Chapter 4. Technology and politics

I. Introduction

With the previous two chapters as background it is now possible to analyse a number of specific aspects of verification which illustrate the intense interaction between the technical and political dimensions. It is essential to understand this interaction in order to obtain a realistic picture of the capabilities and limitations of monitoring techniques and compliance mechanisms in arms control.

The first aspect examined is the legitimacy and/or legality of various monitoring techniques. Just as in so many other areas of modern life the development of intelligence-gathering technology has substantially outrun the international legal and institutional mechanisms for regulating it. This has led to much political friction in the past and promises much more in the future. It is therefore worthwhile to look at some examples of this friction including both past problems that seem to have been reasonably well resolved and current problems that are the subject of serious controversy.

The second aspect is the concept of violation or non-compliance. Violations come in many forms, as does the evidence used to establish them. An assessment of non-compliance usually involves far more than displaying a satellite photograph of a prohibited object or identifying a suspicious pattern in a seismograph. As shown in chapter 1 these are at best useful for identifying suspicious activities. The process of assessment of the evidence is far more subjective and cannot be abstracted from the political and psychological atmosphere in which it is conducted.

A third aspect is the use of so-called 'co-operative measures', in particular on-site inspection, as supplements to national technical means. The attitudes and negotiating postures of the two major powers towards on-site inspection are examined in chapter 3. This chapter first analyses a number of co-operative measures which do not involve on-site inspection, but which nevertheless add significantly to the effectiveness of the compliance process. In contrast, the analysis of on-site inspection (the fourth aspect examined) shows that it has serious political and technical limitations which make its utility considerably more dubious than many in the West appreciate.

A fifth aspect of verification which exhibits an intimate connection between technology and politics is the degree of internationalization of the process. It has already been noted in chapter 3 that the unilateral application of sophisticated national technical means by states able to afford them is highly unsatisfactory to many other states who would prefer an international approach. The final section of this chapter analyses the advantages and disadvantages of such an approach as well as its technical and political feasibility.

II. Legitimacy

National technical means

The phrase 'national technical means of verification' (NTM) has become a fixture in arms control agreements between the USA and USSR since its first use in the ABM Treaty of 1972.[1] It also appears in the Interim SALT I agreement limiting strategic weapons,[2] the Threshold Test Ban Treaty,[3] the Peaceful Nuclear Explosion Treaty[4] and the SALT II Treaty.[5]

Given this evidence of the usefulness and ubiquity of the concept of national technical means of verification it is surprising to learn that nowhere in any of the above-mentioned treaties, nor anywhere in the understandings and protocols that accompany them, is the concept defined in any way. Such relatively trivial or arcane items as ABM radars, 'new types' of ICBM, and the meaning of the phrase 'independently targetable warhead' are defined in meticulous detail in agreed statements and common understandings, especially in the SALT II Treaty, and one would expect at least as much attention would be devoted to defining national technical means, especially in view of the central importance of verification in all of the above treaties. Such is not the case, however, and this crucial concept remains open for interpretation by both sides, a situation which virtually guarantees misunderstanding and political friction.

Neither side has pressed for a clear definition of NTM. From the US point of view, "while some NTM are well known, such as photographic satellites, others are quite sensitive and we don't want to discuss them with the Soviets. An incomplete list would call into question [and could well place outside the protection of the agreement] those systems not on the list".[6] There is no clear public statement of the Soviet reasons for not pressing for a clear definition of NTM. The usual explanation given by Americans who have participated in arms control negotiations is that the Soviet Union is unwilling to recognize explicitly the legitimacy of US intelligence activities based in third countries, while the USA would accept no definition that did not legitimate such activities.[7] It is also reasonable to assume that the Soviet Union has its own intelligence-gathering methods that it would prefer not to discuss with the United States.

Allowing the definition of NTM to remain vague has definite advantages. It

avoids long and contentious haggling over details and limits which would inevitably be highly arbitrary and artificial. It also allows for flexibility in the application of new technologies of verification and the exploitation of the synergisms among different technologies.

However, vagueness also has disadvantages and can lead to serious problems for the compliance process. In particular, if a monitoring activity or technology is not recognized by one party as a legitimate NTM it does not come under the protection afforded to NTM in all treaties which rely on them. This protection is embodied in the commitment in all of the above-mentioned treaties that the parties will refrain from either directly interfering with the NTM of other parties or deliberately using concealment measures which impede the ability of NTM to carry out verification tasks. At the same time states reserve the right to interfere with attempts to gather military intelligence on matters unrelated to specific treaty obligations. This makes the boundary between legitimate NTM and illegitimate intelligence gathering a very sensitive one, especially when the parties are engaged in an intense military competition and are deeply distrustful of each other's intentions.

Satellite photo-reconnaissance

An interesting and highly significant historical example of such a dispute involved the legitimacy of satellite photography. The reaction of the Soviet Union to President Eisenhower's Open Skies proposal and the ultimate shooting down in 1960 of a United States U-2 aircraft on a photo-reconnaissance mission over Soviet intercontinental ballistic missile installations made unmistakably clear the Soviet attitude towards aerial surveillance. It was therefore not at all surprising that the initial Soviet reaction to the launching of US photo-reconnaissance satellites was intensely negative.[8] Such surveillance was seen as a violation of the principles of international law,[9] no different in essence from the violation of their airspace by US reconnaissance planes. Such a reaction was fully anticipated by the United States when plans were being made to launch the first reconnaissance satellites, and a number of parallel efforts were undertaken to mitigate it. One effort involved advertising the international benefits to be gained from satellite surveying of Earth resources and climate by such systems as Landsat. Another involved a total prohibition of official statements which might embarrass the USSR by revealing the extent of US capabilities for photographing their territory. Finally, the USA began research and development on an anti-satellite (ASAT) system, one of whose functions was to deter Soviet attacks on US satellites by the threat of retaliation in kind.[10]

