: Austria, Bahamas, China, Dominica, Guatemala, Haiti, Honduras, Ivory Coast, Malawi, Paraguay, Philippines, St Lucia, St Vincent, Singapore, Uruguay
Absent: Albania, Burundi, Comoros, Djibouti, Equatorial Guinea, Grenada, Kampuchea, Malta, St Christopher and Nevis, Samoa, Seychelles, Solomon Islands, Somalia

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38/183 M 20 December 1983

Gravely concerned over the risks of nuclear war inherent in the world today, solemnly reaffirms the special responsibilities of the nuclear weapon states for nuclear disarmament and for undertaking measures to prevent nuclear war and to halt the nuclear arms race in all its aspects, the vital interest of all peoples of the world in the success of disarmament negotiations and the consequent duty of all states to contribute to efforts in the field of disarmament, and the central role and primary responsibility of the United Nations in the sphere of disarmament. Requests the nuclear weapon states to submit to the General Assembly annual reports on the measures and steps taken by them, jointly or individually, in the discharge of the responsibilities incumbent upon them for the prevention of nuclear war and for halting and reversing the nuclear arms race.

In favour 133
Against 1: USA
Abstaining 14: Belgium, Canada, China, France, FRG, Israel, Italy, Japan, Luxembourg, Netherlands, Norway, Portugal, Turkey, UK
Absent: Albania, Comoros, Equatorial Guinea, Grenada, St Christopher and Nevis, Samoa, Seychelles, Solomon Islands, Somalia

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38/183 G 20 December 1983

Requests again the Conference on Disarmament to undertake, as a matter of the highest priority, negotiations with a view to achieving agreement on appropriate and practical measures for the prevention of a nuclear war; further requests the Conference to establish for that purpose an *ad hoc* working group at the beginning of its 1984 session.

In favour 128
Against 0
Abstaining 20: Australia, Belgium, Canada, Denmark, France, FRG, Haiti, Iceland, Italy, Ivory Coast, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Turkey, UK, USA
Absent: Albania, Comoros, Equatorial Guinea, Grenada, St Christopher and Nevis, Samoa, Seychelles, Solomon Island, Somalia

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Nuclear weapon-free zones

38/188 I 20 December 1983

Recalling its resolution 37/99 F of 13 December 1982, in which it decided that a study should be undertaken to review and supplement the comprehensive study of the question of nuclear weapon-free zones in all its aspects in the light of information and experience accumulated since 1975, requests the Secretary-General to transmit to the Group of governmental experts on nuclear weapon-free zones for its consideration and analysis all the relevant documents submitted to the General Assembly at its thirty-eighth session, as well as the records of the debate, on the question of nuclear weapon-free zones.

In favour 146
Against 0
Abstaining 3: India, UK, USA
Absent: Albania, Comoros, Equatorial Guinea, Grenada, St Christopher and Nevis, Samoa, Seychelles, Solomon Islands

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38/61 15 December 1983

Deplores that the signature by France of Additional Protocol I to the Treaty of Tlatelolco, which took place on 2 March 1979, has not yet been followed by the corresponding ratification, and urges France not to delay further such ratification.

In favour 135
Against 0
Abstaining 9: Argentina, Belize, Cuba, France, Guyana, Ivory Coast, Malawi, Mali, Venezuela
Absent: Albania, Central African Republic, Chad, Comoros, Djibouti, Dominica, Equatorial Guinea, Guinea-Bissau, St Christopher and Nevis, St Vincent, Samoa, Seychelles, Vanuatu

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38/181 A 20 December 1983

Strongly reiterates its call upon all states to consider and respect the continent of Africa and its surrounding areas as a nuclear weapon-free zone; condemns South Africa's continued pursuit of a nuclear capability and all forms of nuclear collaboration by any state, corporation, institution or individual with the racist regime which enable it to frustrate the objective of the Declaration on the Denuclearization of Africa; demands once again that the racist regime of South Africa refrain from testing, manufacturing, deploying, transporting, storing, using or threatening to use nuclear weapons; and demands once again that South Africa submit all its nuclear installations and facilities to inspection by the IAEA.

In favour 142
Against 0

Abstaining 6: Belgium, France, Israel, Portugal, UK, USA
Absent: Comoros, Equatorial Guinea, Grenada, Lesotho, Paraguay, St Christopher and Nevis, Samoa, Seychelles, Solomon Islands

38/64 15 December 1983

Urges all parties directly concerned to consider taking the practical and urgent steps required for the implementation of the proposal to establish a nuclear weapon-free zone in the region of the Middle East in accordance with the relevant resolutions of the General Assembly and, as a means of promoting this objective, invites the countries concerned to adhere to the Non-Proliferation Treaty; calls upon all countries of the region that have not done so, pending the establishment of the zone, to agree to place all their nuclear activities under IAEA safeguards; and invites the nuclear-weapon states and all other states to render their assistance in the establishment of the zone and at the same time to refrain from any action that runs counter to both the letter and spirit of this resolution.

Adopted without vote

38/65 15 December 1983

Reaffirms its endorsement, in principle, of the concept of a nuclear weapon-free zone in South Asia; and urges once again the states of South Asia and such other neighbouring non-nuclear weapon states as may be interested to continue to make all possible efforts to establish a nuclear weapon-free zone and to refrain, in the meantime, from any action contrary to this objective.

In favour 94
Against 3: Bhutan, India, Mauritius
Abstaining 46: Afghanistan, Algeria, Argentina, Australia, Austria, Bahamas, Belize, Benin, Brazil, Bulgaria, Burma, Byelorussia, Cape Verde, Congo, Cuba, Cyprus, Czechoslovakia, Denmark, Ethiopia, Fiji, France, GDR, Guinea, Hungary, Iceland, Indonesia, Israel, Italy, Lao People's Democratic Republic, Madagascar, Mongolia, Mozambique, Nicaragua, Norway, Papua New Guinea, Poland, Sao Tome and Principe, Seychelles, Sweden, UK, Ukraine, Upper Volta, USSR, Viet Nam, Democratic Yemen, Yugoslavia
Absent: Albania, Central African Republic, Comoros, Dominica, Equatorial Guinea, Grenada, Guinea-Bissau, St Christopher and Nevis, St Vincent, Samoa, Solomon Islands, Suriname, Syria, Vanuatu

Indian Ocean as a zone of peace

38/185 20 December 1983

Regrets that the *Ad Hoc* Committee on the Indian Ocean has failed to reach consensus on the dates for the convening, during 1984, of the Conference on the Indian Ocean; emphasizes its decision to convene the Conference at Colombo as a necessary step for the implementation of the Declaration adopted in 1971; and requests the Committee to complete preparatory work with a view to enabling the opening of the Conference in the first half of 1985, it being understood that such preparatory work would comprise organizational matters including the provisional agenda for the Conference, rules of procedure, and documentation and consideration of appropriate arrangements for any international agreement that may ultimately be reached for the maintenance of the Indian Ocean as a zone of peace.

Adopted without vote

Non-proliferation of nuclear weapons

38/181 B 20 December 1983

Condemns the massive buildup of South Africa's military machine, including its acquisition of nuclear weapon capability for repressive and aggressive purposes and as an instrument of blackmail; reaffirms that the racist regime's acquisition of nuclear weapon capability constitutes a very grave danger to international peace and security and, in particular, jeopardizes the security of African states and increases the danger of the proliferation of nuclear weapons; requests the Security Council to take enforcement measures to prevent any racist regimes from acquiring arms or arms technology; condemns, in particular, recent decisions by some member states to grant licences to several corporations in their territories to provide equipment and technical and maintenance services for nuclear installations in South Africa; and calls upon all states, corporations, institutions and individuals to terminate forthwith all military and nuclear collaboration with the racist regime, including the provision to it of such materials as computers, electronic equipment and related technology.

In favour 133
Against 4: France, Israel, UK, USA
Abstaining 11: Australia, Belgium, Canada, FRG, Italy, Japan, Luxembourg, Malawi, Netherlands, New Zealand, Portugal
Absent: Comoros, Equatorial Guinea, Grenada, Lesotho, Paraguay, St Christopher and Nevis, Samoa, Seychelles, Solomon Islands

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38/69 15 December 1983

Condemns Israel's refusal to renounce any possession of nuclear weapons and to place all its nuclear activities under international safeguards; and requests the IAEA to suspend any scientific co-operation with Israel which could contribute to Israel's nuclear capabilities.

In favour 99
Against 2: Israel, USA
Abstaining 39: Argentina, Australia, Austria, Bahamas, Belgium, Burma, Canada, Chile, Colombia, Denmark, Dominican Republic, Fiji, Finland, France, FRG, Guatemala, Haiti, Honduras, Iceland, Ireland, Italy, Ivory Coast, Japan, Liberia, Luxembourg, Malawi, Nepal, Netherlands, New Zealand, Norway, Panama, Paraguay, Philippines, Portugal, Swaziland, Sweden, UK, Uruguay, Zaire
Absent: Antigua and Barbuda, Belize, Comoros, Dominica, El Salvador, Equatorial Guinea, Guinea-Bissau, Jamaica, Lesotho, Mauritius, St Christopher and Nevis, St Lucia, St Vincent, Samoa, Singapore, Solomon Islands

Costa Rica announced that it was not participating in the vote.

38/9 10 November 1983

Reiterating its alarm over the information and evidence regarding the acquisition and development of nuclear weapons by Israel, and noting that serious radiological effects would result from an armed attack with conventional weapons on a nuclear installation, which could also lead to the initiation of radiological warfare, reiterates its demand that Israel withdraw forthwith its threat to attack and destroy nuclear facilities in Iraq and in other countries; and reaffirms its call for the continuation of the consideration, at the international level, of legal measures to prohibit armed attacks against nuclear facilities, and threats thereof, as a contribution to promoting and ensuring the safe development of nuclear energy for peaceful purposes.

In favour 123
Against 2: Israel, USA
Abstaining 12: Australia, Bahamas, Barbados, Chile, Colombia, Fiji, Guatemala, Haiti, Ivory Coast, Jamaica, Malawi, Paraguay
Absent: Antigua and Barbuda, Belize, Botswana, Burma, Costa Rica, Dominica, Dominican Republic, Equatorial Guinea, Honduras, Iran,[a] Liberia, Nigeria, St Christopher and Nevis, St Lucia, St Vincent, Seychelles,[a] Suriname, Swaziland, Vanuatu, Zaire

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38/8 4 November 1983

Urges all states to strive for effective and harmonious international co-operation in carrying out the work of the International Atomic Energy Agency (IAEA) and to implement strictly the mandate of its Statute; expresses satisfaction at the prospect of mutual benefit arising from the membership of the Peoples Republic of China in the IAEA; and affirms its confidence in the role of the IAEA in the application of nuclear energy for peaceful purposes.

Adopted without vote

38/60 14 December 1983

Decides that the United Nations Conference for the Promotion of International Co-operation in the Peaceful Uses of Nuclear Energy shall be held in 1986; requests the Preparatory Committee to submit a report to the General Assembly at its thirty-ninth session so that the Assembly may consider, in the light of this report, the venue and actual dates for the Conference in 1986 as also for further meetings of the Committee.

Adopted without vote

38/74 15 December 1983

Since the Second Review Conference of the Parties to the Non-Proliferation Treaty proposed to the depositary governments that a third conference to review the operation of the Treaty be convened in 1985, and since there appears to be a consensus among the parties that the Third Review Conference should be held at Geneva in August/September of that year, notes that, following appropriate consultations, an open-ended preparatory committee had been formed of parties to the Non-Proliferation Treaty serving on the Board of Governors of the

IAEA or represented on the Committee on Disarmament as well as any party to the Treaty which may express its interest in participating.

In favour 134
Against 0
Abstaining 7: Argentina, Brazil, Cuba, India, Pakistan, Tanzania, Zambia
Absent: Albania, Algeria, Burma, China, Comoros, Djibouti, Dominica, El Salvador, Equatorial Guinea, France, Guinea-Bissau, Mozambique, St Christopher and Nevis, St Vincent, Samoa[a], Zimbabwe

Chemical and biological weapons

38/187 B 29 December 1983

Urges the Conference on Disarmament, as a matter of high priority, to intensify, during its session in 1984, the negotiations on a convention on the complete and effective prohibition of the development, production and stockpiling of all chemical weapons and on their destruction, taking into account all existing proposals and future initiatives, and to re-establish its *Ad Hoc* Working Group on Chemical Weapons for this purpose.

Adopted without vote

38/187 A 20 December 1983

Urges the Conference on Disarmament to intensify the negotiations in the *Ad Hoc* Working Group on Chemical Weapons, in fulfilment of its present mandate, to achieve accord on a chemical weapons convention at the earliest possible date and, for this purpose, to proceed immediately to drafting such a convention for submission to the General Assembly at its thirty-ninth session; and reaffirms its call to all states to refrain from any action that could impede negotiations on the prohibition of chemical weapons and specifically to refrain from the production and deployment of binary and other new types of chemical weapon, as well as from stationing chemical weapons on the territory of other states.

In favour 98
Against 1: USA
Abstaining 49: Argentina, Australia, Austria, Bahamas, Belgium, Brazil, Burma, Canada, Chile, China, Colombia, Costa Rica, Denmark, Djibouti, Dominican Republic, El Salvador, Finland, France, FRG, Greece, Guatemala, Haiti, Honduras, Iceland, India, Ireland, Israel, Italy, Ivory Coast, Japan, Kampuchea, Lebanon, Luxembourg, Netherlands, New Zealand, Norway, Paraguay, Philippines, Portugal, Seychelles, Somalia, Spain, Sri Lanka, Sudan, Suriname, Sweden, Turkey, UK, Uruguay
Absent: Albania, Comoros, Equatorial Guinea, Grenada, Malta, Morocco, St Christopher and Nevis, Samoa, Solomon Islands

38/187 C 20 December 1983

Takes note of the report submitted by the Secretary-General on the implementation of resolution 37/98 D concerning the procedures for investigating allegations of a violation of the 1925 Geneva Protocol, and requests the Secretary-General to complete during 1984, with the assistance of the group of qualified consultant experts established by him, the task entrusted to him, and to submit his report on the work of the group.

In favour 97[d]
Against 20: Afghanistan, Bulgaria, Byelorussia, Congo, Cuba, Czechoslovakia, Ethiopia, GDR, Hungary, India, Lao People's Democratic Republic, Libya, Mongolia, Mozambique, Poland, Syria, Ukraine, USSR, Viet Nam, Democratic Yemen
Abstaining 30: Algeria, Angola, Argentina, Bahrain, Barbados, Benin, Brazil, Burma, Cape Verde, Chile, Cyprus, Finland, Guinea-Bissau, Iraq, Jordan, Kuwait, Madagascar, Mexico, Nicaragua, Panama, Qatar, Seychelles, Sri Lanka, Tanzania, Uganda, United Arab Emirates, Upper Volta, Venezuela, Yemen, Yugoslavia
Absent: Albania, Comoros, Equatorial Guinea, Grenada, Iran, St Christopher and Nevis, Samoa, Sao Tome and Principe, Solomon Islands, Vanuatu

Radiological weapons

38/188 D 20 December 1983

Requests the Conference on Disarmament to continue negotiations with a view to a prompt conclusion of the elaboration of a convention prohibiting the development, production, stockpiling and use of radiological weapons in order that it may be submitted to the General Assembly at its thirty-ninth session; and further requests the Conference on Disarmament to continue its search for a prompt solution to the question of prohibition of attacks on nuclear facilities, including the scope of such prohibition, taking into account all proposals submitted to it to this end.

Adopted without vote

New weapons of mass destruction

38/182 20 December 1983

Requests the Conference on Disarmament, in the light of its existing priorities, to intensify negotiations with a view to preparing a draft comprehensive agreement on the prohibition of the development and manufacture of new types of weapons of mass destruction and new systems of such weapons, and to draft possible agreements on particular types of such weapons; once again urges all states to refrain from any action which could adversely affect these talks; and calls upon the permanent members of the Security Council as well as upon other militarily significant states to make declarations, identical in substance, renouncing the creation of new types of weapons of mass destruction.

In favour 116
Against 1: USA
Abstaining 26: Australia, Austria, Belgium, Canada, Denmark, France, FRG, Greece, Iceland, Ireland, Israel, Italy, Ivory Coast, Japan, Luxembourg, Netherlands, New Zealand, Norway, Paraguay, Portugal, Somalia, Spain, Swaziland, Sweden, Turkey, UK
Absent: Albania, China, Comoros, Djibouti, Dominica, Equatorial Guinea, Grenada, Guatemala, Kampuchea, Malta, St Christopher and Nevis, Samoa, Seychelles, Solomon Islands

Conventional weapons

38/188 A 20 December 1983

Requests the Secretary-General to continue the study on the conventional arms race and on disarmament relating to conventional weapons and armed forces, and to submit the final report to the General Assembly at its thirty-ninth session.

In favour 138
Against 0
Abstaining 8: Bahrain, India, Iraq, Jordan, Kuwait, Qatar, United Arab Emirates, Yemen
Absent: Albania, Botswana, Comoros, Equatorial Guinea, Ghana, Grenada, Libya, St Christopher and Nevis, Samoa, Seychelles, Solomon Islands

38/66 15 December 1983

Notes with satisfaction that the Convention on prohibitions or restrictions on the use of certain conventional weapons which may be deemed to be excessively injurious or to have indiscrimate effects, and the three Protocols annexed thereto, entered into force on 2 December 1983; and urges all states that have not yet done so to become parties to the Convention and the Protocols as early as possible.