It is interesting that in its attempts at legitimating satellite photo-reconnaissance the USA often drew an analogy between outer space and the high seas, the freedom of which was guaranteed to all states by international law.[11] The Soviet Union preferred, at least in the early days of the space age,

a less liberal analogy, referring to all of the space 'above' the territory of the Soviet Union as its airspace. This is an intriguing semantic problem that has no obvious solution. For example, while the atmosphere above any portion of the Earth rotates along with that portion, the rest of space remains stationary. Therefore the 'space' above any state is constantly changing, and it is not at all clear that it can be thought of as equivalent to airspace.

An exception to this rule occurs in the use of 'geosynchronous' orbits, in which a satellite does remain in a fixed location relative to the Earth and therefore continuously occupies what could be called the 'airspace' of a state located on the Earth's equator. The Outer Space Treaty of 1967 gives free access to all states to "outer space" and has 85 signatories (see table 1, p. 4). However a number of equatorial countries stated in 1977 that: "The Outer Space Treaty 'cannot be considered as a final answer to the problem of the exploration and use of Outer Space' because it was 'elaborated when the developing countries could not count on adequate scientific advice' and were thus unable to participate effectively in its drafting".[12]

While such problems will remain to plague international lawyers for many years to come, the problem of Soviet acceptance of the legitimacy of satellite photo-reconnaissance was solved without fanfare in 1963 when the Soviet Union simply dropped its objection to the practice.[13] There has never been an official Soviet explanation of this change of heart. From one point of view it seems quite illogical to oppose overflights by aircraft and permit them by satellites, when the coverage and resolution of the latter are in many ways as good as or better than those of the former. And satellite photography and signal-detection capabilities are the most important sources of data for US strategic target planning,[14] just as aircraft would have been in the 1950s if the Open Skies proposal had been accepted. Yet satellite reconnaissance has become legitimate and accepted while aerial reconnaissance remains illegitimate and unacceptable, a contrast dramatically emphasized by the destruction of a South Korean airliner which violated Soviet airspace in 1983.

The most likely explanation of this difference in attitude is the realization by Soviet authorities that the use of such satellites would be as highly advantageous to them as it is to the USA, and that the possession of such capabilities by both sides would not only contribute to stabilizing the competition between them but provide excellent means for observing the activities of other states. Indeed, Soviet photo-reconnaissance satellites are very active in monitoring crisis and conflict situations in all parts of the world as well as US and NATO military exercises and deployments.[15]

An extremely important feature of this acceptance of satellite photography by the Soviet Union was its informal nature. It followed closely on the heels of the Cuban missile crisis during a period when the USA and USSR were anxious to reduce tensions and prevent the repetition of such a crisis.[16] No agreement or treaty was ever discussed formally between the parties on legitimating satellite photography, and in fact none of the treaties which rely

on NTM for their verification mentions satellites specifically. The legitimacy of satellite photography therefore remains tacit and not explicit in international law.

A major reason for the success of this informal agreement may have been the refusal of US officials to publicly discuss, or even admit, the extent of US photo-reconnaissance capabilities. This 'black-out' of public announcements and discussions was first ordered in 1961 by the Kennedy Administration[17] and remained in effect until 1978, when President Carter admitted that the USA was photographing the territory of the Soviet Union from satellites.[18] By maintaining this official silence in the early years of satellite reconnaissance the USA probably made it easier for Soviet advocates of satellite reconnaissance to overcome the resistance of those who wanted to deal with satellites in the same way as aircraft.

This official secrecy has now outlived its usefulness, but unfortunately it has had over 20 years to embed itself in the bureaucratic mentality of the US intelligence community, and resistance to change is intense. If not for this resistance President Carter's announcement might have been followed by the release of satellite photographs to support his attempt to gain ratification of the SALT II Treaty.[19] Unless this deeply entrenched opposition to greater openness can be overcome it is difficult to see how public confidence in the arms control process can be regained (see chapter 3).

The informal nature of the legitimacy of satellite photo-reconnaissance has some drawbacks. Since the limits of this legitimacy have never been agreed upon and codified, each side is free to attach whatever limits or reservations it chooses. This is most significant in the case of the Soviet Union, which maintains that there is a difference in principle between reconnaissance carried out for verification purposes and for the gathering of military intelligence, even if it is not feasible to distinguish these two missions in practice. For example a 1979 Soviet article on space law stated: "If supervision by means of space equipment goes beyond the purpose of monitoring provided by the treaty and, for example, is carried out for purpose of getting some intelligence information, this activity must be regarded as unlawful".[20] A more recent Soviet assessment begins with the clear assertion that "the use of observation satellites is within the norms of existing international law. The space treaty of 1967... does not impose any restrictions on the use of satellites". Yet this same author concludes with a sentence that can only be interpreted as a reservation: "But not a single international legal document directly approves the use of such satellites for monitoring and control".[21]

Such reservations may be interpreted as keeping open the option of interfering with or attacking satellites which are perceived to be exceeding their legitimate functions. The Soviet Union continues to develop, albeit fitfully, an anti-satellite capability, even though it was hoped by some that acceptance of the legitimacy of reconnaissance satellites would make such a capability unnecessary.[22] The Soviet testing programme has been interrupted several

times in the past and is now observing a unilateral moratorium declared by Secretary Andropov in 1983. Nevertheless work continues on a large phased-array radar which, according to one analyst, may contribute to an ASAT battle management capability.[23] And the United States, which has never doubted the legitimacy of satellite reconnaissance, is also moving forward in the development of an ASAT system whose only plausible functions are to attack Soviet photo-reconnaissance, ocean-surveillance or electronic-reconnaissance satellites.[24] So while reconnaissance satellites have come to be accepted almost totally as legitimate intruments for monitoring, the 'almost' is significant, and even this relatively stable and secure situation could be weakened in a time of heightened political tension.

It must be kept in mind, however, that an attack on a satellite of another state would certainly constitute an aggressive act, similar to firing on a ship in international waters.[25] Such an action is likely only when the threat of war is already at a high level. It is extremely unlikely that attacks on satellites would be contemplated in peace-time, whatever formal reservation a state might have about their legitimacy.

Telemetry encryption

In contrast to the high degree of legitimacy now accorded to the use of photo-reconnaissance satellites, another national technical means of verification has come under increasing pressure in recent years and is now facing a genuine crisis of legitimacy. This is the use of land-, sea- and satellite-based antennas to monitor the telemetry from missiles during test flights (see chapter 2, section VIII, p. 79).

The interception of electronic communications is not generally recognized as a legitimate NTM, and most states devote considerable effort to encrypting or otherwise concealing sensitive messages from the intelligence agencies of other states. It is only in one narrow area that the interception of telemetry has been recognized as legitimate, and this recognition is embodied in the following Common Understanding regarding the SALT II Treaty:

> Each party is free to use various methods of transmitting telemetric information, including its encryption, except that, in accordance with the provisions of Paragraph 3 of Article XV of the Treaty, neither Party shall engage in deliberate denial of telemetric information, such as through the use of telemetry encryption, whenever such denial impedes verification of compliance with the provisions of the Treaty.[26]

Several comments and qualifications must be made about this clause. First, the SALT II Treaty has never been ratified by the USA, which means that the understanding has no force in international law. Second, the understanding does not confine its limitation to the encryption of telemetry, but prohibits

all forms of "deliberate denial of telemetric information" which "impede" verification. For example, a state testing a missile might decide to dispense entirely with telemetry transmissions and instead record flight-test data on magnetic tape aboard the missile. The tape could then be recovered after the test, thereby denying access to the data to anyone other than the state conducting the test. Another method would be to use low-power, highly directional transmitters on the missile so that the telemetry could only be received by those ground stations for which it is intended.

A third complication arises from the heavy dependence of the US telemetry monitoring on ground stations based in third countries (see chapters 2 and 3). But the Soviet Union has never accepted the legitimacy of such third-country monitoring sites as legitimate national technical means,[27] implying that they need not respect limitations on interfering with the operation of such stations. Finally, it is important to emphasize that the common understanding legitimates *both* the interception of telemetry *and* its encryption, providing only a poorly defined criterion for distinguishing acceptable from unacceptable encryption. It is this attempt to have it both ways that has led to one of the most serious of the compliance issues currently dividing the USA and the USSR.

The monitoring of telemetry is very similar to satellite photography in the high degree of overlap between its verification and military intelligence functions. The same information which is needed to obtain an accurate measure of the throw-weight of a missile, a property controlled by SALT II, is very helpful in estimating the accuracy of the missile, a property not regulated by the Treaty but of great interest to military planners. Telemetry information can be important in determining whether an anti-aircraft missile is being tested in an anti-ballistic missile mode in violation of the SALT I Treaty, but it can also help to assess the effectiveness of the anti-aircraft defences of the state doing the testing, something which is not covered by a treaty and which any state would consider highly sensitive information.

There is also an important difference between telemetry monitoring and satellite photography in the relative ease with which each can be interfered with, either actively or passively. In order to interfere actively with a photo-reconnaissance satellite it must be physically attacked, but active interference with a telemetry monitoring antenna requires only a jamming signal. Passive interference with a photo-reconnaissance satellite requires elaborate and often unreliable camouflage or a degree of mobility which is impracticable for many weapons. On the other hand, as chapter 2 shows, the concealement of information in telemetry is a relatively simple matter of combining the signal with a one-time encryption key, producing a message which is indecipherable by even the most powerful computers. It is reasonable to assume that one of the reasons why satellite photography achieved acceptance was the technical difficulty involved in interfering with it. Such inhibitions are not present in telemetry monitoring.

The unlimited monitoring of telemetry clearly conflicts with the basic principles the Soviet Union has used to evaluate past verification proposals. One statement of these principles is given in chapter 3, and the two most relevant to the issue of telemetry encryption are numbers 1 and 3 (see p. 140). Under these principles the conduct of verification should not prejudice the sovereign rights of states, one of which is certainly the right to keep sensitive military information secret from potential enemies. Nor should the scope and forms of verification be any greater than those which are needed for assuring compliance with the specific obligations agreed to in the treaty. This is generally interpreted by Soviet negotiators to mean that the gathering of information should be confined strictly to information relevant to verification of specific treaty provisions; presumably no less, but certainly no more.