Adopted without vote

Naval arms race

38/188 F 20 December 1983

Appeals to all member states, in particular the major naval powers, to refrain from enlarging their naval activities in areas of conflict or tension, or far from their own shores; recognizes the urgent need to start negotiations on the limitation of naval activities, the limitation and reduction of naval armaments, taking into due account the nuclear aspect of the naval arms race, and the extension of confidence-building measures to seas and oceans, especially to regions with the busiest sea lanes or regions where the probability of conflict situations is high; invites the states to communicate to the Secretary-General, not later than June 1984, their views concerning modalities for holding such negotiations; and requests the Secretary-General to submit to the General Assembly at its thirty-ninth session a report based on the replies of states.

In favour 73[e]
Against 19: Australia, Belgium, Canada, Denmark, France, FRG, Iceland, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Turkey, UK, USA
Abstaining 44: Angola, Austria, Bahamas, Bangladesh, Barbados, Belize, Bhutan, Chad, Chile, Costa Rica, Djibouti, Dominica, Dominican Republic, Egypt, El Salvador, Fiji, Gabon, Greece, Guatemala, Haiti, India, Indonesia, Ireland, Ivory Coast, Lebanon, Liberia, Malawi, Maldives, Mauritius, Morocco, Nepal, Oman, Pakistan, Paraguay, Philippines, St Lucia, St Vincent,

Sri Lanka, Sudan, Suriname, Swaziland, Sweden, Togo, Zaire
Absent: Albania, Botswana, Burma, Central African Republic, China, Comoros, Equatorial Guinea, Grenada, Kampuchea, Panama,[a] St Christopher and Nevis, Samoa, Senegal, Seychelles, Singapore, Solomon Islands, Somalia, Thailand, Trinidad and Tobago, Tunisia, Uruguay[a]

38/188 G 20 December 1983

Requests the Secretary-General, with the assistance of qualified government experts, to carry out a comprehensive study on the naval arms race, on naval forces and naval arms systems, including maritime nuclear weapon systems, as well as on the development, deployment and mode of operation of such naval forces and systems, all with a view to analysing their possible implications for international security and for freedom of the high seas and for the international shipping routes and for the exploitation of marine resources, thereby facilitating the identification of possible areas for disarmament and confidence-building measures; and invites all governments to submit to the Secretary-General, not later than 1 April 1984, their views on the content of such a study and to co-operate with him by making relevant material available so that the objectives of the study may be achieved.

In favour 113
Against 1: USA
Abstaining 32: Afghanistan, Angola, Belgium, Bulgaria, Byelorussia, Canada, Cuba, Czechoslovakia, Dominica, France, FRG, GDR, Hungary, India, Israel, Italy, Japan, Lao People's Democratic Republic, Liberia, Luxembourg, Mongolia, Mozambique, New Zealand, Poland, Portugal, St Lucia, Togo, Turkey, UK, Ukraine, USSR, Viet Nam
Absent: Albania, Botswana, Central African Republic, Comoros, Equatorial Guinea, Grenada, St Christopher and Nevis, Samoa, Sao Tome and Principe, Seychelles, Solomon Islands

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Regional disarmament

38/73 J 15 December 1983

Takes note of the proposals made in the context of regional disarmament since the adoption of its resolution 37/100 F; and requests the Secretary-General to keep the General Assembly informed of the activities carried out by the Secretariat, in particular the Department for Disarmament Affairs and the UN Institute for Disarmament Research, in the field of the regional approach to disarmament.

Adopted without vote

Antarctica

38/77 15 December 1983

Affirming the conviction that, in the interest of all mankind, Antarctica should continue forever to be used exclusively for peaceful purposes, and that it should not become the scene or object of international discord, requests the Secretary-General to prepare a comprehensive, factual and objective study on all aspects of Antarctica, taking fully into account the Antarctic Treaty system and other relevant factors.

Adopted without vote

Military expenditures

38/184 A 20 December 1983

Calls upon all member states, in particular the most heavily armed states, to co-operate in a constructive manner with a view to reaching agreements to freeze, reduce or otherwise restrain military expenditures and, pending the conclusion of such agreements, to exercise self-restraint in their military expenditures with a view to reallocating the funds thus saved to economic and social development, particularly for the benefit of developing countries. Requests the Disarmament Commission to continue, at its next substantive session, the consideration of the item entitled "Reduction of military budgets".

Adopted without vote

38/184 B 20 December 1983

Stresses the need to increase the number of states participating in the international system of standardized reporting of military expenditures; and reiterates the recommendation that all member states should report annually, by 30 April, to the Secretary-General, their military expenditures for the latest fiscal year for which data are available.

In favour 116
Against 13: Afghanistan, Bulgaria, Byelorussia, Cuba, Czechoslovakia, GDR,

Hungary, Lao People's Democratic Republic, Mongolia, Poland, Ukraine, USSR, Viet Nam
Abstaining 8: Argentina, Brazil, China, India, Mozambique, Syria, Tanzania, Zambia
Absent: Albania, Algeria, Burma, Comoros, Equatorial Guinea, Ethiopia, Grenada, Iran, Kuwait, Libya, Nicaragua, St Christopher and Nevis, Samoa, Sao Tome and Principe, Saudi Arabia, Seychelles, Solomon Islands, Upper Volta, Democratic Yemen, Zimbabwe

Remnants of war

38/162 19 December 1983

Regrets that no concrete measures have been taken to solve the problem of remnants of war despite the various resolutions and decisions adopted thereon by the General Assembly and the Governing Council of the UN Environment Programme; reiterates its support of the just demands of the developing countries affected by the implantation of mines and the presence of other remnants of war in their territories for full compensation from the states responsible for those remnants; and requests the Secretary-General to intensify his efforts to urge the states concerned immediately to conduct bilateral consultations with the aim of concluding, as soon as possible, agreements for the solution of this problem.

In favour 121
Against 0
Abstaining 23: Australia, Austria, Belgium, Canada, Denmark, Finland, France, FRG, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Senegal, Spain, Sweden, UK, USA
Absent: Antigua and Barbuda, Comoros, Dominica, Equatorial Guinea, Grenada, Israel, St Christopher and Nevis, Samoa, Seychelles, Singapore, Solomon Islands, Vanuatu, Zimbabwe

Sea-bed

38/188 B 20 December 1983

Welcomes with satisfaction the positive assessment by the Review Conference of the Parties to the Treaty on the prohibition of the emplacement of nuclear weapons and other weapons of mass destruction on the sea-bed and the ocean floor and in the subsoil thereof of the effectiveness of the Treaty since its entry into force, as reflected in its Final Declaration; reiterates its hope for the widest possible adherence to the Treaty; calls again upon all states to refrain from any action which might lead to the extension of the arms race to the sea-bed and the ocean floor; and requests the Conference on Disarmament, in consultation with the states parties to the Treaty, taking into account existing proposals and any relevant technological developments, to proceed promptly with consideration of further measures in the field of disarmament for the prevention of an arms race on the sea-bed, the ocean floor and the subsoil thereof.

Adopted without vote

Outer space

38/70 15 December 1983

Taking note of the draft treaty on the prohibition of the use of force in outer space and from space against the Earth, submitted by the USSR, as well as views and comments expressed during the discussion of that draft, requests the Conference on Disarmament to intensify its consideration of the question of the prevention of an arms race in outer space in all its aspects, taking into account all relevant proposals, and to establish an *ad hoc* working group at the beginning of its session in 1984, with a view to undertaking negotiations for the conclusion of an agreement or agreements, as appropriate.

In favour 147
Against 1: USA
Abstaining 1: UK
Absent: Albania, Comoros, Dominica, Equatorial Guinea, Guinea-Bissau, St Christopher and Nevis, St Vincent, Samoa

38/80 15 December 1983

Calls upon all states, in particular those with major space capabilities, to undertake prompt negotiations under the auspices of the United Nations with a view to reaching agreement or agreements designed to halt the militarization of outer space and to prevent an arms race in outer space, thus contributing to the achievement of the internationally accepted goal of ensuring the use of outer space exclusively for peaceful purposes; and requests the Committee on the Peaceful Uses of Outer Space to consider, as a matter of priority, the questions relating to the militarization of outer space, taking into account that the Committee on

Disarmament was requested to consider as a matter of priority the question of preventing an arms race in outer space and also taking into account the need to co-ordinate the efforts of the Committee on the Peaceful Uses of Outer Space and the Committee on Disarmament.

In favour 124
Against 12: Australia, Belgium, France, FRG, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, UK, USA
Abstaining 8: Canada, Denmark, Finland, Iceland, Norway, Portugal, Spain, Sweden
Absent: Albania, Antigua and Barbuda, Central African Republic, Comoros, Costa Rica,[a] Cuba,[a] Grenada, Guatemala,[a] Haiti,[a] St Christopher and Nevis, St Vincent, Samoa, Solomon Islands

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International security and peaceful settlement of disputes

38/188 H 20 December 1983

Recalling that the Disarmament Commission recommended that the report of the Independent Commission on Disarmament and Security Issues entitled "Common security" be taken into account in ongoing and future disarmament efforts, welcomes the report of the Independent Commission as a constructive contribution to international efforts to achieve disarmament and to maintain and strengthen international peace and security; requests the Secretary-General, with the assistance of qualified government experts, to carry out a comprehensive study of concepts of security, in particular security policies which emphasize co-operative efforts and mutual understanding between states, with a view to developing proposals for policies aimed at preventing the arms race, building confidence in the relations between states, enhancing the possibility of reaching agreements on arms limitation and disarmament and promoting political and economic security; and invites all states to submit to the Secretary-General, not later than 1 April 1984, their views on the content of such a study.

In favour 132
Against 1: USA
Abstaining 15: Belgium, Canada, France, FRG, India, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Portugal, Somalia, Turkey, UK
Absent: Albania, China, Comoros, Equatorial Guinea, Grenada, St Christopher and Nevis, Samoa, Seychelles, Solomon Islands

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38/73 H 15 December 1983

Requests the Security Council to expedite the conclusion of the agreements making available to the council armed forces, as required by the Charter of the United Nations, to render operative the collective security system provided for in the Charter, and thereby facilitate productive negotiations for the cessation of the arms race, particularly the nuclear arms race, and for progress on disarmament.

In favour 133
Against 0
Abstaining 13: Belgium, Canada, France, FRG, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Portugal, UK, USA
Absent: Albania, Comoros, Dominica, Equatorial Guinea, Guinea-Bissau, Indonesia, Iran, St Christopher and Nevis, St Vincent, Samoa, Turkey

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38/131 19 December 1983

Requests the Secretary-General to prepare a preliminary outline on the possible content of a handbook on the peaceful settlement of disputes between states, which will comprise all existing means and mechanisms available for the purpose.

Adopted without vote

38/133 19 December 1983

Decides that the Special Committee shall continue its work with the goal of drafting, at the earliest possible date, a world treaty on the non-use of force in international relations as well as the peaceful settlement of disputes.

In favour 119
Against 15: Belgium, Canada, Denmark, France, Iceland, Israel, Italy, Japan, Luxembourg, Netherlands, Norway, Portugal, Spain, UK, USA
Abstaining 8: Australia, Austria, FRG, Ireland, Ivory Coast, New Zealand, Sweden, Turkey
Absent: Albania, Antigua and Barbuda, Botswana, Central African Republic, Comoros, Dominica, Equatorial Guinea, Grenada, St Christopher and Nevis, St Vincent, Samoa, Seychelles, Solomon Islands, Democratic Yemen, Zimbabwe

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Disarmament and development

38/71 A 15 December 1983

Recalling the conclusions contained in the study entitled *The Relationship between Disarmament and Development*, and recalling also its resolution 37/84 of 9 December 1982, requests the Secretary-General to submit a report to the General Assembly at its fortieth session based on appropriate measures taken by member states and within the United Nations system in accordance with that resolution.

In favour 137
Against 0
Abstaining 12: Afghanistan, Bulgaria, Byelorussia, Czechoslovakia, GDR, Hungary, Lao People's Democratic Republic, Mongolia, Poland, Ukraine, USSR, Viet Nam
Absent: Albania, Comoros, Dominica, Equatorial Guinea, Guinea-Bissau, St Christopher and Nevis, St Vincent, Samoa

38/71 B 15 December 1983

Invites member states to communicate to the Secretary-General, by 1 April 1984, their views and proposals concerning the relationship between disarmament and development, in particular with regard to the following: (*a*) the evaluation of the burden of armaments in the world; (*b*) the impact of military expenditures on the world economic situation and development; (*c*) the contribution that a reduction in arms and military expenditures, in particular by nuclear weapon states and other militarily important states, would make to development tasks; (*d*) the ways and means that would enable this contribution to be made, in particular in the interests of the economic and social progress of the developing countries; and (*e*) the consideration of proposals relating to the convening of a conference. Requests the Disarmament Commission to consider the replies received and to make appropriate recommendations to the General Assembly at its thirty-ninth session.

Adopted without vote

Confidence building

38/73 A 15 December 1983

Welcoming the convening at Stockholm of the Conference on confidence- and security-building measures and disarmament in Europe, invites all states to consider the possible introduction unilaterally, bilaterally or multilaterally of confidence-building measures in their particular regions and, where possible, to negotiate on them in keeping with the conditions and requirements prevailing in their respective regions; and requests the Disarmament Commission to continue and conclude at its 1984 session the consideration of the item entitled "Elaboration of guidelines for appropriate types of confidence-building measures and for the implementation of such measures on a global or regional level".

Adopted without vote

38/188 C 20 December 1983

Calls upon all states, in particular nuclear weapon states and other militarily significant states, to consider measures to facilitate objective information on, as well as objective assessments of, military capabilities; and invites all states that have not communicated to the Secretary-General their views and proposals concerning such measures to do so as soon as possible, and those states that have already communicated such views and proposals to supplement them, as appropriate.

In favour 119
Against 0
Abstaining 21: Afghanistan, Angola, Bulgaria, Byelorussia, Congo, Cuba, Czechoslovakia, GDR, Guyana, Hungary, India, Lao People's Democratic Republic, Mongolia, Mozambique, Poland, Syria, Tanzania, Ukraine, USSR, Viet Nam, Zambia
Absent: Albania, Botswana, China, Comoros, Democratic Yemen, Equatorial Guinea, Ethiopia, Grenada, Libya, Nicaragua, Rwanda, St Christopher and Nevis, Samoa, Sao Tome and Principe, Seychelles, Solomon Islands, Democratic Yemen, Zimbabwe

Disarmament machinery

38/183 H 20 December 1983

Calls upon all states to refrain from any actions which have or may have negative effects on the outcome of disarmament negotiations; once again calls upon the Conference on Disarmament to concentrate its work on the substantive and priority items on its agenda, to proceed to negotiations on nuclear disarmament and on prevention of nuclear war without further delay and to elaborate drafts of treaties on a nuclear weapon test ban and on a complete and effective prohibition of the development, production and stockpiling of all chemical weapons and on their destruction; calls upon nuclear weapon states engaged in separate negotiations on issues of nuclear disarmament to exert the utmost effort with a view to achieving concrete results in those negotiations and thus contribute to the success of multilateral negotiations on nuclear disarmament; and invites all states engaged in disarmament and arms limitation negotiations outside the framework of the United Nations to keep the General Assembly and the Conference on Disarmament informed on the status and/or results of such negotiations.

In favour 132
Against 9: Canada, France, FRG, Luxembourg, Netherlands, Portugal, Turkey, UK, USA
Abstaining 8: Australia, Belgium,[b] Israel, Italy, Japan, New Zealand, Norway, Spain
Absent: Albania, Comoros, Equatorial Guinea, Grenada, St Christopher and Nevis, Samoa, Seychelles, Solomon Islands

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38/183 D 20 December 1983

Calls upon the Conference on Disarmament to proceed without delay to negotiations on the cessation of the nuclear arms race and nuclear disarmament in accordance with paragraph 50 of the Final Document of the first Special Session of the General Assembly devoted to disarmament, and especially to elaborate a nuclear disarmament programme, and to establish for this purpose an *ad hoc* working group.

In favour 108
Against 19: Australia, Belgium, Canada, Denmark, France, FRG, Iceland, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Turkey, UK, USA
Abstaining 16: Bahamas, Chad, Dominica, Gambia, Guatemala, Haiti, Honduras, Ivory Coast, Paraguay, Philippines, St Lucia, St Vincent, Senegal, Swaziland, Uruguay, Zaire
Absent: Albania, China, Comoros, Djibouti, Equatorial Guinea, Grenada, Kampuchea, Malta, Morocco, St Christopher and Nevis, Samoa, Seychelles, Solomon Islands, Somalia

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38/183 K 20 December 1983

Urges the Conference on Disarmament, as soon as it considers that the circumstances are propitious for that purpose, to renew its work on the elaboration of the Comprehensive Programme of Disarmament.

Adopted without vote

38/183 I 20 December 1983

Requests the Conference on Disarmament to intensify its work, and to make the utmost effort to achieve concrete results in the shortest possible period of time on the specific priority issues of disarmament on its agenda: to provide the existing *ad hoc* working groups with appropriate negotiating mandates and to establish, as a matter of urgency, *ad hoc* working groups on the cessation of the nuclear arms race and nuclear disarmament, on the prevention of nuclear war and on the prevention of an arms race in outer space.

In favour 129
Against 2: UK, USA
Abstaining 18: Australia, Belgium, Canada, Denmark, France, FRG, Greece, Iceland, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Turkey.
Absent: Albania, Comoros, Equatorial Guinea, Grenada, St Christopher and Nevis, Samoa, Seychelles, Solomon Islands

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38/183 E 20 December 1983

Requests the Disarmament Commission to meet for a period not exceeding four weeks during 1984 and to submit a substantive report, containing specific recommendations on the items inscribed on its agenda, to the General Assembly at its thirty-ninth session.