For this reason, and possibly for other reasons as well, the Soviet Union began encrypting the telemetry from its missile tests in the mid-1970s, when they learned through espionage of the extent and sophistication of US satellite monitoring capabilities.[28] Since 1977, when the process began in earnest, reports of Soviet telemetry encryption have steadily increased in the US media and in congressional speeches and testimony. Finally, in January 1984 President Reagan included charges of Soviet violation of the common understanding on encryption in a long list of alleged Soviet violations of arms control treaties which he submitted to Congress.[29]

More recently there have been unconfirmed reports in the US press that the Soviet Union has gone beyond the encryption of telemetry and has begun the active jamming of US reconnaissance satellites.[30] If these charges are true, then it would represent a far more direct and less ambiguous Soviet challenge to the legitimacy of electronic satellite reconnaissance. Article XV, paragraph 2 of the SALT II Treaty explicitly forbids interference with the national technical means of the other party as long as the latter are operating "in a manner consistent with generally recognized principles of international law".[31] According to one US interpretation, the legitimacy of satellite photography can be extended to include all "passive sensors" deployed in space.[32] The active interference with such a passive sensor (that is, a receiving antenna) would represent a clear rejection of this interpretation by the Soviet Union.

Soviet encryption of telemetry was already going on at the time when the SALT II Treaty was being negotiated in the late 1970s, but the USA found it difficult to gain a bureaucratic consensus behind a demand for a complete ban on encryption as part of the Treaty.[33] The strongest advocate of a complete ban was the CIA, which over the years has invested vast sums of money and talent in a series of sophisticated satellite monitors such as the Rhyolite, Chalet and Aquacade programmes.[34] Soviet encryption practices make these assets highly vulnerable, and the CIA has a powerful interest in protecting them. At

the same time other US bureaucratic interests were less enthusiastic about banning telemetry encryption, suggesting that the USA might also want to use it on some occasions. Although one US negotiator has stated flatly that "the US does not encrypt telemetry",[35] another has suggested that "a lot of people in the US armed forces would substantially object to the loss of the ability to encrypt telemetry in certain areas".[36] Although these statements are not strictly contradictory, the latter one seems more plausible given the natural desire of the developers of new weapon systems to keep the capabilities and limitations of the systems secret as long as possible.

In the end the USA never did formally propose to the Soviet Union that telemetry encryption be totally banned, ostensibly because the US delegation believed that the Soviets would never accept such a proposal,[37] but also possibly because the US delegation could not itself reach a consensus on the demand. For most of the negotiations the Soviet side resisted any implication that the encryption of telemetry was less than proper or could actually impede verification. The final common understanding therefore represented a Soviet concession that there might possibly be ways in which encryption would impede verification,[38] but at the same time Soviet Defence Minister Ustinov made it clear that Soviet encryption practices in no way violated the understanding. He stated emphatically in 1979: "as far as telemetry goes, I don't think there is any sense in discussing this problem. The information essential to verification of the provisions of the Treaty will not be encrypted. Agreement in this has been reached".[39] This statement is difficult to reconcile with reports in the US press that Soviet encryption has on several occasions included 100 per cent of the telemetry data from tests of the allegedly illegal new ICBM, called the SS-X-25 by the USA.[40]

There are a number of possible motivations for the Soviet encryption activities. The most obvious, of course, is the desire to conceal as much information as possible from the USA on the capabilities of the various missiles being tested. It has been alleged by the USA that the Soviet Union is in fact developing two new ICBMs, the SS-X-24 and SS-X-25, in violation of the SALT II restriction to a single new type of ICBM. If the purpose of the Soviet Union is really to conceal a violation of the SALT II limits on new types of ICBM, one can hardly imagine a more clumsy and politically counterproductive means of accomplishing this goal than to try to cover it up by an even more blatant and obvious violation of the Treaty.

Because these "violations" are so blatant and easily recognized they cannot be called "cheating" in the usual sense of carrying out some clandestine activity in order to gain a surprise military advantage. Even without access to telemetry there are other ways for the USA to get information about the properties of the new missiles,[41] information which, although possibly not as complete or precise as that available from telemetry monitoring, is still useful in determining necessary countermeasures. Meanwhile the political con-

sequences are clearly negative, and the Soviet Union has every reason to expect that the USA will put the worst possible interpretation on these activities and use them to justify activities of its own which cut away at the boundaries of the Treaty.

Other possible explanations for the Soviet actions are that they are a response to what the Soviet Union perceives to be US violations, that they are a result of political conflicts within the Soviet hierarchy, or that they are designed to create an incentive for the USA to ratify the SALT II Treaty and to use the Standing Consultative Commission (SCC) to clarify the encryption limits. In fact, all of these motivations may be present simultaneously, and the only effective means of dealing with them is through negotiations. Even internal Soviet bureaucratic conflicts can probably only be resolved as part of the process of domestic consensus building that both sides must go through during US–Soviet negotiations.

One possible response of the USA to the Soviet challenge to the legitimacy of telemetry monitoring would have been to bring the problem to the Standing Consultative Commission for a confidential resolution. This has apparently been attempted, but not with much enthusiasm or success. One source of US reticence in using the SCC has been the reluctance of the Reagan Administration to recognize the legitimacy of a commission associated with the SALT process.[42] The few complaints which have been lodged have reportedly been reponded to by Soviet requests for a detailed description of the data the USA needs in order to verify the Treaty and what necessary data the USA believes are being encrypted. The US delegation has been understandably reluctant to respond to this request, since it would involve revealing highly sensitive US techniques for collecting and analysing telemetry data. The Soviet Union would also acquire a much clearer picture of the limitations of US monitoring capabilities and some insight into the degree of dependence of US intelligence agencies on telemetry data.[43]

The dispute over telemetry encryption has all the earmarks of an impasse which could persist for many years. There seem to be three possibilities for breaking through this impasse, but all three have some genuine difficulties. One possiblity is for the two sides to agree on a total encryption ban. This would certainly be the simplest and most reassuring kind of agreement, and there is a reasonable probability that the USA could get a bureaucratic consensus behind such a proposal. But such a total ban would represent a major change in position by the Soviet Union, a change similar to its acceptance of satellite photography 20 years ago. This historical precedent gives some hope that such a resolution could be achieved, but it is also reasonable to assume that before it acceded to such a ban the Soviet Union would want appropriate compensation in the form of US concessions of similar magnitude. Just what those might be is very difficult to imagine at this time.

A second possible resolution would be to eliminate from future arms control treaties provisions which require telemetry monitoring for their verification.

This would have the advantage of eliminating squabbles over encryption but would have the great disadvantage of preventing agreements limiting a wide range of qualitative improvements in weapon systems. The testing of missiles is essential to the great majority of nuclear weapon developments, and the access of each side to the other's test data is an excellent source of information with which to monitor compliance with limits on such developments. Only if all missile testing could be stopped entirely, or possibly limited drastically to some small number of tests per year, could telemetry monitoring be dispensed with entirely. Such an agreement would represent, in effect, the end of the arms race and would undoubtedly be the most desirable result. However, it does not appear to be a likely outcome of any negotiations in the foreseeable future.

The third way around the telemetry encryption impasse is for the USA to ratify the SALT II Treaty and for the US and Soviet representatives on the SCC to work out a mutually acceptable definition of the limits on encryption. This would be a difficult, sensitive and continuous task, requiring the detailed specification of what kinds of data are essential for verification and what it means to 'impede' verification. One can imagine a situation in which one side decides that a particular data channel is no longer useful for its own testing procedures and drops it from the telemetry programme, only to encounter a protest from the other side that that channel was important for verification. It would be wrong to assume that just because these problems are complicated they are insoluble, but at the same time the combination of technical ambiguities and bureaucratic sensitivities inherent in this issue makes a satisfactory negotiated compromise seem out of reach, at least until the political climate improves considerably.

Of the above possibilities the one which appears to offer the best combination of simplicity, significance and achievability is a complete ban on telemetry encryption. While this would certainly be a difficult decision for the Soviet Union to make, those Soviet leaders who supported it could point to a historical precedent as well as to the potentially substantial political gains to be made in other areas if US hostility on this issue can be neutralized. For its part, the USA could greatly improve the chances of such a resolution by ratifying the SALT II Treaty, returning the SCC to its past important status, and ceasing activities which threaten the SALT Treaties. Among the latter are the development of a space-based ballistic missile defence, planning for both the MX and Midgetman missiles (the analogues of the SS-X-24 and SS-X-25), and the prospective launching of the seventh Trident submarine which, if no other missile launchers are retired, will violate the SALT II launcher limits.[44]

The next section shows that technical violations of treaties can serve as a form of communication between the parties. The case of telemetry encryption seems to be a particularly clear instance of this kind of communication, and both sides will have to listen more carefully to the messages being sent by the other if any resolution is to be achieved.

III. Non-compliance

A typology of non-compliance

It is very difficult to identify and isolate a set of factors unique to the problem of non-compliance. The problem is in fact implicit in much of the discussion in chapter 3, especially in the analyses of adequacy and trust. On top of this there is the myriad of individual charges and countercharges of specific acts of non-compliance with arms control treaties which have been made in the past and are being made in the present with alarming frequency. While the vast majority of these come from the USA, the Soviet Union has occasionally responded with its own charges of US violations, and there have also been charges of violations of various treaties and conventions directed against other states.

An attempt to analyse all or even a significant fraction of these specific charges of non-compliance would require a book of its own and no such comprehensive review will be attempted here. It is more in keeping with the theoretical approach of this study to focus on some general principles.

It is first necessary to define what is meant by a 'violation' of a treaty or agreement. As might be expected, there is no single, unambiguous definition of this term; instead there is a spectrum of definitions which covers the wide range of actions that could be construed as non-compliance. One such spectrum is as follows:[45]

1. A deliberate violation aimed at increasing a state's military capability in ways which the agreement was intended to preclude. Example: The Iraqi use of chemical weapons in the war against Iran.[46]
2. An action inconsistent with the sense or spirit of the agreement and tending to undermine its viability even though it is not prohibited by the agreement. There can be borderline situations in which the activity strains the interpretation of particular provisions. Example: The Soviet Union has charged that continuing research and development by the USA on ballistic missile defence systems along with President Reagan's open commitment to a full-scale space-based defence imply intentions which if implemented would lead to undermining the ABM Treaty of 1972.[47]
3. Unintended violations, occurring, for example, through negligence of higher officials responsible for ensuring compliance by their subordinate organizations. Example: The discovery in 1975 that some samples of biological toxins were hidden by CIA researchers in contradiction to the explicit order by President Nixon that all such toxins be destroyed to bring the USA into compliance with the Biological Weapons Convention of 1972.[48]
4. Actions not banned by an agreement but which complicate verification of the agreement. Example: US charges of Soviet encryption of missile test telemetry may fall into this category, or if 100 per cent encryption and jamming are taking place this would be an example of category 2.

5. Ambiguous activities resulting from differing interpretations of the provisions of the agreement. Example: Soviet deployment of the SS-19 ICBM in spite of the unilateral US interpretation of this missile as a 'heavy missile' prohibited by the SALT I Interim Agreement.[49]

6. Activities assessed as ambiguous due to inadequate information or misinterpretation of information which suggest a violation where in fact none exists. Example: Although it is never possible to state categorically that no violation in fact exists, a good candidate for an example of this last type of 'violation' is the accusations by both the USA and USSR of violations by the other of the Threshold Test Ban Treaty.[50] Another strong candidate for this group is US charges of the use of 'yellow rain' by the Soviet Union or its allies in Indo-China and Afghanistan.[51]

This spectrum shows that 'violations' come in many shapes and sizes. Some of these are intentional and can have as their purpose anything from the conscious attempt to gain a military advantage to the desire to underline a unilateral interpretation of an ambiguous treaty provision or to test the intelligence capabilities of the other side. Other violations are unintentional or 'technical', resulting from misunderstandings, failures of execution or insubordination. Still others cannot be called violations in any meaningful sense since they result from poorly drafted treaty provisions or the inability of the monitoring side to perceive accurately what is going on.