Adopted without vote

38/188 J 20 December 1983

Invites the specialized agencies and other institutions and programmes within the UN system to broaden further their contribution, within their areas of competence, to the cause of arms limitation and disarmament.

In favour 114
Against 17: Australia, Belgium, Canada, France, FRG, Iceland, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Turkey, UK, USA
Abstaining 12: Austria, Bahamas, Barbados, China, Denmark, Finland, Greece, Ireland, Paraguay, St Vincent, Spain, Sweden

Absent: Albania, Burma, Central African Republic, Comoros, Djibouti, Equatorial Guinea, Grenada, Haiti, Kampuchea, Malta, St Christopher and Nevis, Samoa, Seychelles, Solomon Islands

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38/186 20 December 1983

Requests the *Ad Hoc* Committee on the World Disarmament Conference to continue to maintain close contact with the representatives of the states possessing nuclear weapons, in order to remain currently informed of their attitudes, as well as with all other states, and to consider any relevant comments and observations which might be made to the Committee.

Adopted without vote

38/73 1 15 December 1983

Decides that the third Special Session of the General Assembly devoted to disarmament should be held not later than 1988; decides also to set, not later than at its fortieth session, the date of the Special Session and to make appropriate arrangements concerning the establishment of a preparatory committee.

Adopted without vote

Information and training

38/73 D 15 December 1983

Takes note of the implementation of the programme of activities of the World Disarmament Campaign for 1983; notes also with satisfaction the voluntary contributions made by member states to the trust fund for the Campaign, prior to and during the first United Nations Pledging Conference for the Campaign held on 27 October 1983; decides that at the thirty-ninth session of the General Assembly there should be a second pledging conference, and recommends that the voluntary contributions for the World Disarmament Campaign should not be earmarked for specific activities inasmuch as it is most desirable that the Secretary-General may enjoy full freedom to take the decisions he deems fit within the framework of the Campaign previously approved by the General Assembly and in exercise of the powers vested on him in connection with the Campaign.

Adopted without vote

38/73 F 15 December 1983

Reaffirms the usefulness of further carrying out actions and activities which are an important manifestation of the will of world public opinion and contribute effectively to the achievement of the objectives of the World Disarmament Campaign and thus to the creation of a favourable climate for making progress in the field of disarmament; and invites once again member states to co-operate with the United Nations to ensure a better flow of accurate information with regard to the various aspects of disarmament as well as action and activities of the world public in support of peace and disarmament, and to avoid dissemination of false and tendentious information.

In favour 112
Against 1: Brazil
Abstaining 29: Argentina, Austria, Bahamas, Belgium, Canada, Chile, Denmark, Finland, France, FRG, Greece, Honduras, Iceland, Ireland, Israel, Italy, Kampuchea, Luxembourg, Netherlands, New Zealand, Norway, Paraguay, Portugal, Spain, Sweden, Turkey, UK, USA, Uruguay
Absent: Albania, Burma, China, Comoros, Dominica, Equatorial Guinea, Guinea-Bissau, Malta, Morocco, St Christopher and Nevis, St Vincent, Samoa, Singapore, Somalia, Zaire

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38/183 F 20 December 1983

Declares that the elaboration and dissemination of any doctrines and concepts justifying the unleashing of nuclear war endanger world peace, lead to deterioration of the international situation and further intensification of the arms race and are detrimental to the generally recognized necessity of international co-operation for disarmament; appeals to states which are members of military groupings to promote, in the spirit of international co-operation for disarmament, a gradual mutual limitation of military activities of these groupings, thus creating conditions for their dissolution; and calls upon all states to cultivate and disseminate, particularly in connection with the World Disarmament Campaign, the ideas of international co-operation for disarmament, *inter alia*, through their educational systems, mass media and cultural policies.

In favour 109
Against 15: Australia, Belgium, Canada, France, FRG, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Turkey, UK, USA
Abstaining 15: Austria, Brazil, Denmark, Finland, Greece, Guatemala, Honduras, Iceland, Ireland, Israel, Lebanon, Paraguay, Philippines, Spain, Sweden
Absent: Albania, Burma, China, Comoros, Equatorial Guinea, Gambia, Grenada, Kampuchea, Malta, St Christopher and Nevis, Samoa, Senegal, Seychelles, Singapore, Solomon Islands, Somalia, Swaziland, Uruguay[a]

38/73 C 15 December 1983

Decides to continue the UN programme of fellowships on disarmament; expresses its appreciation of the governments of FR Germany, Japan, Sweden, the Soviet Union and the United States for inviting the fellows to their countries in 1983 to study selected activities in the field of disarmament and expresses the hope that other states will extend similar support for the programme.

Adopted without vote

38/183 O 20 December 1983

Expresses satisfaction that the Secretary-General has revived the Advisory Board on Disarmament Studies; and requests the Secretary-General to report annually to the General Assembly on the work of the Board.

Adopted without vote

38/183 L 20 December 1983

Invites the relevant specialized agencies and the IAEA to intensify activities, within their areas of competence, to disseminate information on the consequences of the arms race; requests governments and non-governmental organizations to inform the Secretary-General of activities undertaken to promote the objectives of Disarmament Week.

In favour 136
Against 0
Abstaining 12: Australia, Belgium, France, FRG, Israel, Italy, Kampuchea, Luxembourg, Netherlands, Turkey, UK, USA
Absent: Albania, China, Comoros, Equatorial Guinea, Grenada, St Christopher and Nevis, Samoa, Seychelles, Solomon Islands

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[a] Later advised the Secretariat it had intended to vote in favour.
[b] Later advised the Secretariat it had intended to vote against.
[c] Later advised the Secretariat it had intended to abstain.
[d] Malawi later advised the Secretariat it had intended to abstain.
[e] Honduras and Malaysia later advised the Secretariat they had intended to abstain.

18. Arms control agreements

JOZEF GOLDBLAT and RAGNHILD FERM

Superscript numbers refer to the list of notes and references at the end of the chapter.

(For the full texts of the arms control agreements, see Goldblat, J., *Agreements for Arms Control, A Critical Survey*, SIPRI (Taylor & Francis, London, 1982.)

I. Bilateral agreements: summaries

Treaty between the USA and the USSR on the limitation of anti-ballistic missile systems (ABM Treaty)

Signed at Moscow on 26 May 1972; entered into force on 3 October 1972.

Prohibits the deployment of ABM systems (or their components) for the defence of the whole territory of the USA and the USSR (or the creation of a base for such defence) or of an individual region, except as expressly permitted. Permitted ABM deployments are limited to two areas in each country—one for the defence of the national capital, and the other for the defence of an intercontinental ballistic missile (ICBM) complex. No more than 100 ABM launchers and 100 ABM interceptor missiles may be deployed in each ABM deployment area. ABM radars should not exceed specified numbers and are subject to qualitative restrictions. In particular, it is forbidden to deploy radars for early warning of strategic ballistic missile attack, including large phased-array radars, except at locations along the periphery of the national territory of each party and on condition that they be oriented outward. An agreed interpretation, accompanying the Treaty, permits deployment of large phased-array radars for tracking objects in outer space or for use as national technical means of verification to provide assurance of compliance with the provisions of the Treaty.

In addition, the parties undertake not to develop, test or deploy ABM systems or components which are sea-, air-, space- or mobile land-based, nor to give missiles, launchers or radars, other than ABM interceptor missiles, launchers or radars, capabilities to counter strategic ballistic missiles, nor to test them in an ABM mode. According to another agreed interpretation, development, testing or deployment of ABM interceptor missiles for the delivery by each missile of more than one independently guided warhead are prohibited. The parties also agreed that in the event ABM systems based on other physical principles and including components capable of substituting for ABM interceptor missiles, launchers or radars are created in the future, specific limitations on such systems and their components would be subject to discussion and agreement. The use of deliberate concealment measures impeding verification is prohibited. A Standing Consultative Commission is established to promote the objectives and implementation of the Treaty. The ABM Treaty is of unlimited duration.

Protocol to the US–Soviet ABM Treaty

Signed at Moscow on 3 July 1974; entered into force on 25 May 1976

Provides that each party shall be limited to a single area for deployment of anti-ballistic missile systems or their components instead of two such areas as allowed by the ABM Treaty. Each party will have the right to dismantle or destroy its ABM system and the components thereof in the area where they were deployed at the time of the signing of the Protocol and to deploy an ABM system or its components in the alternative area permitted by the ABM Treaty, provided that, before starting construction, notification is given during the year beginning on 3 October 1977 and ending on 2 October 1978, or during any year which commences at five-year intervals thereafter, those being the years for periodic review of the ABM Treaty. This right may be exercised only once. The deployment of an ABM system within the area selected shall remain limited by the levels and other requirements established by the ABM Treaty.

Interim Agreement between the USA and the USSR on certain measures with respect to the limitation of strategic offensive arms (SALT I Agreement)

Signed at Moscow on 26 May 1972; entered into force on 3 October 1972
In September 1977 the USA and the USSR formally stated that, although the Interim Agreement was to expire on 3 October 1977, they intended to refrain from any actions incompatible with its provisions or with the goals of the ongoing talks on a new agreement.

Provides for a freeze for a period of five years of the aggregate number of fixed land-based intercontinental ballistic missile (ICBM) launchers (i.e., launchers of missiles capable of a range in excess of 5 500 km) and ballistic missile launchers on modern submarines. The parties are free to choose the mix, except that conversion of land-based launchers for light ICBMs, or for ICBMs of older types, into land-based launchers for modern heavy ICBMs is prohibited. National technical means of verification are to be used to provide assurance of compliance with the provisions of the Agreement, and the parties undertake not to use deliberate concealment measures impeding verification.

A *protocol*, which is an integral part of the Interim Agreement, specifies that the USA may have not more than 710 ballistic missile launchers on submarines and 44 modern ballistic missile submarines, while the USSR may have not more than 950 ballistic missile launchers on submarines and 62 modern ballistic missile submarines. Up to those levels, additional ballistic missile launchers—in the USA over 656 launchers on nuclear-powered submarines and in the USSR over 740 launchers on nuclear-powered submarines, operational and under construction—may become operational as replacements for equal numbers of ballistic missile launchers of types deployed before 1964, or of ballistic missile launchers on older submarines.

Treaty between the USA and the USSR on the limitation of underground nuclear weapon tests (Threshold Test Ban Treaty—TTBT)

Signed at Moscow on 3 July 1974; not in force by 31 December 1983
Since the Treaty was not in force by 31 March 1976 (the agreed cut-off date for explosions above the established threshold) the parties stated that they would observe the limitation during the pre-ratification period.

Prohibits from 31 March 1976 the carrying out of any underground nuclear weapon test having a yield exceeding 150 kt. Each party undertakes to limit the number of its underground nuclear weapon tests to a minimum. The parties have agreed, in a separate understanding, that one or two "slight, unintended" breaches per year would not be considered a violation of the Treaty, because of the technical uncertainties associated with predicting the precise yield of nuclear weapon tests. National technical means of verification are to be used to provide assurance of compliance, and a *protocol* to the Treaty specifies the data that have to be exchanged between the parties to ensure such verification.

Treaty between the USA and the USSR on underground nuclear explosions for peaceful purposes (Peaceful Nuclear Explosions Treaty—PNET)

Signed at Moscow and Washington on 28 May 1976; not in force by 31 December 1983

Prohibits the carrying out of any individual underground nuclear explosion for peaceful purposes, having a yield exceeding 150 kt, or any group explosion (consisting of two or more individual explosions) with an aggregate yield exceeding 1 500 kt. The Treaty governs all nuclear explosions carried out outside the weapon test sites after 31 March 1976. The question of carrying out individual explosions with a yield exceeding 150 kt will be considered at an appropriate time to be agreed. In addition to the use of national technical means of verification, the Treaty provides for access to sites of explosions in certain specified cases. A *protocol* to the Treaty sets forth operational arrangements for ensuring that no weapon-related benefits precluded by the TTBT are derived from peaceful nuclear explosions.

Treaty between the USA and the USSR on the limitation of strategic offensive arms (SALT II Treaty)

Signed at Vienna on 18 June 1979; not ratified

Although the Treaty did not enter into force, the signatories stated that they would refrain from actions contrary to its provisions.

Sets, for both parties, an initial ceiling of 2 400 on the number of intercontinental ballistic missile (ICBM) launchers, submarine-launched ballistic missile (SLBM) launchers, heavy bombers, and air-to-surface ballistic missiles (ASBMs) capable of a range in excess of 600 km. This ceiling will be lowered to 2 250 and the lowering must begin on 1 January 1981, while the dismantling or destruction of systems which exceed that number must be completed by 31 December 1981. A sublimit of 1 320 is imposed upon each party for the combined number of launchers of ICBMs and SLBMs equipped with multiple independently targetable re-entry vehicles (MIRVs), ASBMs equipped with MIRVs, and aeroplanes equipped for long-range (over 600 km) cruise missiles. Moreover, each party is limited to a total of 1 200 launchers of MIRVed ICBMs, SLBMs and ASBMs, and of this number no more than 820 may be launchers of MIRVed ICBMs. A freeze is introduced on the number of re-entry vehicles on current types of ICBMs, with a limit of 10 re-entry vehicles on the one new type of ICBM allowed each side, a limit of 14 re-entry vehicles on SLBMs and a limit of 10 re-entry vehicles on ASBMs. An average of 28 long-range air-launched cruise missiles (ALCMs) per heavy bomber is allowed, while current heavy bombers may carry no more than 20 ALCMs each. Ceilings are established on the throw-weight and launch-weight of light and heavy ICBMs.

There is a ban on the flight-testing or deployment of new types of ICBMs, except for one new type of light ICBM. The term "new" refers to any ICBM differing in the number of stages and (in excess of 5 per cent) in the length, diameter, launch-weight or throw-weight, from those ICBMs flight-tested as of 1 May 1979, as well as differing with respect to the type of propellant (liquid or solid) of any of the missile stages. No ICBM of an existing type, equipped with a single re-entry vehicle, may be flight-tested or deployed with a re-entry vehicle the weight of which is less than 50 per cent of the throw-weight of that ICBM. The parties are not allowed to convert land-based launchers of ballistic missiles which are not ICBMs into launchers for ICBMs, and not to test them for this purpose. In this connection, the Soviet Union undertakes not to produce, test or deploy ICBMs known as SS-16; neither will it produce the third stage and the re-entry vehicle of that missile, or the appropriate device for targeting the re-entry vehicle. In the case of ICBM launchers undergoing structural changes after entry into force of the Treaty, launchers of MIRVed missiles are to be made distinguishable from launchers of missiles not equipped with MIRVs. Furthermore, there are prohibitions: on building additional fixed ICBM launchers; on converting fixed light ICBM launchers into heavy ICBM launchers; on heavy mobile ICBMs, heavy SLBMs and heavy ASBMs; on surface-ship ballistic missile launchers; on systems to launch missiles from the sea-bed or the beds of internal waters; as well as on systems for delivery of nuclear weapons from Earth orbit, including fractional orbital missiles.

National technical means will be used to verify compliance. Any interference with such means of verification, or any deliberate concealment measures which impede verification, are prohibited. In particular, neither party shall engage in denial of telemetric information (radio signals sent from a missile to ground monitors during a flight test), such as through the use of telemetry encryption, whenever such denial impedes verification. In addition, each party undertakes not to circumvent the provisions of the Treaty through any other state or states, or in any other manner, nor to assume international obligations conflicting with the Treaty. To consider questions concerning compliance, the parties are to use the Standing Consultative Commission established in 1972. The envisaged duration of the Treaty is until 31 December 1985.

Prior to the signing of the Treaty, on 16 June 1979, the USSR informed the USA that the Soviet Tu-22M aircraft, called 'Backfire', is a medium-range bomber, and that the Soviet Union does not intend to give this bomber an intercontinental capability and will not increase its radius of action to enable it to strike targets on US territory. The USSR also pledged to limit the production of Backfire aircraft to the 1979 rate.

Protocol to the SALT II Treaty

Signed at Vienna on 18 June 1979; not ratified

Bans until 31 December 1981: the deployment of mobile ICBM launchers or the flight-testing of ICBMs from such launchers; the deployment (but not the flight-testing) of long-range (over 600 km) cruise missiles on sea-based or land-based launchers; the flight-testing of long-range cruise missiles with multiple warheads from sea-based or land-based launchers; and the flight-testing or deployment of ASBMs. The Protocol is an integral part of the Treaty.

In a *Memorandum of Understanding* the parties agreed on the numbers of strategic offensive arms in each of the 10 categories limited by the Treaty, as of 1 November 1978. In separate statements of data, each party declared that it possessed the stated number of strategic offensive arms subject to the Treaty limitations as of the date of signature of the Treaty.

II. Multilateral agreements: summaries

Protocol for the prohibition of the use in war of asphyxiating, poisonous or other gases, and of bacteriological methods of warfare (Geneva Protocol)

Signed at Geneva on 17 June 1925; entered into force on 8 February 1928

Declares that the parties agree to be bound by the above prohibition, which should be universally accepted as part of international law, binding alike the conscience and the practice of nations. (Reservations made by a number of states have limited the applicability of the Protocol to nations party to it and to first use only.) (Parties: see appendix 18A.)

Antarctic Treaty

Signed at Washington on 1 December 1959; entered into force on 23 June 1961

Declares the Antarctic an area to be used exclusively for peaceful purposes. Prohibits any measure of a military nature in the Antarctic, such as the establishment of military bases and fortifications, and the carrying out of military manoeuvres or the testing of any type of weapon. Bans any nuclear explosion as well as the disposal of radioactive waste material in Antarctica, subject to possible future international agreements on these subjects.