The most important of the intentional violations is, of course, the first one on the list: the attempt to gain a military edge or 'break-out' by clandestine violation of the treaty. In order to be effective such violations must be of substantial military significance and must be kept secret until the time when the new capability is to be employed.

The other forms of intentional activity, the attempt to exploit loopholes or assert unilateral interpretations, are not violations in the literal sense of the word and are in fact a form of military-political communication. Presumably these activities are perceived as having military value or they would not be undertaken, and while they may be hidden or disguised to protect military secrets, they do not have to be clandestine in the same sense as purposeful violations intended to gain a surprise advantage. In fact, the nature of the US–Soviet arms race is such that attempts to gain a perceptual edge by exploiting weak treaty provisions (many of which were put into the treaty precisely to allow for such flexibility) are more effective if the adversary is aware of their existence.

One example of this kind of communication, Soviet encryption of telemetry, has already been discussed in the previous section. Another important example can be found in the ways the USA and USSR carry out nuclear weapon tests. The excellent capabilities of each side to monitor the underground explosions of the other opens up the possibility for a kind of political communication. A number of US and Soviet tests have been timed for maximum political

impact on the other side, and the Reagan Administration has increased the testing rate in spite of the development of a number of techniques for acquiring information about weapon effects without testing. Presumably this is being done because: "There's nothing that wakes up the Soviets more than a blip on a seismograph".[52]

Break-out scenarios

So far in the history of US–Soviet arms control there have been no discovered violations of the first type described above. This is hardly surprising given the great technical and political obstacles standing in the way of such violations. The high weapon levels on both sides of the arms race imply that to gain significant military advantage a violation would have to be very large and therefore very difficult to hide. It would have to be carried out over many years and involve many people from many professions and backgrounds. It is almost inconceivable that such a massive effort could be carried on clandestinely in the face of the extensive intelligence surveillance to which both major powers are subjected.

It is very difficult to pose a convincing scenario for such a massive violation. One attempt (such scenarios are a uniquely American cultural phenomenon) postulates that the Soviet Union hides 500 MIRVed ICBMs in nondescript buildings widely spread out over the country. These buildings are made to look like thousands of so-called 'light manufacturing' structures routinely catalogued as innocuous by US photo-interpreters.[53] The secret missiles would then be used in a surprise attack against the United States land-based ICBM force, which would leave the USA in a deeply inferior position with respect to the Soviet Union, and therefore effectively inhibited from carrying out a retaliatory strike.[54]

This scenario is a variation of a theme which has haunted US strategic planners for many years: the presumed vulnerability of the land-based ICBM force and the impact of this vulnerability on the credibility of the US 'deterrent'. The above scenario differs from others of its type only in its use of a secret cache of missiles to carry out the surprise attack. Others have postulated the same sort of attack or threat with known Soviet ICBM forces.[55]

How technically and politically feasible is this scenario? How likely is it that 500 MIRVed ICBMs (objects with lengths of 25–30 metres and diameters of 2–3 metres) could be assembled in secret in widely dispersed sheds? (Transporting them assembled from a central factory is clearly too risky.) How likely is it that the warheads, the command-control system, and the multitude of personnel could be assembled, distributed and controlled all in secret? And even if the secrecy succeeds and the moment arrives to carry out the surprise attack, what will be the political objective of such an attack and how confident will the attackers be that their intimidation will work and that the remaining US retaliatory force will not be used?

If this scenario is looked at from the point of view of the political and military leaders who must bear the responsibility for the enormous risks involved at every step, it makes no sense whatsoever. At every stage there is an unknown probability that the secret will be exposed, and at the final stage there is an incalculable probability that the result will be a total disaster. There is not a shred of evidence to suggest that the Soviet Union or any other state would take such risks. Yet this scenario and its many variations are the backbone of the 'ICBM vulnerability' problem in US political discourse and constitute the most probable massive cheating scenarios. All others are even less plausible.

The invocation of weird and irrational evasion scenarios is not confined to a handful of zealots; it is a common currency in the debate over verification in the USA. One US official, in explaining why a ban on anti-satellite weapons could not be verified, suggested that "for all we know there are antisatellite weapons up there now. We can't rule it out".[56] The vast apparatus possessed by the USA for monitoring and tracking not only every Soviet rocket launch, but every piece of junk still in Earth orbit from satellites launched more than 20 years ago, is not mentioned by this official.

Another US official has argued that the proposed use of control posts to monitor movements of troops into and out of the Mutual Force Reduction (MFR) zone in Central Europe is a 'farce' because the Soviet Union could evade them by flying in troops dressed in civilian clothes in Aeroflot airliners.[57] Just how many tens of thousands of such phony tourists would be needed to upset the military balance in Central Europe was not specified by the official.

Many more examples could be given of this genre, but these will suffice to show how empty and detached from technical and political reality these scenarios are. Despite such inept attempts to discredit it, the proposition still appears to hold true that the greater the military significance of a possible violation the less the likelihood that it could be kept a secret. This relationship has at least the virtue of plausibility, and until reasonably plausible counter-examples are suggested it must stand as a useful working hypothesis in designing verification systems.

The politics of accusation

Most of the accusations of Soviet cheating which have flooded the US mass media in the past few years have not involved massive clandestine 'break-out' scenarios. Indeed, if the Soviet Union has been trying to cheat secretly these past 10 years it has done an exceptionally poor job. Veritable catalogues of alleged Soviet violations can be found in US Congressional sources,[58] and new reports of US intelligence discoveries of Soviet cheating are leaked almost daily to receptive US newspapers and journals.

If it is assumed for a moment that even a fraction of these allegations repre-

sent real Soviet violations of existing treaties, the serious question arises as to why the Soviet leadership would act in such a way. What would it hope to gain by blatantly and systematically violating treaties it has signed with the United States and many other states? The answer according to the accusers can be summarized as follows:

> Under present and foreseeable circumstances, the last thing the U.S. government would want to be confronted with is evidence of a major Soviet violation of SALT. The Soviets have been all too aware of this aversion and they have exploited it with a strategy of selective SALT violations that create just enough ambiguity to give the U.S. Administration some leeway in rationalizing Soviet actions....
>
> Optimistic assessments of U.S. verification under SALT II are based in large part on the presumption that the Soviets will be deterred from violations by an acute fear of detection and its consequences. Quite the contrary can be assumed: namely, that the Soviets know full well what they have gotten away with under SALT I and that they will act accordingly under SALT II.[59]

Just what it was that the Soviet Union has "gotten away with" in SALT I has been graphically described by another critic of SALT and its verifiability: "under SALT I the United States has traded away its ABM in return for a tripling or quadrupling of the Soviet strategic threat against it, all the while tolerating Soviet negotiating deception and massive operational concealments and ruses in Soviet strategic deployments".[60] In short, according to this view the Soviet Union does not have to go to elaborate lengths to hide its cheating. A compliant, fearful and even complicit US government will look the other way and try to cover up the evidence anyway.

This is not the first time in US history that political debate over arms control has sunk to such a primitive level. Nor is it necessary to point out that the Soviet Union has suffered its own spasms of irrational fears, bizarre suspicions and bitter rhetoric. At such times it is easy for verification to serve as a fig leaf to cover much deeper attitudes of hostility and suspicion, but it is crystal clear that the arguments themselves have virtually nothing to do with verification. They are premised on the assumption that the threat of detection of violations is no deterrent in any event. The real target of these attacks is arms control itself, and attempts to counter arguments like these with assertions about the capabilities of monitoring instruments and data analysis are doomed to futility. In an atmosphere in which these positions have achieved prominence and widespread influence, a balanced discussion of the capabilities and limitations of verification is very much whistling into the wind.

Nevertheless one can hope that the debate will someday return to reality, and then there will still be the question of how to deal with all the other kinds of 'violation' in the above list, that is, those which are not purposeful and blatant, but which are ambiguous, inadvertent or the result of errors in monitoring and interpretation. In such cases the nature and handling of the evidence

are extremely important in determining the response, and the response itself should be carefully tailored to the magnitude and significance of the violation. For example, if there is any reason to suspect that an apparent violation is the result of inadvertent or unauthorized behaviour on the part of subordinate officials, it would be a serious error to make public accusations of violation. No state enjoys admitting to incompetence or insubordination, and public accusations by foreigners will generally produce a closing of ranks behind the perpetrators rather then a quiet and speedy correction of the problem.

The evaluation process

There is no more critical point in the entire process of verification than the boundary at which the technology of detection encounters the politics of evaluation and response. However precise and comprehensive the monitoring techniques, there is no escaping the need to evaluate all evidence within some political context which must include as coherent and accurate as possible a model of the "behavioural style and approach to calculating political action" of the state being monitored.[61] But while such a model is indispensible, it is also dangerous, because it inevitably biases the receptivity of those who subscribe to it in favour of evidence which reinforces the model and against evidence which contradicts it.[62] This problem has already been pointed out in chapter 3 in connection with the problem of adequacy in verification, but some further elaboration on it is essential for an understanding of the nature and effects of treaty violations.

It has been a basic assumption of arms control advocates that violations of treaties would be strongly inhibited by the potential political consequences of detection and exposure. According to one US advocate of SALT II: "Evidence of non-compliance is a strong signal. Without an agreement, there can be neither cheating nor the indicator of a barrier crossing that results if cheating is detected. Verification has at least this modest importance".[63] There are two criticisms which can be made of this assertion. First it should be noted that while 'signal' is given an adjective (strong), 'evidence' is given no adjective. Does the statement suggest that weak evidence is also a strong signal? What, in fact, constitutes evidence? Such questions are often begged in discussions of verification, yet the quality of the evidence supporting charges of non-compliance is critical to the credibility of any arms control treaty. And disputes over the quality of the evidence are certain to arise. For example, one highly placed US official, when asked about the allegations by the Reagan Administration of Soviet violations of various treaties, replied: "It's not alleged cheating; it's cheating—period. We have hard evidence of a number of major violations".[64] But a careful analysis of the charges, by the Federation of American Scientists, states: "Given the ambiguity of some of the treaty provisions as well as the inconclusive nature of U.S. evidence, few, if any, of the alleged violations can be proven".[65]

A second criticism derives from the psychological insight that "it is incorrect to think that a signal will be detected simply because it is strong relative to the background noise. The rewards which a person gets if he detects the stimulus, and the cost he must pay if he fails or gives a false report, are as important as the signal's strength in determining whether the person will perceive the stumulus".[66] Notice that the signals could as well be signals of compliance as opposed to non-compliance. The problem of detection against a background of entrenched ideological and institutional biases is no different in the two cases.