Representatives of the contracting parties meet at regular intervals to exchange information and consult each other on matters of common interest pertaining to Antarctica, as well as to recommend to their governments measures in furtherance of the principles and objectives of the Treaty. (Parties: see appendix 18A.)

Treaty banning nuclear weapon tests in the atmosphere, in outer space and under water (Partial Test Ban Treaty—PTBT)

Signed at Moscow on 5 August 1963; entered into force on 10 October 1963

Prohibits the carrying out of any nuclear weapon test explosion or any other nuclear explosion: (*a*) in the atmosphere, beyond its limits, including outer space, or under water, including territorial waters or high seas; or (*b*) in any other environment if such explosion causes radioactive debris to be present outside the territorial limits of the state under whose jurisdiction or control the explosion is conducted. (Parties: see appendix 18A.)

Treaty on principles governing the activities of states in the exploration and use of outer space, including the Moon and other celestial bodies (Outer Space Treaty)

Signed at London, Moscow and Washington on 27 January 1967; entered into force on 10 October 1967

Prohibits the placing in orbit around the Earth of any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, the installation of such weapons on celestial bodies, or the stationing of them in outer space in any other manner. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies are also forbidden. (Parties: see appendix 18A.)

Treaty for the prohibition of nuclear weapons in Latin America (Treaty of Tlatelolco)

Signed at Mexico City on 14 February 1967; entered into force on 22 April 1968

Prohibits the testing, use, manufacture, production or acquisition by any means, as well as the receipt, storage, installation, deployment and any form of possession of any nuclear weapons by Latin American countries.

The parties should conclude agreements with the IAEA for the application of safeguards to their nuclear activities.

Under *Additional Protocol I*, annexed to the Treaty, the extra-continental or continental states which, *de jure* or *de facto*, are internationally responsible for territories lying within the limits of the geographical zone established by the Treaty (France, the Netherlands, the UK and the USA), undertake to apply the statute of military denuclearization, as defined in the Treaty, to such territories.

Under *Additional Protocol II*, annexed to the Treaty, the nuclear weapon states undertake to respect the statute of military denuclearization of Latin America, as defined and delimited in the Treaty, and not to contribute to acts involving a violation of the Treaty, nor to use or threaten to use nuclear weapons against the parties to the Treaty. (Parties: see appendix 18A.)

Treaty on the non-proliferation of nuclear weapons (NPT)

Signed at London, Moscow and Washington on 1 July 1968; entered into force on 5 March 1970

Prohibits the transfer by nuclear weapon states, to any recipient whatsoever, of nuclear weapons or other nuclear explosive devices or of control over them, as well as the assistance, encouragement or inducement of any non-nuclear weapon state to manufacture or otherwise acquire such weapons or devices. Prohibits the receipt by non-nuclear weapon states from any transferor whatsoever, as well as the manufacture or other acquisition by those states, of nuclear weapons or other nuclear explosive devices.

Non-nuclear weapon states undertake to conclude safeguards agreements with the International Atomic Energy Agency (IAEA) with a view to preventing diversion of nuclear energy from peaceful uses to nuclear weapons or other nuclear explosive devices.

The parties undertake to facilitate the exchange of equipment, materials and scientific and technological information for the peaceful uses of nuclear energy and to ensure that potential benefits from peaceful applications of nuclear explosions will be made available to non-nuclear weapon parties to the Treaty. They also undertake to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament. (Parties: see appendix 18A.)

Treaty on the prohibition of the emplacement of nuclear weapons and other weapons of mass destruction on the sea-bed and the ocean floor and in the subsoil thereof (Sea-Bed Treaty)

Signed at London, Moscow and Washington on 11 February 1971; entered into force on 18 May 1972

Prohibits emplanting or emplacing on the sea-bed and the ocean floor and in the subsoil thereof beyond the outer limit of a sea-bed zone (coterminous with the 12-mile outer limit of the zone referred to in the 1958 Geneva Convention on the Territorial Sea and the Contiguous Zone) any nuclear weapons or any other types of weapons of mass destruction as well as structures, launching installations or any other facilities specifically designed for storing, testing or using such weapons. (Parties: see appendix 18A.)

Convention on the prohibition of the development, production and stockpiling of bacteriological (biological) and toxin weapons and on their destruction (BW Convention)

Signed at London, Moscow and Washington on 10 April 1972; entered into force on 26 March 1975

Prohibits the development, production, stockpiling or acquisition by other means or retention of microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes, as well as weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict. The destruction of the agents, toxins, weapons, equipment and means of delivery in the possession of the parties, or their diversion to peaceful purposes, should be effected not later than nine months after the entry into force of the Convention. (Parties: see appendix 18A.)

Document on confidence-building measures and certain aspects of security and disarmament, included in the Final Act of the Conference on Security and Co-operation in Europe (CSCE)

Signed at Helsinki on 1 August 1975

Provides for notification of major military manoeuvres in Europe to be given at least 21 days in advance or, in the case of a manoeuvre arranged at shorter notice, at the earliest possible opportunity prior to its starting date. The term "major" means that at least 25 000 troops are involved. The following information is to be provided: the designation of the manoeuvre (if any); its general purpose; the states involved; the types and numerical strength of the forces engaged; and the area and estimated time-frame of its conduct. States may invite observers to attend the manoeuvres.

The Final Act was signed by Austria, Belgium, Bulgaria, Canada, Cyprus, Czechoslovakia, Denmark, Finland, France, GDR, FRG, Greece, Holy See, Hungary, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, Malta, Monaco, Netherlands, Norway, Poland, Portugal, Romania, San Marino, Spain, Sweden, Switzerland, Turkey, UK, USA, USSR, Yugoslavia.

Convention on the prohibition of military or any other hostile use of environmental modification techniques (ENMOD Convention)

Signed at Geneva on 18 May 1977; entered into force on 5 October 1978

Prohibits military or any other hostile use of environmental modification techniques having widespread, long-lasting or severe effects as the means of destruction, damage or injury to states party to the Convention. The term "environmental modification techniques" refers to any technique for changing—through the deliberate manipulation of natural processes—the dynamics, composition or structure of the Earth, including its biota, lithosphere, hydrosphere and atmosphere, or of outer space.

The understandings reached during the negotiations, but not written into the Convention, define the terms "widespread", "long-lasting" and "severe". (Parties: see appendix 18A.)

Convention on the prohibitions or restrictions on the use of certain conventional weapons which may be deemed to be excessively injurious or to have indiscriminate effects ('Inhumane Weapons' Convention)

Signed at New York on 10 April 1981; entered into force on 2 December 1983

The Convention is an 'umbrella treaty', under which specific agreements can be concluded in the form of protocols.

Protocol I prohibits the use of weapons intended to injure by fragments which are not detectable in the human body by X-rays.

Protocol II prohibits or restricts the use of mines, booby-traps and similar devices.

Protocol III prohibits or restricts the use of incendiary weapons. (Parties: see appendix 18A.)

III. Allegations of breaches

Allegations of breaches of arms control agreements have been made repeatedly in the past 10 years, especially since 1980 when East–West cold war rhetoric became particularly shrill. They coincided, significantly enough, with the interruption or suspension of a series of important US–Soviet negotiations. But it was only at the beginning of 1984 that the United States and the Soviet Union decided to draw up comprehensive lists of their complaints against each other and make the lists public. This section summarizes the allegations put forward by the two powers as well as their responses. An attempt is also made to evaluate the charges.

US allegations

A report sent by President Reagan to the US Congress on 23 January 1984 lists seven cases of alleged non-compliance by the Soviet Union with its obligations under arms control agreements.[1]

1. The USSR maintains an "offensive" biological warfare programme and capabilities, and is involved in the production, transfer and use of toxins and other lethal chemical warfare agents that have been used in Laos, Kampuchea and Afghanistan. It has therefore violated its legal obligations under the 1972 Biological Weapons Convention and customary international law as codified in the 1925 Geneva Protocol.

2. The notification of the Soviet military manoeuvre *Zapad-81*, which took place on 4–12 September 1981, was "inadequate". The USSR therefore violated its political commitment under the Document on confidence-

building measures, included in the 1975 Final Act (Helsinki Declaration) of the Conference on Security and Co-operation in Europe (CSCE).

3. The USSR is building near Krasnoyarsk in central Siberia a large phased-array radar. This is "almost certainly" a violation of the Soviet legal obligations assumed under the 1972 ABM Treaty, which limits the location and orientation of such radars with the view to precluding a territorial anti-ballistic missile defence.

4. The USSR has engaged in encryption of missile test telemetry (radio signals sent from a missile to ground monitors) deliberately to impede verification. This practice constitutes a violation of the 1979 SALT II Treaty, under which the parties shall not deny telemetric information whenever such denial impedes verification. (Although the SALT II Treaty did not formally enter into force, the signatories were obligated under international law not to take action during the pre-ratification period, which would defeat the object and purpose of the unratified agreement; in 1981, after the USA had made clear its intention not to ratify the Treaty, the signatories assumed a 'political' commitment, as distinct from a 'legal' obligation, to refrain from actions contrary to its provisions.)

5. The USSR has tested a 'second new' type of ICBM (the SS-X-25). While the evidence is "somewhat ambiguous", such testing is a "probable" violation of the Soviet political commitment to observe the 1979 SALT II Treaty, which limits each party to 'one new type' of ICBM in order to constrain modernization and proliferation of more capable types. Even if the Soviet assertion were accepted that the SS-X-25 was not a prohibited new type of ICBM (the USSR stated that the SS-X-24 was its allowed one new type of ICBM), the USSR still acted contrary to the SALT II Treaty provision which prohibits an ICBM of an existing type, and equipped with a single re-entry vehicle, to be flight-tested with a re-entry vehicle the weight of which is less than 50 per cent of the throw-weight of that ICBM in order to bar the possibility that single warhead ICBMs could be quickly converted to MIRVed (multiple independently targetable re-entry vehicles) systems. Encryption on this missile impeded verification by the USA.

6. The USSR has deployed the SS-16 ICBM. While the evidence is "somewhat ambiguous" and no definitive conclusion could be reached, the Soviet Union's activities at Plesetsk (a missile test range) are a "probable" violation of its legal obligation (prior to 1981) and of its political commitment (after 1981) under the 1979 SALT II Treaty not to deploy the SS-16 nor to produce the third stage and the re-entry vehicle of that missile in order not to leave open the possibility of converting land-based launchers of ballistic missiles which are not ICBMs into launchers for ICBMs.

7. The USSR has conducted nuclear tests having a yield in excess of the agreed threshold. While the evidence is "ambiguous" and no definitive

conclusion could be reached, the Soviet nuclear testing activities for a number of tests constitute a "likely" violation of the legal obligations under the 1974 Threshold Test Ban Treaty (TTBT), which prohibits the carrying out, as from 31 March 1976, of any underground nuclear weapon test having a yield higher than 150 kt. (The TTBT is not formally in force, but since neither party has indicated an intention not to ratify it, both the USA and the USSR are obligated under international law to refrain from acts which would defeat its object and purpose.)

The Soviet response to US allegations

The USSR characterized the US allegations as lies. It rejected, in particular, the accusation that it had transferred to others, or had used itself, chemical weapons in Laos, Kampuchea and Afghanistan. Regarding the Soviet military manoeuvre *Zapad-81*, the USSR stated that it had provided in advance all information required under the 1975 Helsinki Declaration. It also stressed its strict observance of the nuclear arms limitation agreements, including the 1972 ABM Treaty and the 1979 SALT II Treaty. It said that the charges against the Soviet Union were aimed at diverting attention from the USA's own violations of arms control agreements.[2]

Soviet allegations

At the end of January 1984, the Soviet Embassy in Washington transmitted to the US Department of State an aide-memoire listing cases of alleged non-compliance by the USA with its obligations under arms control agreements.[3]

1. The USA is engaged in a strategic programme of unprecedented dimensions with the avowed aim of achieving military superiority over the USSR. The USA, which is responsible for the unilateral interruption of the talks on a nuclear test ban, the Indian Ocean, anti-satellite systems, and others, has also blocked and wrecked the Geneva negotiations on nuclear arms. Such activities clearly contradict the US–Soviet accords stipulating that neither side shall strive for military superiority and that, in their mutual relations, the USA and the USSR will be guided by the principle of equality and equal security. Neither is the US position in line with the 1968 Non-Proliferation Treaty, under which the parties are obliged to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament.

2. In refusing to carry the 1979 SALT II Treaty into effect, the USA has rendered impossible the development of mutually acceptable solutions in respect of long-range sea- and land-based cruise missiles, as specified in the

Protocol to the Treaty, in order to be free to deploy such missiles on a massive scale. This does not accord with the US stated intention to refrain from acts undermining the existing agreements on strategic arms.

3. By deploying in western Europe the Pershing II ballistic missiles and long-range land-based cruise missiles, capable of reaching targets on the territory of the USSR, the USA has violated the provision of the 1979 SALT II Treaty which prohibits circumvention of the Treaty through any other state or states, or in any other manner, as well as the undertaking not to assume international obligations conflicting with the Treaty. The deployment in western Europe of nuclear weapons, which obviously complement the strategic offensive arsenal of the USA, is not in conformity with the US commitment to refrain from actions undermining the SALT II Treaty.

4. The USA has been using shelters to cover launchers of Minuteman II and Titan II intercontinental ballistic missiles. This practice is contrary to the provisions for effective verification, as contained in the 1972 SALT I Agreement. (The SALT I Agreement expired on 3 October 1977, but the USA and the USSR formally stated that they intended to refrain from any actions incompatible with its provisions or with the goals of the current talks on a new agreement.) Of particular concern are shelters over silos for Minuteman II launchers which are being refitted. Since the refitted launchers of Minuteman II differ in no practical terms from launchers of Minuteman III, one can make a 'supposition' that it is the Minuteman III missiles, equipped with MIRVs, that are actually deployed in the silos in question. If this is so, the evident failure of the USA to observe the verification provisions of the SALT I Agreement constitutes at the same time a failure to respect one of the main obligations under the SALT II Treaty—the limitation on the number of MIRVed ICBMs.

5. The US intention to build two new types of ICBM—the MX and the Midgetman—does not conform with the task of limiting strategic arms, as reflected in the US–Soviet agreements.

6. The USA has deployed a large radar on Sheyma Island, using for its construction radar components tested for ABM purposes; it used shelters over silos containing ABM missile launchers; it develops mobile ABM radars and space-based ABM systems; it tests Minuteman I missiles to give them a capability to counter missiles; it develops multiple warheads for ABM missiles; "and so on". All these activities are clearly in conflict with the 1972 ABM Treaty.

7. The USA is deploying on the Atlantic and the Pacific coasts, as well as in the south, new large PAVE PAWS radars. This deployment runs counter to the obligation under the ABM Treaty not to deploy an ABM system for the defence of the territory of the whole country, nor to provide a base for such a defence.

8. The deployment of large-scale ABM systems, the development of which was formally announced by the USA in March 1983, would undermine the ABM Treaty.

9. The USA systematically violates the agreed principle of confidentiality of discussions in the US–Soviet Standing Consultative Commission.

10. There have been repeated instances of US nuclear explosions exceeding the 150-kt yield limit fixed by the 1974 TTBT.

11. There have also been instances when, as a result of US underground nuclear explosions, radioactive debris was found outside the territorial limits of the USA. This is a violation of the 1963 Partial Test Ban Treaty (PTBT).

12. Each year, the USA organizes in Europe military exercises on such an enormous scale that it is becoming increasingly difficult to distinguish them from actual deployment of armed forces for war purposes. Mere notification of such exercises does nothing to remove the danger.

The US response to Soviet allegations

The USA dismissed the Soviet allegations as "groundless". In response to specific charges it gave the following explanations.[4]

Regarding the use of shelters over ICBM launchers: During the initial Minuteman missile launcher construction, as well as the Minuteman silo upgrade programme during the mid-1970s, environmental shelters were employed to protect construction at the launchers from the weather. The facts concerning the activities being carried out at the launchers were provided and explained to the USSR, and were also available to the public. In response to Soviet expressions of concern, the shelters were modified and their use was discontinued after the completion of the Minuteman silo upgrade programme in early 1979. In the case of the Titan II silo, a cover was used to protect it from the weather during repair work on damage due to an accident. It was specifically designed to avoid any impediment to national technical means of verification, and was removed promptly after the need for it ceased.

Regarding the charge that by not ratifying the 1979 SALT II Treaty, the USA has not fulfilled the provisions of the Protocol to the Treaty concerning the development of solutions for long-range sea- and land-based missiles: The SALT II Protocol would have expired on 31 December 1981, even if the SALT II Treaty had been ratified and had entered into force. The USA made it clear at the time the SALT II Treaty was signed that the Protocol would not be extended. The subsequent NATO decision to deploy land-based longer-range intermediate nuclear force (INF) missiles in Europe was made in response to Soviet SS-20 deployments. The USA remains willing to negotiate on all such systems, including ground-launched cruise missiles.

Regarding the Sheyma Island and PAVE PAWS radars: The Sheyma Island radar in the Aleutians is for national technical means of verification, and the PAVE PAWS radars are ballistic missile early-warning radars located on the periphery of the national territory and oriented outward, as specifically permitted by the 1972 ABM Treaty.

Regarding the circumvention of the SALT II Treaty: The USA made it clear to the Soviet Union during the SALT II negotiations, and subsequently stated publicly following the signature of the Treaty, that the SALT II non-circumvention provision would not alter existing patterns of co-operation with its allies or preclude transfer of systems and weapons technology. The only provision of SALT II which would have applied to longer-range INF systems was contained in the Protocol to the Treaty. The Protocol limited deployment until 31 December 1981 of cruise missiles capable of a range in excess of 600 km on sea- or land-based launchers. However, that provision would have expired in 1981. The Pershing II and the ground-launched cruise missiles (viewed as strategic by the Soviet Union) do not circumvent the 1979 SALT II Treaty, because the Treaty defines land-based strategic ballistic missiles as those having a range of 5 500 km or more. The US INF systems do not fall into that category. Moreover, in signing the SALT II Treaty, the USA stated explicitly that any future limitations on US systems principally designed for theatre missions would have to be accompanied by appropriate limits on Soviet theatre systems like the SS-20.

Regarding the yield limit of nuclear explosions: Since the effective date of the 1974 TTBT and the 1976 Peaceful Nuclear Explosions Treaty (PNET), the USA has conducted no nuclear tests having yields which exceeded the 150-kt threshold fixed in these treaties.

Regarding the conversion of Minuteman II into MIRVed Minuteman III: The Minuteman II silos were not converted to Minuteman III launchers. The Soviet Union has been informed that any launchers of Minuteman II ICBMs converted to launchers of Minuteman III ICBMs would be made distinguishable on the basis of externally observable design features, as required by the 1979 SALT II Treaty.

Regarding the confidentiality of the Standing Consultative Commission (SCC): The USA continues properly to discharge its obligations and responsibilities under the Regulations of the SCC. The US government is not making public the proceedings of the SCC; the appearance of stories in the press about the SCC and possible subjects under discussion there does not reflect a change in that policy.

Regarding the Helsinki Declaration: The USA is in compliance with all the undertakings contained in the Helsinki Declaration, and its military activities are completely in accordance with the provisions of that Declaration. The USA and its allies notify all exercises which exceed the threshold of 25 000 troops established by the Declaration, and often notify smaller-scale military manoeuvres as a voluntary effort to strengthen mutual confidence.

Regarding the radioactive fall-out from nuclear tests: Both the USA and the USSR have encountered some difficulty in totally containing all their underground nuclear tests. The USA, however, has had only a few problems in the past with the venting of radioactive debris from underground tests at the Nevada test site. As more experience was gained with the containment of underground tests, venting from US tests became even more rare. Over the past decade there has been only one incident of local and minor venting. The Soviet Union had not raised its concerns about US venting with the USA since 1976 until the latest reference to it.

Regarding space-based ABM systems: The 1972 ABM Treaty does not prohibit research, and both sides have had research programmes since the signing of the Treaty. Soviet research and development efforts in the ABM field have been continuous and more extensive than those of the USA. The US programme calls only for enhanced research in this area. As stated by the US President in his March 1983 speech, US activities in this area will be consistent with US treaty obligations.

Conclusions

The recent allegations of breaches of arms control agreements made by the USA and the USSR may be said to fall roughly into two categories: those relating to the general spirit of the agreements, and those dealing with specific provisions.

The charges belonging to the first category have been put forward mainly by the USSR. The Soviet Union gave a subjective interpretation of such controversial notions as military superiority versus equal security, or strategic versus non-strategic weapon missions in the European context. It also presented its own understanding of the duties of states under signed but unratified agreements, including non-circumvention of the treaty provisions. However, failure to share Soviet perceptions of the goals pursued in the arms limitation exercise can hardly be labelled a violation of treaty obligations.

The charges belonging to the second category have been put forward by both the USA and the USSR. Most of them are vague and conjectural. In some cases, the charges may be the result of a lack of sufficiently precise definitions. For example, the complex language of the ABM Treaty is far from unequivocal as to what is actually prohibited. The SALT II Treaty, banning encryption of telemetry which would impede verification, fails to indicate what kinds and amounts of information are needed to ensure verification.

In other instances, suspicions of breaches may have arisen because the relevant treaties have not entered into force. Thus, for example, the parties have accused each other of exceeding the 150-kt yield threshold for nuclear explosions set by the unratified 1974 TTBT, while the exchange of data necessary to establish a correlation between yields of explosions at specific sites and the seismic signals produced, as envisaged in the TTBT, is being held up pending ratification of the Treaty. It may be added that the parties themselves had recognized that predicting the precise yield of nuclear weapon tests was associated with uncertainties; upon signing the TTBT they reached an understanding that one or two breaches per year would not be considered a violation. Equally, had the SALT II Treaty formally entered into force, there most probably would have been fewer problems regarding compliance, because the envisaged regular and obligatory exchange of data on strategic arms possessed by each side would have facilitated a uniform interpretation of the Treaty provisions as well as their verification.

At least in two cases, old controversies which were practically resolved have been dug out, it can be suggested, merely to inflate the list of grievances. Thus, because it is impossible to contain radioactive material that has vented from an underground nuclear test to the surface entirely within the boundaries of the testing state, both powers decided years ago to consider sporadic radioactive leakages spreading outside their territories as no more than 'technical' violations. Also, the placement of shelters over ICBM silos was discussed as early as the mid-1970s, and the matter appeared already then to have been adequately explained.

The bulk of the remaining charges concern issues of relatively minor military significance. For example, one fails to see how the construction of a radar or radars, whatever their size, could render more effective the existing systems of ballistic missile defence (that is, those subject to limitation under the ABM Treaty), which are widely considered to be patently inadequate for preventing nuclear warheads from reaching the target. It is difficult to understand how a notification of a military exercise, which is less than "adequate", could affect the security of other states. The intentions (expressed or presumed) to deploy new weapon systems, to which both sides referred in their indictments, may well sound ominous, but cannot be censured as breaches of contracted commitments.

The most serious charges concern (*a*) the use of chemical and biological weapons by the USSR, and (*b*) the testing and deployment of strategic missiles prohibited by the treaties by both the USA and the USSR. But, as regards the first charge, no fresh evidence was provided to invalidate the statement made in 1982 by a group of UN experts that the allegations had not been proven. On the contrary, since that time, various scientific reports have lent weight to the suggestion that the phenomenon of 'Yellow

Rain', the centrepiece of the US CBW accusations, is of natural origin. As regards the second charge, the US allegations were admittedly based on "somewhat ambiguous" evidence, while the Soviet allegation was based on a mere "supposition". One wonders how assertions challenging the good faith of governments, and therefore fraught with grave political consequences, can be made so lightly and on such loose grounds. The fact that the consultative bodies provided for in the arms control treaties, such as the Standing Consultative Commission, set up under the SALT agreements, had not been exhaustively used testifies to the propagandistic nature of the US and Soviet recriminations.

It goes without saying that agreements, such as the 1925 Geneva Protocol, that have no provision for verification, facilitate unsubstantiated charges. But even with the most elaborate safeguards against cheating, there will always be problems with the implementation of treaties, especially those dealing with arms control. This does not mean that the existing treaties should be undone, or that efforts to reach new agreements should be abandoned as some have suggested. But effective mechanisms to clarify suspicions regarding compliance and to protect parties against ill-considered allegations of violations are indispensable, if there is to be progress in arms control negotiations.

Notes and references

[1] US Information Service, Document Foreign Policy EUR-114, 23 January 1984, US Embassy, Stockholm.
[2] *Pravda*, 3 February 1983.
[3] *Pravda*, 30 January 1984.
[4] US Information Service, Document Foreign Policy EUR-116 and 117, 30 January 1984, US Embassy, Stockholm.

Appendix 18A

Status of the implementation of the major multilateral arms control agreements as of 31 December 1983

Number of parties

1925 Geneva Protocol	106
Antarctic Treaty	27
Partial Test Ban Treaty	112
Outer Space Treaty	85
Treaty of Tlatelolco	23
Additional Protocol I	3
Additional Protocol II	5
Non-Proliferation Treaty	121
NPT safeguards agreements	76
Sea-Bed Treaty	74
BW Convention	99
ENMOD Convention	42
'Inhumane Weapons' Convention	23

Note

1. The list of parties records ratifications, accessions and successions.

2. The Partial Test Ban Treaty, the Outer Space Treaty, the Non-Proliferation Treaty, the Sea-Bed Treaty and the Biological Weapons Convention provide for three depositaries—the governments of the UK, the USA and the USSR. The dates given in the table are the earliest dates on which countries deposited their instruments of ratification, accession or succession—whether in London, Washington or Moscow.

Under the 1925 Geneva Protocol, the only depositary is the French government; under the Antarctic Treaty, the US government; under the Treaty of Tlatelolco, the Mexican government; and under the ENMOD Convention and the 'Inhumane Weapons' Convention, the UN Secretary-General. The dates given for these agreements are the dates of the deposit of the instruments of ratification, accession or succession with the respective depositaries.

3. Key to abbreviations used in the table:
   - S: signature without further action
   - PI: Additional Protocol I to the Treaty of Tlatelolco
   - PII: Additional Protocol II to the Treaty of Tlatelolco
   - SA: Safeguards agreement in force with the International Atomic Energy Agency under the Non-Proliferation Treaty or the Treaty of Tlatelolco

4. The footnotes are listed at the end of the table and are grouped separately under the heading for each agreement. The texts of the statements contained in the footnotes have been abridged, but the wording is close to the original version.

State	Geneva Protocol	Antarctic Treaty	Partial Test Ban Treaty	Outer Space Treaty	Treaty of Tlatelolco	Non-Proliferation Treaty	Sea-Bed Treaty	BW Convention	ENMOD Convention	'Inhumane Weapons' Convention
Afghanistan			1964	S		1970 SA	1971	1975		S
Algeria			S							
Antigua and Barbuda					1983[2]					
Argentina	1969	1961	S	1969	S[1]		1983	1979		S
Australia	1930[1]	1961	1963	1967		1973[1] SA	1973	1977	S	1983
Austria	1928		1964	1968		1969 SA	1972	1973[1]		1983
Bahamas			1976[1]	1976[1]	1977[2]	1976[2]				
Bangladesh						1979 SA			1979	
Barbados	1976[2]			1968	1969[2]	1980		1973		
Belgium	1928[1]	1960	1966	1973		1975 SA	1972	1979	1982	S
Benin			1964			1972	S	1975	S	
Bhutan	1978		1978					1978		

Bolivia			1965	S	1969[2]	1970	S	1975	S	
Botswana			1968[1]	S		1969	1972	S		
Brazil	1970	1975	1964	1969[2]	1968[3]		S[2]	1973	S	
Bulgaria	1934[1]		1963	1967		1969 SA	1971	1972	1978	1982
Burma			1963	1970			S	S		
Burundi			S	S		1971	S	S		
Byelorussia	1970[3]		1963[3]	1967[3]			1971	1975	1978	1982
Cameroon			S[2]	S		1969	S			
Canada	1930[1]		1964	1967		1969 SA	1972[3]	1972	1981	S
Cape Verde			1979			1979	1979	1977	1979	
Central African Republic	1970		1964	S		1970	1981	S		
Chad			1965			1971				

State	Geneva Protocol	Antarctic Treaty	Partial Test Ban Treaty	Outer Space Treaty	Treaty of Tlatelolco	Non-Proliferation Treaty	Sea-Bed Treaty	BW Convention	ENMOD Convention	'Inhumane Weapons' Convention
Chile	1935[1]	1961	1965	1981	1974[4]			1980		
China	1929[4]	1983		1983	PII: 1974[5]					1982[1]
Colombia			S	S	1972[2] SA	S	S	1983		
Congo						1978	1978	1978		
Costa Rica			1967		1969[2] SA[16]	1970 SA	S	1973		
Cuba	1966			1977[4]			1977[4]	1976	1978	S
Cyprus	1966[2]		1965	1972		1970 SA	1971	1973	1978	
Czechoslovakia	1938[5]	1962	1963	1967		1969 SA	1972	1973	1978	1982
Denmark	1930	1965	1964	1967		1969 SA	1971	1973	1978	1982
Dominican Republic	1970		1964	1968	1968[2] SA[16]	1971 SA	1972	1973		
Ecuador	1970		1964	1969	1969[2] SA[16]	1969 SA		1975		1982

Egypt	1928		1964	1967		1981[3] SA		S	1982	S
El Salvador	S		1964	1969	1968[2] SA[16]	1972 SA		S		
Equatorial Guinea							S			
Ethiopia	1935		S	S		1970 SA	1977	1975	S	
Fiji	1973[1,2]		1972[1]	1972[1]		1972[2] SA		1973		
Finland	1929		1964	1967		1969 SA	1971	1974	1978	1982
France	1926[1]	1960		1970	PI: S[6] PII: 1974[7]	[4]				S[2]
Gabon			1964			1974		S		
Gambia	1966[2]		1965[1]	S		1975 SA	S	S		
German Dem. Republic	1929	1974[1]	1963	1967		1969 SA	1971	1972	1978	1982
FR Germany	1929	1979[2]	1964[4]	1971[5]		1975[5] SA	1975[5]	1983[2]	1983[1]	S

State	Geneva Protocol	Antarctic Treaty	Partial Test Ban Treaty	Outer Space Treaty	Treaty of Tlatelolco	Non-Proliferation Treaty	Sea-Bed Treaty	BW Convention	ENMOD Convention	'Inhumane Weapons' Convention
Ghana	1967		1963	S		1970 SA	1972	1975	1978	
Greece	1931		1963	1971		1970 SA	S	1975	1983	S
Grenada					1975[2]	1975[2]				
Guatemala	1983		1964[2]		1970[2] SA[16]	1970 SA	S	1973		1983
Guinea							S			
Guinea-Bissau			1976	1976		1976	1976	1976		
Guyana				S				S		
Haiti			S	S	1969[2]	1970		S		
Holy See (Vatican City)	1966			S		1971[6] SA			S	
Honduras			1964	S	1968[2] SA[16]	1973 SA	S	1979		
Hungary	1952		1963	1967		1969 SA	1971	1972	1978	1982

Iceland	1967		1964	1968		1969 SA	1972	1973	S	S
India	1930[1]	1983	1963	1982			1973[6]	1974[3]	1978	S
Indonesia	1971[2]		1964	S		1979[7] SA		S		
Iran	1929		1964	S		1970 SA	1971	1973	S	
Iraq	1931[1]		1964	1968		1969 SA	1972[4]	S	S	
Ireland	1930[6]		1963	1968		1968 SA	1971	1972[4]	1982	S
Israel	1969[7]		1964	1977						
Italy	1928	1981	1964	1972		1975[8] SA	1974[7]	1975	1981	S[3]
Ivory Coast	1970		1965			1973 SA	1972	S		
Jamaica	1970[2]		S	1970	1969[2] SA[16]	1970 SA	S	1975		
Japan	1970	1960	1964	1967		1976[9] SA	1971	1982	1982	1982

State	Geneva Protocol	Antarctic Treaty	Partial Test Ban Treaty	Outer Space Treaty	Treaty of Tlatelolco	Non-Proliferation Treaty	Sea-Bed Treaty	BW Convention	ENMOD Convention	'Inhumane Weapons' Convention
Jordan	1977[8]		1964	S		1970 SA	1971	1975		
Kampuchea	1983[9]					1972	S	1983		
Kenya	1970		1965			1970		1976		
Korea, Republic of (South)			1964[2]	1967[4]		1975[11] SA	S[4]	S[5]		
Kuwait	1971[10]		1965[5]	1972[6]		S		1972[6]	1980[2]	
Lao People's Dem. Republic			1965	1972		1970	1971	1973	1978	1983
Lebanon	1969		1965	1969		1970 SA	S	1975	S	
Lesotho	1972[2]			S		1970 SA	1973	1977		
Liberia	1927		1964			1970	S	S	S	
Libya	1971[11]		1968	1968		1975 SA		1982		
Liechtenstein						1978[12] SA				S

Luxembourg	1936		1965	S		1975 SA	1982	1976	S	S
Madagascar	1967		1965	1968[7]		1970 SA	S	S		
Malawi	1970		1964[1]					S	1978	
Malaysia	1970		1964	S		1970 SA	1972	S		
Maldives	1966[2]					1970 SA				
Mali			S	1968		1970	S	S		
Malta	1970[2]		1964[1]			1970	1971	1975		
Mauritania			1964							
Mauritius	1970[2]		1969[1]	1969[1]		1969 SA	1971	1972		
Mexico	1932		1963	1968	1967[2,8] SA	1969[13] SA		1974[7]		1982
Monaco	1967									
Mongolia	1968[12]		1963	1967		1969 SA	1971	1972	1978	1982

State	Geneva Protocol	Antarctic Treaty	Partial Test Ban Treaty	Outer Space Treaty	Treaty of Tlatelolco	Non-Proliferation Treaty	Sea-Bed Treaty	BW Convention	ENMOD Convention	'Inhumane Weapons' Convention
Morocco	1970		1966	1967		1970 SA	1971	S	S	S
Nauru						1982				
Nepal	1969		1964	1967		1970 SA	1971	S		
Netherlands	1930[13]	1967	1964	1969	PI: 1971[9]	1975 SA	1976	1981	1983[3]	S
New Zealand	1930[1]	1960	1963	1968		1969 SA	1972	1972		S
Nicaragua	S		1965	S	1968[2,10] SA[16]	1973 SA	1973	1975	S	S
Niger	1967[2]		1964	1967			1971	1972		
Nigeria	1968[1]		1967	1967		1968		1973		S
Norway	1932	1960	1963	1969		1969 SA	1971	1973	1979	1983
Pakistan	1960[2]		S	1968				1974		S
Panama	1970		1966	S	1971[2]	1977	1974	1974		

Papua New Guinea	1981[1]	1981	1980[1]	1980[1]		1982 SA		1980	1980	
Paraguay	1933[14]		S		1969[2] SA[16]	1970 SA	S	1976		
Peru		1981	1964	1979	1969[2] SA	1970 SA		S		
Philippines	1973		1965[2]	S		1972 SA		1973		S
Poland	1929	1961	1963	1968		1969 SA	1971	1973	1978	1983
Portugal	1930[1]		S			1977 SA	1975	1975	S	S
Qatar	1976						1974	1975		
Romania	1929[1]	1971[3]	1963	1968		1970 SA	1972	1979	1983	S[4]
Rwanda	1964[2]		1963	S		1975	1975	1975		
Saint Lucia						1979[2]				
Samoa			1965			1975 SA				
San Marino			1964	1968		1970		1975		

State	Geneva Protocol	Antarctic Treaty	Partial Test Ban Treaty	Outer Space Treaty	Treaty of Tlatelolco	Non-Proliferation Treaty	Sea-Bed Treaty	BW Convention	ENMOD Convention	'Inhumane Weapons' Convention
Sao Tome and Principe						1983	1979	1979	1979	
Saudi Arabia	1971			1976			1972	1972		
Senegal	1977		1964			1970 SA	S	1975		
Seychelles				1978			1976	1979		
Sierra Leone	1967		1964	1967		1975	S	1976	S	S
Singapore			1968[1]	1976		1976 SA	1976	1975		
Solomon Islands						1981[2]	1981	1981[11]	1981[5]	
Somalia			S	S		1970		S		
South Africa	1930[1]	1960	1963	1968			1973	1975		
Spain	1929[15]	1982	1964	1968				1979	1978	S
Sri Lanka	1954		1964	S		1979		S	1978	
Sudan	1980		1966			1973 SA	S			S

Suriname					1977[2] SA[16]	1976[2] SA				
Swaziland			1969			1969 SA	1971			
Sweden	1930		1963	1967		1970 SA	1972	1976		1982
Switzerland	1932		1964	1969		1977[12] SA	1976	1976[8]		1982
Syria	1968[16]		1964	1968[8]		1969[10]		S	S	
Taiwan	1929		1964	1970[9]		1970	1972[8]	1973[9]		
Tanzania	1963		1964				S	S		
Thailand	1931		1963	1968		1972 SA		1975		
Togo	1971		1964	S		1970	1971	1976		S
Tonga	1971		1971[1]	1971[1]		1971[2]		1976		
Trinidad and Tobago	1970[2]		1964	S	1970[2]	S				
Tunisia	1967		1965	1968		1970	1971	1973	1978	

State	Geneva Protocol	Antarctic Treaty	Partial Test Ban Treaty	Outer Space Treaty	Treaty of Tlatelolco	Non-Proliferation Treaty	Sea-Bed Treaty	BW Convention	ENMOD Convention	'Inhumane Weapons' Convention
Turkey	1929		1965	1968		1980[14] SA	1972	1974	S[4]	S
Tuvalu						1979[2]				
Uganda	1965		1964	1968		1982			S	
UK	1930[1]	1960	1963[6]	1967	PI: 1969[12] PII: 1969[12]	1968[15] SA[16]	1972[9]	1975[10]	1978	S
Ukraine			1963[3]	1967[3]			1971	1975	1978	1982
United Arab Emirates								S		
Upper Volta	1971		S	1968		1970				
Uruguay	1977	1980[4]	1969	1970	1968[2] SA[16]	1970 SA	S	1981		
USA	1975[17]	1960	1963	1967	PI: 1981[13] PII: 1971[14]	1970 SA[17]	1972	1975	1980	S[5]
USSR	1928[18]	1960	1963	1967	PII: 1979[11]	1970	1972	1975	1978	1982
Venezuela	1928		1965	1970	1970[2,15] SA[16]	1975 SA		1978		

Viet Nam	1980[1]			1980		1982	1980[10]	1980	1980	S
Yemen Arab Republic	1971		S			S	S	S	1977	
Yemen, People's Dem. Republic of			1979	1979		1979	1979	1979	1979	
Yugoslavia	1929[19]		1964	S		1970[18] SA	1973[11]	1973		1983
Zaire			1965	S		1970 SA		1977	S	
Zambia			1965[1]	1973			1972			

The 1925 Geneva Protocol

[1] The Protocol is binding on this state only as regards states which have signed and ratified or acceded to it. The Protocol will cease to be binding on this state in regard to any enemy state whose armed forces or whose allies fail to respect the prohibitions laid down in the Protocol.
[2] Notification of succession. (In notifying its succession to the obligations contracted in 1930 by the United Kingdom, Barbados stated that as far as it was concerned the reservation made by the UK was to be considered as withdrawn.)
[3] In a note of 2 March 1970, submitted at the United Nations, Byelorussia stated that "it recognizes itself to be a party" to the Protocol.
[4] On 13 July 1952 the People's Republic of China issued a statement recognizing as binding upon it the accession to the Protocol in the name of China. China considers itself bound by the Protocol on condition of reciprocity on the part of all the other contracting and acceding powers.
[5] Czechoslovakia shall cease to be bound by this Protocol towards any state whose armed forces, or the armed forces of whose allies, fail to respect the prohibitions laid down in the Protocol.
[6] The government of Ireland does not intend to assume, by this accession, any obligation except towards the states having signed and ratified this Protocol or which shall have finally acceded thereto, and should the armed forces or the allies of an enemy state fail to respect the Protocol, the government of Ireland would cease to be bound by the said Protocol in regard to such state. In February 1972, Ireland declared that it had decided to withdraw the above reservations made at the time of accession to the Protocol.
[7] The Protocol is binding on Israel only as regards states which have signed and ratified or acceded to it. The Protocol shall cease to be binding on Israel as regards any enemy state whose armed forces, or the armed forces of whose allies, or the regular or irregular forces, or groups or individuals operating from its territory, fail to respect the prohibitions which are the object of the Protocol.
[8] The accession by Jordan to the Protocol does not in any way imply recognition of Israel. Jordan undertakes to respect the obligations contained in the Protocol with regard to states which have undertaken similar commitments. It is not bound by the Protocol as regards states whose armed forces, regular or irregular, do not respect the provisions of the Protocol.
[9] The accession was made on behalf of the coalition government of Democratic Kampuchea (the government in exile), with a statement that the Protocol will cease to be binding on it in regard to any enemy state whose armed forces or whose allies fail to respect the prohibitions laid down in the Protocol. The French government declared that as a party to the Geneva Protocol (but not as the depositary) it considers this accession to have no effect. A similar statement was made by the governments of Australia, Bulgaria, Cuba, Czechoslovakia, GDR, Hungary, Mauritius, Netherlands, Poland, Romania, USSR and Viet Nam, which do not recognize the coalition government of Kampuchea.
[10] The accession of Kuwait to the Protocol does not in any way imply recognition of Israel or the establishment of relations with the latter on the basis of the present Protocol. In case of breach of the prohibition laid down in this Protocol by any of the parties, Kuwait will not be bound, with regard to the party committing the breach, to apply the provisions of this Protocol.
[11] The accession to the Protocol does not imply recognition of Israel. The Protocol is binding on Libya only as regards states which are effectively bound by it, and will cease to be binding on Libya as regards states whose armed forces, or the armed forces of whose allies, fail to respect the prohibitions which are the object of this Protocol.
[12] In the case of violation of this prohibition by any state in relation to Mongolia or its allies, the government of Mongolia shall not consider itself bound by the obligations of the Protocol towards that state.
[13] As regards the use in war of asphyxiating, poisonous or other gases and of all analogous liquids, materials or devices, this Protocol shall cease to be binding on the Netherlands with regard to any enemy state whose armed forces or whose allies fail to respect the prohibitions laid down in the Protocol.
[14] This is the date of receipt of Paraguay's instrument of accession. The date of the notification by the depositary government "for the purpose of regularization" is 1969.
[15] Spain declared the Protocol as binding *ipso facto*, without special agreement with respect to any other member or state accepting and observing the same obligation, that is, on condition of reciprocity.
[16] The accession by Syria to the Protocol does not in any case imply recognition of Israel or lead to the establishment of relations with the latter concerning the provisions laid down in the Protocol.
[17] The Protocol shall cease to be binding on the USA with respect to the use in war of asphyxiating, poisonous or other gases, and of all analogous liquids, materials, or devices, in regard to an enemy state if such state or any of its allies fails to respect the prohibitions laid down in the Protocol.
[18] The Protocol only binds the USSR in relation to the states which have signed and ratified or which have definitely acceded to the Protocol. The Protocol shall cease to be binding on the USSR in regard to any enemy state whose armed forces or whose allies *de jure* or in fact do not respect the prohibitions which are the object of this Protocol.
[19] The protocol shall cease to be binding on Yugoslavia in regard to any enemy state whose armed forces or whose allies fail to respect the prohibitions which are the object of the Protocol.

The Antarctic Treaty

[1] The German Democratic Republic stated that in its view Article XIII, paragraph 1 of the Treaty was inconsistent with the principle that all states whose policies are guided by the purposes and

principles of the United Nations Charter have a right to become parties to treaties which affect the interests of all states.
[2] The Federal Republic of Germany stated that the Treaty applies also to Berlin (West).
[3] Romania stated that the provisions of Article XIII, paragraph 1 of the Treaty were not in accordance with the principle according to which multilateral treaties whose object and purposes concern the international community, as a whole, should be open for universal participation.
[4] In acceding to the Treaty, Uruguay proposed the establishment of a general and definitive statute on Antarctica in which the interests of all states involved and of the international community as a whole would be considered equitably. It also declared that it reserved its rights in Antarctica in accordance with international law.

The Partial Test Ban Treaty

[1] Notification of succession.
[2] With a statement that this does not imply the recognition of any territory or regime not recognized by this state.
[3] The United States considers that Byelorussia and Ukraine are already covered by the signature and ratification by the Soviet Union.
[4] The Federal Republic of Germany stated that the Treaty applies also to Berlin (West).
[5] Kuwait stated that its signature and ratification of the Treaty do not in any way imply its recognition of Israel nor oblige it to apply the provisions of the Treaty in respect of the said country.
[6] The United Kingdom stated its view that if a regime is not recognized as the government of a state, neither signature nor the deposit of any instrument by it, nor notification of any of those acts, will bring about recognition of that regime by any other state.

The Outer Space Treaty

[1] Notification of succession.
[2] The Brazilian government interprets Article X of the Treaty as a specific recognition that the granting of tracking facilities by the parties to the Treaty shall be subject to agreement between the states concerned.
[3] The United States considers that Byelorussia and Ukraine are already covered by the signature and ratification by the Soviet Union.
[4] With a statement that this does not imply the recognition of any territory or regime not recognized by this state.
[5] The Federal Republic of Germany stated that the Treaty applies also to Berlin (West).
[6] Kuwait acceded to the Treaty with the understanding that this does not in any way imply its recognition of Israel and does not oblige it to apply the provisions of the Treaty in respect of the said country.
[7] Madagascar acceded to the Treaty with the understanding that under Article X of the Treaty the state shall retain its freedom of decision with respect to the possible installation of foreign observation bases in its territory and shall continue to possess the right to fix, in each case, the conditions for such installation.
[8] Syria acceded to the Treaty with the understanding that this should not mean in any way the recognition of Israel, nor should it lead to any relationship with Israel that could arise from the Treaty.
[9] The People's Republic of China declared as illegal and null and void the signature and ratification of the Outer Space Treaty by the Taiwan authorities.

The Treaty of Tlatelolco

[1] Argentina stated that it understands Article 18 as recognizing the right of parties to carry out, by their own means or in association with third parties, explosions of nuclear devices for peaceful purposes, including explosions which involve devices similar to those used in nuclear weapons.
[2] The Treaty is in force for this country due to a declaration, annexed to the instrument of ratification in accordance with Article 28, paragraph 2, which waived the requirements for the entry into force of the Treaty, specified in paragraph 1 of that Article: namely, that all states in the region deposit the instruments of ratification; that Protocol I and Protocol II be signed and ratified by those states to which they apply; and that agreements on safeguards be concluded with the IAEA. Colombia made this declaration subsequent to the deposit of ratification, as did Nicaragua and Trinidad and Tobago.
[3] On signing the Treaty, Brazil stated that, according to its interpretation, Article 18 of the Treaty gives the signatories the right to carry out, by their own means or in association with third parties, nuclear explosions for peaceful purposes, including explosions which involve devices similar to those used in nuclear weapons. This statement was reiterated at the ratification. Brazil also stated that it did not waive the requirements for the entry into force of the Treaty laid down in Article 28. The Treaty is therefore not yet in force for Brazil.
[4] Chile has not waived the requirements for the entry into force of the Treaty laid down in Article 28. The Treaty is therefore not yet in force for Chile.

[5] On signing Protocol II, China stated, *inter alia*: China will never use or threaten to use nuclear weapons against non-nuclear Latin American countries and the Latin American nuclear weapon-free zone; nor will China test, manufacture, produce, stockpile, install or deploy nuclear weapons in these countries or in this zone, or send its means of transportation and delivery carrying nuclear weapons to cross the territory, territorial sea or airspace of Latin American countries. The signing of the Protocol does not imply any change whatsoever in China's stand on the disarmament and nuclear weapons issue and, in particular, does not affect the Chinese government's stand against the Non-Proliferation Treaty and the Partial Test Ban Treaty.

The Chinese government holds that, in order that Latin America may truly become a nuclear weapon-free zone, all nuclear countries, and particularly the superpowers, must undertake not to use or threaten to use nuclear weapons against the Latin American countries and the Latin American nuclear weapon-free zone, and implement the following undertakings: (1) dismantle all foreign military bases in Latin America and refrain from establishing new bases there, and (2) prohibit the passage of any means of transportation and delivery carrying nuclear weapons through Latin American territory, territorial sea or airspace.

[6] On signing Protocol I, France made the following reservations and interpretative statements: the Protocol, as well as the provisions of the Treaty to which it refers, will not affect the right of self-defence under Article 51 of the UN Charter; the application of the legislation referred to in Article 3 of the Treaty relates to legislation which is consistent with international law; the obligations under the Protocol shall not apply to transit across the territories of the French Republic situated in the zone of the Treaty, and destined to other territories of the French Republic; the Protocol shall not limit, in any way, the participation of the populations of the French territories in the activities mentioned in Article 1 of the Treaty, and in efforts connected with the national defence of France; the provisions of Articles 1 and 2 of the Protocol apply to the text of the Treaty as it stands at the time when the Protocol is signed by France, and consequently no amendment to the Treaty that might come into force under Article 29 thereof would be binding on the government of France without the latter's express consent.

[7] On signing Protocol II, France stated that it interprets the undertaking contained in Article 3 of the Protocol to mean that it presents no obstacle to the full exercise of the right of self-defence enshrined in Article 51 of the United Nations Charter; it takes note of the interpretation of the Treaty given by the Preparatory Commission for the Denuclearization of Latin America and reproduced in the Final Act, according to which the Treaty does not apply to transit, the granting or denying of which lies within the exclusive competence of each state party in accordance with the pertinent principles and rules of international law; it considers that the application of the legislation referred to in Article 3 of the Treaty relates to legislation which is consistent with international law. The provisions of Articles 1 and 2 of the Protocol apply to the text of the Treaty as it stands at the time when the Protocol is signed by France. Consequently, no amendment to the Treaty that might come into force under the provision of Article 29 would be binding on the government of France without the latter's express consent. If this declaration of interpretation is contested in part or in whole by one or more contracting parties to the Treaty or to Protocol II, these instruments would be null and void as far as relations between the French Republic and the contesting state or states are concerned. On depositing its instrument of ratification of Protocol II, France stated that it did so subject to the statement made on signing the Protocol. On 15 April 1974, France made a supplementary statement to the effect that it was prepared to consider its obligations under Protocol II as applying not only to the signatories of the Treaty, but also to the territories for which the statute of denuclearization was in force in conformity with Article 1 of Protocol I.

[8] On signing the Treaty, Mexico said that if technological progress makes it possible to differentiate between nuclear weapons and nuclear devices for peaceful purposes, it will be necessary to amend the relevant provisions of the Treaty, according to the procedures established therein.

[9] The Netherlands stated that Protocol I shall not be interpreted as prejudicing the position of the Netherlands as regards its recognition or non-recognition of the rights of or claims to sovereignty of the parties to the Treaty, or of the grounds on which such claims are made.

[10] Nicaragua stated that it reserved the right to use nuclear energy for peaceful purposes such as the removal of earth for the construction of canals, irrigation works, power plants, and so on, as well as to allow the transit of atomic material through its territory.

[11] The Soviet Union signed and ratified Protocol II with the following statement:

The Soviet Union proceeds from the assumption that the effect of Article 1 of the Treaty extends, as specified in Article 5 of the Treaty, to any nuclear explosive device and that, accordingly, the carrying out by any party to the Treaty of explosions of nuclear devices for peaceful purposes would be a violation of its obligations under Article 1 and would be incompatible with its non-nuclear status. For states parties to the Treaty, a solution to the problem of peaceful nuclear explosions can be found in accordance with the provisions of Article V of the Non-Proliferation Treaty and within the framework of the international procedures of the IAEA. The signing of the Protocol by the Soviet Union does not in any way signify recognition of the possibility of the force of the Treaty being extended beyond the territories of the states parties to the Treaty, including airspace and territorial waters as defined in accordance with international law. With regard to the reference in Article 3 of the Treaty to "its own legislation" in connection with the territorial waters, airspace and any other space over which the states parties to the Treaty exercise sovereignty, the signing of the Protocol by the Soviet Union does not signify recognition of their claims to the exercise of sovereignty which are contrary to generally accepted standards of international law. The Soviet Union takes note of the interpretation of the Treaty given in the Final Act of the Preparatory Commission for the Denuclearization of Latin America to the effect that the transport of nuclear weapons by the parties to the Treaty is covered by the prohibitions in Article 1 of the Treaty. The Soviet Union reaffirms its position that authorizing the transit of nuclear weapons in any form would be contrary to the objectives of the Treaty, according to which, as specially mentioned in the preamble, Latin America must be completely free from nuclear weapons, and that it would be incompatible with the non-nuclear status of the states parties to the Treaty and with their obligations as laid down in Article 1 thereof.

Any actions undertaken by a state or states parties to the Treaty which are not compatible with their non-nuclear status, and also the commission by one or more states parties to the Treaty of an act of aggression with the support of a state which is in possession of nuclear weapons or together with such a state, will be regarded by the Soviet Union as incompatible with the obligations of those countries under the Treaty. In such cases the Soviet Union reserves the right to reconsider its obligations under Protocol II. It further reserves the right to reconsider its attitude to this Protocol in the event of any actions on the part of other states possessing nuclear weapons which are incompatible with their obligations under the said Protocol. The provisions of the articles of Protocol II are applicable to the text of the Treaty for the Prohibition of Nuclear Weapons in Latin America in the wording of the Treaty at the time of the signing of the Protocol by the Soviet Union, due account being taken of the position of the Soviet Union as set out in the present statement. Any amendment to the Treaty entering into force in accordance with the provisions of Articles 29 and 6 of the Treaty without the clearly expressed approval of the Soviet Union shall have no force as far as the Soviet Union is concerned.

In addition, the Soviet Union proceeds from the assumption that the obligations under Protocol II also apply to the territories for which the status of the denuclearized zone is in force in conformity with Protocol I of the Treaty.

[12] When signing and ratifying Protocol I and Protocol II, the United Kingdom made the following declarations of understanding:

In connection with Article 3 of the Treaty, defining the term "territory" as including the territorial sea, airspace and any other space over which the state exercises sovereignty in accordance with "its own legislation", the UK does not regard its signing or ratification of the Protocols as implying recognition of any legislation which does not, in its view, comply with the relevant rules of international law.

The Treaty does not permit the parties to carry out explosions of nuclear devices for peaceful purposes unless and until advances in technology have made possible the development of devices for such explosions which are not capable of being used for weapon purposes.

The signing and ratification by the UK could not be regarded as affecting in any way the legal status of any territory for the international relations of which the UK is responsible, lying within the limits of the geographical zone established by the Treaty.

Should a party to the Treaty carry out any act of aggression with the support of a nuclear weapon state, the UK would be free to reconsider the extent to which it could be regarded as committed by the provisions of Protocol II.

In addition, the UK declared that its undertaking under Article 3 of Protocol II not to use or threaten to use nuclear weapons against the parties to the Treaty extends also to territories in respect of which the undertaking under Article 1 of Protocol I becomes effective.

[13] The United States ratified Protocol I with the following understandings: The provisions of the Treaty made applicable by this Protocol do not affect the exclusive power and legal competence under international law of a state adhering to this Protocol to grant or deny transit and transport privileges to its own or any other vessels or aircraft irrespective of cargo or armaments; the provisions of the Treaty made applicable by this Protocol do not affect rights under international law of a state adhering to this Protocol regarding the exercise of the freedom of the seas, or regarding passage through or over waters subject to the sovereignty of a state, and the declarations attached by the United States to its ratification of Protocol II apply also to its ratification of Protocol I.

[14] The United States signed and ratified Protocol II with the following declarations of understanding:

In connection with Article 3 of the Treaty, defining the term "territory" as including the territorial sea, airspace and any other space over which the state exercises sovereignty in accordance with "its own legislation", the US ratification of the Protocol could not be regarded as implying recognition of any legislation which did not, in its view, comply with the relevant rules of international law.

Each of the parties retains exclusive power and legal competence, unaffected by the terms of the Treaty, to grant or deny non-parties transit and transport privileges.

As regards the undertaking not to use or threaten to use nuclear weapons against the parties, the United States would consider that an armed attack by a party, in which it was assisted by a nuclear weapon state, would be incompatible with the party's obligations under Article 1 of the Treaty.

The definition contained in Article 5 of the Treaty is understood as encompassing all nuclear explosive devices; Articles 1 and 5 of the Treaty restrict accordingly the activities of the parties under paragraph 1 of Article 18.

Article 18, paragraph 4 permits, and US adherence to Protocol II will not prevent, collaboration by the USA with the parties to the Treaty for the purpose of carrying out explosions of nuclear devices for peaceful purposes in a manner consistent with a policy of not contributing to the proliferation of nuclear weapon capabilities.

The United States will act with respect to such territories of Protocol I adherents, as are within the geographical area defined in Article 4, paragraph 2 of the Treaty, in the same manner as Protocol II requires it to act with respect to the territories of the parties.

[15] Venezuela stated that in view of the existing controversy between Venezuela on the one hand and the United Kingdom and Guyana on the other, Article 25, paragraph 2 of the Treaty should apply to Guyana. This paragraph provides that no political entity should be admitted, part or all of whose territory is the subject of a dispute or claim between an extra-continental country and one or more Latin American states, so long as the dispute has not been settled by peaceful means.

[16] Safeguards under the Non-Proliferation Treaty cover the Treaty of Tlatelolco.

The Non-Proliferation Treaty

[1] On signing the Treaty, Australia stated, *inter alia*, that it regarded it as essential that the Treaty should not affect security commitments under existing treaties of mutual security.

[2] Notification of succession.

[3] On the occasion of the deposit of the instrument of ratification, Egypt stated that since it was embarking on the construction of nuclear power reactors, it expected assistance and support from industrialized nations with a developed nuclear industry. It called upon nuclear weapon states to promote research and development of peaceful applications of nuclear explosions in order to overcome all the difficulties at present involved therein. Egypt also appealed to these states to exert their efforts to conclude an agreement prohibiting the use or threat of use of nuclear weapons against any state, and expressed the view that the Middle East should remain completely free of nuclear weapons.

[4] France, not party to the Treaty, declared that it would behave like a state adhering to the Treaty and that it would follow a policy of strengthening appropriate safeguards relating to nuclear equipment, material and technology. On 12 September 1981 an agreement between France, the European Atomic Energy Community (Euratom) and the IAEA for the application of safeguards in France entered into force. The agreement covers nuclear material and facilities notified to the IAEA by France, and is similar to the agreements concluded with the IAEA by the United Kingdom and the United States.

[5] On depositing the instrument of ratification, the Federal Republic of Germany reiterated the declaration made at the time of signing: it reaffirmed its expectation that the nuclear weapon states would intensify their efforts in accordance with the undertakings under Article VI of the Treaty, as well as its understanding that the security of FR Germany continued to be ensured by NATO; it stated that no provision of the Treaty may be interpreted in such a way as to hamper further development of European unification; that research, development and use of nuclear energy for peaceful purposes, as well as international and multinational co-operation in this field, must not be prejudiced by the Treaty; that the application of the Treaty, including the implementation of safeguards, must not lead to discrimination of the nuclear industry of FR Germany in international competition; and that it attached vital importance to the undertaking given by the United States and the United Kingdom concerning the application of safeguards to their peaceful nuclear facilities, hoping that other nuclear weapon states would assume similar obligations.

In a separate note, FR Germany declared that the Treaty will also apply to Berlin (West) without affecting Allied rights and responsibilities, including those relating to demilitarization. In notes of 24 July, 19 August and 25 November 1975, respectively, addressed to the US Department of State, Czechoslovakia, the Soviet Union and the German Democratic Republic stated that this declaration by FR Germany had no legal effect.

[6] On acceding to the Treaty, the Holy See stated, *inter alia*, that the Treaty will attain in full the objectives of security and peace and justify the limitations to which the states party to the Treaty submit, only if it is fully executed in every clause and with all its implications. This concerns not only the obligations to be applied immediately but also those which envisage a process of ulterior commitments. Among the latter, the Holy See considers it suitable to point out the following:

(*a*) The adoption of appropriate measures to ensure, on a basis of equality, that all non-nuclear weapon states party to the Treaty will have available to them the benefits deriving from peaceful applications of nuclear technology.

(*b*) The pursuit of negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective control.

[7] On signing the Treaty, Indonesia stated, *inter alia*, that the government of Indonesia attaches great importance to the declarations of the United States, the United Kingdom and the Soviet Union affirming their intention to provide immediate assistance to any non-nuclear weapon state party to the Treaty that is a victim of an act of aggression in which nuclear weapons are used. Of utmost importance, however, is not the action *after* a nuclear attack has been committed but the guarantees to prevent such an attack. The Indonesian government trusts that the nuclear weapon states will study further this question of effective measures to ensure the security of the non-nuclear weapon states. On depositing the instrument of ratification, Indonesia expressed the hope that the nuclear countries would be prepared to co-operate with non-nuclear countries in the use of nuclear energy for peaceful purposes and implement the provisions of Article IV of the Treaty without discrimination. It also stated the view that the nuclear weapon states should observe the provisions of Article VI of the Treaty relating to the cessation of the nuclear arms race.

[8] Italy stated that in its belief nothing in the Treaty was an obstacle to the unification of the countries of western Europe; it noted full compatibility of the Treaty with the existing security agreements; it noted further that when technological progress would allow the development of peaceful explosive devices different from nuclear weapons, the prohibition relating to their manufacture and use shall no longer apply; it interpreted the provisions of Article IX, paragraph 3 of the Treaty, concerning the definition of a military nuclear state, in the sense that it referred exclusively to the five countries which had manufactured and exploded a nuclear weapon or other nuclear explosive device prior to 1 January 1967, and stressed that under no circumstance would a claim of pertaining to such category be recognized by the Italian government to any other state.
[9] On depositing the instrument of ratification, Japan expressed the hope that France and China would accede to the Treaty; it urged a reduction of nuclear armaments and a comprehensive ban on nuclear testing; appealed to all states to refrain from the threat or use of force involving either nuclear or non-nuclear weapons; expressed the view that peaceful nuclear activities in non-nuclear weapon states party to the Treaty should not be hampered and that Japan should not be discriminated against in favour of other parties in any aspect of such activities. It also urged all nuclear weapon states to accept IAEA safeguards on their peaceful nuclear activities.
[10] A statement was made containing a disclaimer regarding the recognition of states party to the Treaty.
[11] On depositing the instrument of ratification, the Republic of Korea took note of the fact that the depositary governments of the three nuclear weapon states had made declarations in June 1968 to take immediate and effective measures to safeguard any non-nuclear weapon state which is a victim of an act or an object of a threat of aggression in which nuclear weapons are used. It recalled that the UN Security Council adopted a resolution to the same effect on 19 June 1968.
[12] On depositing the instruments of accession and ratification, Liechtenstein and Switzerland stated that activities not prohibited under Articles I and II of the Treaty include, in particular, the whole field of energy production and related operations, research and technology concerning future generations of nuclear reactors based on fission or fusion, as well as production of isotopes. Liechtenstein and Switzerland define the term "source or special fissionable material" in Article III of the Treaty as being in accordance with Article XX of the IAEA Statute, and a modification of this interpretation requires their formal consent; they will accept only such interpretations and definitions of the terms "equipment or material especially designed or prepared for the processing, use or production of special fissionable material", as mentioned in Article III of the Treaty, that they will expressly approve; and they understand that the application of the Treaty, especially of the control measures, will not lead to discrimination of their industry in international competition.
[13] On signing the Treaty, Mexico stated, *inter alia*, that none of the provisions of the Treaty shall be interpreted as affecting in any way whatsoever the rights and obligations of Mexico as a state party to the Treaty of Tlatelolco.

It is the understanding of Mexico that at the present time any nuclear explosive device is capable of being used as a nuclear weapon and that there is no indication that in the near future it will be possible to manufacture nuclear explosive devices that are not potentially nuclear weapons. However, if technological advances modify this situation, it will be necessary to amend the relevant provisions of the Treaty in accordance with the procedure established therein.
[14] The ratification was accompanied by a statement in which Turkey underlined the non-proliferation obligations of the nuclear weapon states, adding that measures must be taken to meet adequately the security requirements of non-nuclear weapon states. Turkey also stated that measures developed or to be developed at national and international levels to ensure the non-proliferation of nuclear weapons should in no case restrict the non-nuclear weapon states in their option for the application of nuclear energy for peaceful purposes.
[15] The United Kingdom recalled its view that if a regime is not recognized as the government of a state, neither signature nor the deposit of any instrument by it, nor notification of any of those acts, will bring about recognition of that regime by any other state.
[16] This agreement, signed by the United Kingdom, Euratom and the IAEA, provides for the submission of British non-military nuclear installations to safeguards under IAEA supervision.
[17] Together with the notification that the statutory and constitutional requirements for the entry into force of the agreement for the application of safeguards to US civilian nuclear installations had been met, the IAEA received a list of facilities in the United States eligible to be safeguarded.
[18] In connection with the ratification of the Treaty, Yugoslavia stated, *inter alia*, that it considered a ban on the development, manufacture and use of nuclear weapons and the destruction of all stockpiles of these weapons to be indispensable for the maintenance of a stable peace and international security; it held the view that the chief responsibility for progress in this direction rested with the nuclear weapon powers, and expected these powers to undertake not to use nuclear weapons against the countries which have renounced them as well as against non-nuclear weapon states in general, and to refrain from the threat to use them. It also emphasized the significance it attached to the universality of the efforts relating to the realization of the Non-Proliferation Treaty.

The Sea-Bed Treaty

[1] On signing and ratifying the Treaty, Argentina stated that it interprets the references to the freedom of the high seas as in no way implying a pronouncement of judgement on the different positions relating to questions connected with international maritime law. It understands that the reference to the rights of exploration and exploitation by coastal states over their continental shelves was included

solely because those could be the rights most frequently affected by verification procedures. Argentina precludes any possibility of strengthening, through this Treaty, certain positions concerning continental shelves to the detriment of others based on different criteria.

[2] On signing the Treaty, Brazil stated that nothing in the Treaty shall be interpreted as prejudicing in any way the sovereign rights of Brazil in the area of the sea, the sea-bed and the subsoil thereof adjacent to its coasts. It is the understanding of the Brazilian government that the word "observation", as it appears in paragraph 1 of Article III of the Treaty, refers only to observation that is incidental to the normal course of navigation in accordance with international law.

[3] In depositing the instrument of ratification, Canada declared: Article I, paragraph 1, cannot be interpreted as indicating that any state has a right to implant or emplace any weapons not prohibited under Article I, paragraph 1, on the sea-bed and ocean floor, and in the subsoil thereof, beyond the limits of national jurisdiction, or as constituting any limitation on the principle that this area of the sea-bed and ocean floor and the subsoil thereof shall be reserved for exclusively peaceful purposes. Articles I, II and III cannot be interpreted as indicating that any state but the coastal state has any right to implant or emplace any weapon not prohibited under Article I, paragraph 1 on the continental shelf, or the subsoil thereof, appertaining to that coastal state, beyond the outer limit of the sea-bed zone referred to in Article I and defined in Article II. Article III cannot be interpreted as indicating any restrictions or limitation upon the rights of the coastal state, consistent with its exclusive sovereign rights with respect to the continental shelf, to verify, inspect or effect the removal of any weapon, structure, installation, facility or device implanted or emplaced on the continental shelf, or the subsoil thereof, appertaining to that coastal state, beyond the outer limit of the sea-bed zone referred to in Article I and defined in Article II. On 12 April 1976, the Federal Republic of Germany stated that the declaration by Canada is not of a nature to confer on the government of this country more far-reaching rights than those to which it is entitled under current international law, and that all rights existing under current international law which are not covered by the prohibitions are left intact by the Treaty.

[4] A statement was made containing a disclaimer regarding recognition of states party to the Treaty.

[5] On ratifying the Treaty, the Federal Republic of Germany declared that the Treaty will apply to Berlin (West).

[6] On the occasion of its accession to the Treaty, the government of India stated that as a coastal state, India has, and always has had, full and exclusive rights over the continental shelf adjoining its territory and beyond its territorial waters and the subsoil thereof. It is the considered view of India that other countries cannot use its continental shelf for military purposes. There cannot, therefore, be any restriction on, or limitation of, the sovereign right of India as a coastal state to verify, inspect, remove or destroy any weapon, device, structure, installation or facility, which might be implanted or emplaced on or beneath its continental shelf by any other country, or to take such other steps as may be considered necessary to safeguard its security. The accession by the government of India to the Treaty is based on this position. In response to the Indian statement, the US government expressed the view that, under existing international law, the rights of coastal states over their continental shelves are exclusive only for the purposes of exploration and exploitation of natural resources, and are otherwise limited by the 1958 Convention on the Continental Shelf and other principles of international law. On 12 April 1976, the Federal Republic of Germany stated that the declaration by India is not of a nature to confer on the government of this country more far-reaching rights than those to which it is entitled under current international law, and that all rights existing under current law which are not covered by the prohibitions are left intact by the Treaty.

[7] On signing the Treaty, Italy stated, *inter alia*, that in the case of agreements on further measures in the field of disarmament to prevent an arms race on the sea-bed and ocean floor and in their subsoil, the question of the delimitation of the area within which these measures would find application shall have to be examined and solved in each instance in accordance with the nature of the measures to be adopted. The statement was repeated at the time of ratification.

[8] Ratification of the Treaty by Taiwan is considered by Romania as null and void.

[9] The United Kingdom recalled its view that if a regime is not recognized as the government of a state, neither signature nor the deposit of any instrument by it, nor notification of any of those acts, will bring about recognition of that regime by any other state.

[10] Viet Nam stated that no provision of the Treaty should be interpreted in a way that would contradict the rights of the coastal states with regard to their continental shelf, including the right to take measures to ensure their security.

[11] On 25 February 1974, the Ambassador of Yugoslavia transmitted to the US Secretary of State a note stating that in the view of the Yugoslav government, Article III, paragraph 1, of the Treaty should be interpreted in such a way that a state exercising its right under this Article shall be obliged to notify in advance the coastal state, in so far as its observations are to be carried out "within the stretch of the sea extending above the continental shelf of the said state". On 16 January 1975, the US Secretary of State presented the view of the United States concerning the Yugoslav note, as follows: In so far as the note is intended to be interpretative of the Treaty, the United States cannot accept it as a valid interpretation. In addition, the United States does not consider that it can have any effect on the existing law of the sea. In so far as the note was intended to be a reservation to the Treaty, the United States placed on record its formal objection to it on the grounds that it was incompatible with the object and purpose of the Treaty. The United States also drew attention to the fact that the note was submitted too late to be legally effective as a reservation. A similar exchange of notes took place between Yugoslavia and the United Kingdom. On 12 April 1976, the Federal

Republic of Germany stated that the declaration by Yugoslavia is not of a nature to confer on the government of this country more far-reaching rights than those to which it is entitled under current international law, and that all rights existing under current international law which are not covered by the prohibitions are left intact by the Treaty.

The BW Convention

[1] Considering the obligations resulting from its status as a permanently neutral state, Austria declares a reservation to the effect that its co-operation within the framework of this Convention cannot exceed the limits determined by the status of permanent neutrality and membership with the United Nations.

[2] On depositing its instrument of ratification, the Federal Republic of Germany stated that a major shortcoming of the BW Convention is that it does not contain any provisions for verifying compliance with its essential obligations. The Federal Government considers the right to lodge a complaint with the UN Security Council to be an inadequate arrangement. It would welcome the establishment of an independent international committee of experts able to carry out impartial investigations when doubts arise as to whether the Convention is being complied with.

[3] In a statement made on the occasion of the signature of the Convention, India reiterated its understanding that the objective of the Convention is to eliminate biological and toxin weapons, thereby excluding completely the possibility of their use, and that the exemption with regard to biological agents or toxins, which would be permitted for prophylactic, protective or other peaceful purposes, would not in any way create a loophole in regard to the production or retention of biological and toxin weapons. Also any assistance which might be furnished under the terms of the Convention would be of a medical or humanitarian nature and in conformity with the Charter of the United Nations. The statement was repeated at the time of the deposit of the instrument of ratification.

[4] Ireland considers that the Convention could be undermined if the reservations made by the parties to the 1925 Geneva Protocol were allowed to stand, as the prohibition of possession is incompatible with the right to retaliate, and that there should be an absolute and universal prohibition of the use of the weapons in question. Ireland notified the depositary government for the Geneva Protocol of the withdrawal of its reservations to the Protocol, made at the time of accession in 1930. The withdrawal applies to chemical as well as to bacteriological (biological) and toxin agents of warfare.

[5] The Republic of Korea stated that the signing of the Convention does not in any way mean or imply the recognition of any territory or regime which has not been recognized by the Republic of Korea as a state or government.

[6] In the understanding of Kuwait, its ratification of the Convention does not in any way imply its recognition of Israel, nor does it oblige it to apply the provisions of the Convention in respect of the said country.

[7] Mexico considers that the Convention is only a first step towards an agreement prohibiting also the development, production and stockpiling of all chemical weapons, and notes the fact that the Convention contains an express commitment to continue negotiations in good faith with the aim of arriving at such an agreement.

[8] The ratification by Switzerland contains the following reservations:

1. Owing to the fact that the Convention also applies to weapons, equipment or means of delivery designed to use biological agents or toxins, the delimitation of its scope of application can cause difficulties since there are scarcely any weapons, equipment or means of delivery peculiar to such use; therefore, Switzerland reserves the right to decide for itself what auxiliary means fall within that definition.

2. By reason of the obligations resulting from its status as a perpetually neutral state, Switzerland is bound to make the general reservation that its collaboration within the framework of this Convention cannot go beyond the terms prescribed by that status. This reservation refers especially to Article VII of the Convention as well as to any similar clause that could replace or supplement that provision of the Convention.

In a note of 18 August 1976, addressed to the Swiss Ambassador, the US Secretary of State stated the following view of the US government with regard to the first reservation: The prohibition would apply only to (*a*) weapons, equipment and means of delivery, the design of which indicated that they could have no other use than that specified, and (*b*) weapons, equipment and means of delivery, the design of which indicated that they were specifically intended to be capable of the use specified. The government of the United States shares the view of the government of Switzerland that there are few weapons, equipment or means of delivery peculiar to the uses referred to. It does not, however, believe that it would be appropriate, on this ground alone, for states to reserve unilaterally the right to decide which weapons, equipment or means of delivery fell within the definition. Therefore, while acknowledging the entry into force of the Convention between itself and the government of Switzerland, the US government enters its objection to this reservation.

[9] The deposit of the instrument of ratification by Taiwan is considered by the Soviet Union as an illegal act because the government of the People's Republic of China is regarded by the Soviet Union as the sole representative of China.

[10] The United Kingdom recalled its view that if a regime is not recognized as the government of a state, neither signature nor the deposit of any instrument by it nor notification of any of those acts will bring about recognition of that regime by any other state.

[11] Notification of succession.

The ENMOD Convention

[1] The Federal Republic of Germany declared that the Convention applies also to Berlin (West). The Soviet Union objected to this and stated that the declaration was "illegal".

[2] Kuwait made the following reservation and understanding: This Convention binds Kuwait only towards states parties thereto; its obligatory character shall *ipso facto* terminate with respect to any hostile state which does not abide by the prohibition contained therein. It is understood that accession to this Convention does not mean in any way recognition of Israel by Kuwait; furthermore, no treaty relation will arise between Kuwait and Israel.

On 23 June 1980, the UN Secretary-General, the depositary of the Convention, received from the government of Israel a communication stating that Israel would adopt towards Kuwait an attitude of complete reciprocity.

[3] The Netherlands accepts the obligations laid down in Article 1 of the ENMOD Convention as extending to states which are not party to the Convention and which act in conformity with Article 1 of this Convention.

[4] On signing the Convention, Turkey declared that the terms "widespread", "long-lasting" and "severe effects" contained in the Convention need to be more clearly defined, and that so long as this clarification was not made, Turkey would be compelled to interpret for itself the terms in question and, consequently, reserved the right to do so as and when required. Turkey also stated its belief that the difference between "military or any other hostile purposes" and "peaceful purposes" should be more clearly defined so as to prevent subjective evaluations.

[5] Notification of succession.

The 'Inhumane Weapons' Convention

[1] Upon signature, China stated that the Convention fails to provide for supervision or verification of any violation of its clauses, thus weakening its binding force. The Protocol on mines, booby traps and other devices fails to lay down strict restrictions on the use of such weapons by the aggressor on the territory of the victim and to provide adequately for the right of a state victim of an aggression to defend itself by all necessary means. The Protocol on incendiary weapons does not stipulate restrictions on the use of such weapons against combat personnel.

[2] France stated that it regretted that it had not been possible to reach agreement on the provisions concerning the verification of facts which might be alleged and which might constitute violations of the undertakings subscribed to. It therefore reserved the right to submit, possibly in association with other states, proposals aimed at filling that gap at the first conference to be held pursuant to Article 8 of the Convention and to utilize, as appropriate, procedures that would make it possible to bring before the international community facts and information which, if verified, could constitute violations of the provisions of the Convention and the protocols annexed thereto.

Not being bound by the 1977 Additional Protocol I to the Geneva Conventions of 1949, France considers that the fourth paragraph of the preamble to the Convention on prohibitions or restrictions on the use of certain conventional weapons, which reproduces the provisions of Article 35, paragraph 3, of Additional Protocol I, applies only to states parties to that Protocol. France will apply the provisions of the Convention and its three Protocols to all the armed conflicts referred to in Articles 2 and 3 common to the Geneva Conventions of 1949.

[3] Italy stated its regret that no agreement had been reached on provisions that would ensure respect for the obligations under the Convention. Italy intends to undertake efforts to ensure that the problem of the establishment of a mechanism that would make it possible to fill this gap in the Convention is taken up again at the earliest opportunity in every competent forum.

[4] Romania stated that the provisions of the Convention and its Protocols have a restricted character and do not ensure adequate protection either to the civilian population or to the combatants as the fundamental principles of international humanitarian law require.

[5] The United States stated that it had strongly supported proposals by other countries to include special procedures for dealing with compliance matters, and reserved the right to propose at a later date additional procedures and remedies, should this prove necessary, to deal with such problems.

19. Chronology of major events related to arms control issues

JOZEF GOLDBLAT and RAGNHILD FERM

January–December 1983

5 January In the 'Political Declaration', adopted in Prague, the Warsaw Treaty Organization countries state that a substantial lowering of the levels of conventional weapons and armed forces must be achieved both globally and in individual regions, and that it is advisable to resume negotiations on the restriction of sales of conventional weapons. They are in favour of starting negotiations on the limitation of naval operations, on the limitation and reduction of naval armaments and on the extension of confidence-building measures to cover the seas and the oceans. They suggest that Europe should be free of weapons of mass destruction and propose the conclusion of a treaty with NATO on the mutual renunciation of the use of military force and the maintenance of peaceful relations.

17 February The USA submits to the USSR a request for improving the verification provisions of the 1974 Threshold Test Ban Treaty (TTBT) and the 1976 Peaceful Nuclear Explosions Treaty (PNET) in order to remove the existing uncertainties concerning compliance.

12 March In the 'New Delhi Message', the heads of state or government of the non-aligned countries demand an immediate prohibition of the use or threat of use of nuclear weapons by all nuclear weapon states. They also call for a freeze on the development, production, stockpiling and deployment of nuclear weapons and a speedy finalization of a treaty banning all tests of nuclear weapons. They reiterate that the nuclear weapon states have an obligation to guarantee that non-nuclear weapon states would not be threatened or attacked with nuclear weapons.

23 March Referring to the need to intercept ballistic missiles before they reach US soil, the President of the USA directs (in the so-called 'star wars speech') a comprehensive and intensive effort to define a long-term research and development programme "to begin to achieve" the ultimate goal of eliminating the threat posed by strategic nuclear weapons.

28 March The USSR turns down the suggested modifications of the TTBT and the PNET (see *17 February*), saying that the uncertainties referred to by the USA would not have occurred if the verification system established by these unratified treaties had been put into effect.

7 April In a communiqué issued in Prague, the ministers of foreign affairs of the Warsaw Treaty Organization countries propose that negotiations should be held between the WTO and NATO on a "non-increase" of military expenditures and on a subsequent cut of these expenditures in percentage or absolute terms. They also express readiness to consider practical questions related to the task of "clearing Europe of chemical weapons", and reiterate the view that nuclear weapon-free zones in various regions of Europe would relieve the European continent of the nuclear danger.

3 May The 'Challenge to Peace', the pastoral letter of the US Catholic bishops, states that it is morally unjustifiable to initiate nuclear war in any form, and calls for a halt in the production and deployment of nuclear arms.

2 June The ministers participating in the NATO Defence Planning Committee meeting reaffirm the aim of real increases in defence expenditure of the order of 3 per cent annually. They consider that it is particularly important to increase the combat capability and effectiveness of NATO's conventional forces.

6 June In a speech made in Moscow, Chairman Andropov says that the USSR is prepared to facilitate the establishment of a nuclear weapon-free zone in the north of Europe. Not only will it commit itself to respect the status of such a zone, but it is also ready to study the question of similar and "substantial" measures concerning its own territory adjoining the zone. The Soviet Union could also discuss with the interested parties the question of giving "nuclear-free status" to the Baltic.

14 June Sweden submits to the Committee on Disarmament a draft treaty banning nuclear weapon test explosions in all environments.

16 June The Supreme Soviet of the USSR decides that the Soviet government should propose to the governments of the USA, the UK, France and China a simultaneous freeze, both quantitative and qualitative, of all nuclear weapons.

23 June At the Vienna Talks on the mutual reduction of forces in Europe, the WTO states present a draft treaty proposing a reduction of WTO and NATO forces in the central area of Europe to 900 000 men each, with sub-limits of 200 000 on air force personnel and 700 000 on ground troops, within three years after the effective date of the treaty. Verification measures would include several permanent monitoring stations through which all troops would pass in entering or leaving the area of reductions, as well as on-site inspection if permitted by the host country.

27 June In an interview with the West German magazine *Der Spiegel*, the French Defence Minister says that France has tested a neutron weapon and is able to start its production as soon as the President so decides.

28 June The party and state leaders of the USSR, Bulgaria, Czechoslovakia, the GDR, Hungary, Poland and Romania, meeting in Moscow, express a desire to free Europe from both medium-range and tactical nuclear weapons. They consider that there should be a nuclear weapon freeze and that the nuclear weapon powers which had not yet done so should assume the obligation not to be the first to use nuclear weapons.

17 July The presidents of Colombia, Mexico, Panama and Venezuela (the Contadora group), meeting in Mexico, adopt the "Cancún Declaration" requiring the conclusion of agreements among the Central American states, leading to effective control of the arms race.

30 July The Soviet Minister of Defence states that the USSR will take countermeasures that will make the military threat to the territory of the USA and the countries on whose territories US missiles will be deployed as great as the threat the USA is trying to make to the Soviet Union and its allies.

18 August At a meeting with a group of US senators, Chairman Andropov announces the following decision: the USSR assumes the commitment not to be the first to put into outer space any type of anti-satellite weapon. It thus imposes a unilateral moratorium on such launchings for the entire period during which other countries, including the United States, refrain from stationing anti-satellite weapons of any type in outer space.

19 August The Soviet Union submits to the United Nations a draft treaty on the prohibition of the use of force in outer space and from space against the Earth.

6 September The Conference on Security and Co-operation in Europe, meeting in Madrid, adopts a concluding document which provides for the convening on 17 January 1984, in Stockholm, of a conference on confidence and security-building measures and disarmament in Europe.

9 September Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua agree on a 'Document of Objectives', containing elements of future undertakings to achieve security in Central America: to stop the arms race; to prevent the installation of foreign military bases; to reduce the presence of foreign military advisers; and to restrict the traffic in arms.

12–23 September The Second Review Conference of the parties to the 1971 Sea-Bed Treaty takes place in Geneva.

11 October The General Conference of the International Atomic Energy Agency (IAEA) approves the application of the People's Republic of China for membership.

24 October The Soviet Defence Ministry announces that work has started on the deployment of "missile complexes of operational–tactical designation" on the territory of the GDR and Czechoslovakia.

27–28 October The ministers attending the NATO Nuclear Planning Group meeting at Montebello, Canada, decide to withdraw 1 400 warheads from Europe during the next several years. This decision, taken together with the accomplished withdrawal of 1 000 warheads, will bring to 2 400 the total number of warheads to be removed from Europe since 1979. The reduction will not be affected by the deployment of longer-range intermediate nuclear forces, since one warhead will be removed for each Pershing II or ground-launched cruise missile warhead deployed.

14 November The first US ground-launched cruise missiles arrive in Great Britain to be deployed there in accordance with the NATO decision.

16 November The President of France describes the dispute over nuclear missiles in Europe as the most serious international crisis of the past two decades.

18 November The chairman of the Argentine Atomic Energy Commission announces that Argentina has developed a uranium enrichment technology.

23 November The first Pershing II missiles arrive in FR Germany to be deployed there in accordance with the NATO decision.

At a meeting of the US and Soviet delegations at the Geneva negotiations on intermediate nuclear forces (INF) in Europe, the Soviet representative announces the discontinuation of the present round of talks and refuses to set a date for their resumption.

24 November In a press statement summarizing the talks with the Secretary-General of the Chinese Communist Party, the Prime Minister of Japan says that the two sides share the view that the deployment of the SS-20 missiles in the Far East constitutes a threat to both Japan and China.

2 December The 1980 Convention prohibiting or restricting the use of certain excessively injurious or indiscriminate conventional weapons enters into force.

8 December US–Soviet strategic arms reduction talks (START), held in Geneva, end with the Soviet delegation refusing to set a date for their resumption.

9 December In the 'Declaration of Brussels', the representatives of NATO member states announce that they are going forward with the implementation of the double-track decision of 1979, but that the deployment of US missiles can be halted or reversed by concrete results at the negotiating table. They wish to see an early resumption of the INF negotiations which the Soviet Union has discontinued.

Errata

World Armaments and Disarmament, SIPRI Yearbook 1983

Page 55, lines 7–8	"Submarine-launched cruise missiles (SLCMs)" should read "sea-launched cruise missiles (SLCMs)".
Page 93, line 28:	Should read "Commissioner of the US Nuclear Regulatory Commission advised Congress as".
Page 103, line 27:	Should read "neutralist position and decreased military expenditure [7]."
Page 132, footnote a *of table 7.1:*	Should read "Based on 1982 military spending figures, at 1980 prices and exchange-rates."
Page 165, table 7A.2:	Should read "Niger, 1979: 17.9".
Page 169, table 7A.3:	Should read "Niger, 1979: 3 430".
Page 173, table 7A.4:	Should read "Nigeria, 1973: 4.7; 1974: 3.4; 1975: 5.2; 1976: 4.4; 1977: 4.5".
Page 452, footnote a *of table 15.6:*	"Ekram 1-7" should read "Ekran 1-7".
Page 595, footnote 1, line 2:	Should read "by Sigrid Pöllinger, member of the staff of the Austrian Institute for Peace Research, Vienna, Austria."

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WORLD ARMAMENTS AND DISARMAMENT

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This is the fifteenth SIPRI Yearbook. The aim of the Yearbooks is to bring together information on world armaments and the efforts made to limit or reduce them. The Yearbooks attract world-wide attention and are used extensively in the United Nations, in international disarmament negotiations and in national parliamentary and government debates as an authoritative source of information.

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