Institutional biases can act in different ways at different levels of an intelligence bureaucracy.[67] At the lower levels, close to the stream of monitoring data, there is a high premium on thoroughness and a severe penalty for failure to report a signal. This creates a high noise level as many false signals are passed up to intermediate levels. At these intermediate levels there is a high cost attached to annoying the actual decision makers by passing on false or unsubstantiated reports. Therefore the middle levels act as a 'filter', typically passing on evidence that reinforces existing biases and rejecting that which does not. This filter can act as it did in the USA during the 1970s to screen out ambiguities and reinforce the institutional belief that the Soviet Union was in essential compliance with SALT and other agreements. Or it can act as it has under the Reagan Administration to place negative interpretations on such ambiguities and generate a picture of widespread and systematic non-compliance. This example supports the hypothesis that "the entire communications system is biased by the ideas and plans of the top decision makers".[68]

This biasing is made easier by the fact that the filtering at intermediate levels is done by people who generally have neither the close familiarity with the capabilities and limitations of the monitoring process possessed by those at lower levels, nor the larger world view and policy-making responsibility of those at higher levels. It is little wonder that such a filtering process can often lead to poor intelligence and unpleasant surprises, yet it must also be accepted that such imperfect mechanisms are probably inevitable in any organization as large and complex as a national intelligence apparatus.[69]

Neither of the obvious remedies of moving the filter higher up or lower down is necessarily any better than leaving it where it is. When Henry Kissinger was National Security Advisor to President Nixon an attempt was made to move the filter all the way to the top, and while this solved some problems in the negotiation of the SALT I Treaty it created others (see chapter 3, pp. 155–56). To move the filter downwards would be to place the burden of evaluation of evidence on the professional intelligence analysts themselves, a demand which also raises serious problems of professional competence and responsibility (see chapter 3, pp. 154–55).

A number of analysts have suggested that the problem of bias could be reduced by including within the intelligence bureaucracy groups whose task it is to play the 'devil's advocate', that is, to challenge the prevailing assumptions

and policies and to call attention to evidence which contradicts them.[70] These proposals differ in significant details. For example, one suggests that the devil's advocate group should have nothing to do with particular treaties and that "It should not start with intellectual baggage or emotional investments that need protection".[71] Its purpose would be to devise strategies that an adversary might use to successfully evade detection by US monitoring processes of strategically significant violations.

There are some similarities between this suggestion and the actual employment of 'Team-B' during the Ford Administration to challenge the prevailing CIA assessment of Soviet military capabilities and intentions (see chapter 3, p. 132). The major similarity is the fact that the challenging group was made up entirely of people from outside the CIA who had no organizational interests to protect. But that this group carried no "intellectual baggage or emotional investments" cannot be seriously argued.[72] In fact, the exercise was seen to have clear political motivations, a long way from the objective and dispassionate attitude demanded by the author of the suggestion.

An alternative is to construct the group using people within the agency and to provide them with institutional protection and support for their adversary role.[73] One specific suggestion would have the IAEA safeguards agency explore scenarios for diversion of sensitive nuclear materials in which a state would attempt to hide the diversion by making it difficult for the IAEA to apply safeguards effectively. Current IAEA scenarios consider the problem of diversion only under the assumption that safeguards are operating effectively.[74]

These are important suggestions, and the creation of such internal mechanisms for challenging entrenched assumptions could have very beneficial effects on the alertness and quality of analysis of intelligence agencies. Still, there are real problems with such suggestions, the major one being the great difficulty in preventing political and ideological pressure from corrupting the adversary system. There are real risks that internal pressures will circumscribe the freedom of the challengers to make their challenge effectively, or that frustrated challengers will become 'whistle blowers' and take their challenge outside the agency into the political arena. In either case the process will be damaged. Despite these risks the potential benefits seem great enough to make such an experiment worthwhile as long as it is kept in mind that the essential ambiguity of the verification process can never be fully removed.

This ambiguity is best understood by picturing an arms control treaty as a central "core" of clearly prohibited behaviour, represented by item number 1 on the above list, surrounded by a "penumbra of doubtful conduct",[75] which, in effect, encompasses all the other items on the list. This grey area at the edges of violations is where the vast majority of possible disputes will arise, and the behaviour of states in this area will be closely tied to their overall attitudes towards arms control and each other. A national leadership strongly committed to a particular treaty will be inhibited from engaging in activities inside this

penumbra for fear of creating suspicion or concern on the other side. At the same time it is likely to give the benefit of the doubt to activities in this doubtful area by the other side. These biases are a natural result of the desire to preserve a treaty in which the leadership has had to invest much effort and take many political risks to gain the domestic consensus necessary to ratify it.

However, inhibitions against activities in the penumbra are not consistent with the legalistic premise that everything not prohibited by an arms control agreement is allowed. Such a premise is actually implicit in the concept of arms control (as opposed to disarmament), which recognizes that the control of certain weapons and activities is taking place in the context of continuing competition in other areas that are often closely related. For example, the restriction on anti-ballistic missile systems has coexisted for over 10 years with an absence of prohibitions against anti-satellite weapons. But much of the technology is very similar, so that a large Soviet radar which looks to US analysts like a prohibited ABM radar, and may very well be able to serve that function, can be explained by the Soviet Union as a space-tracking radar, possibly designed for battle management functions in its anti-satellite programme.[76]

The attempt to regulate activities in the penumbra must run up against this difficulty. The Soviet Union has often been characterized as having a "strict constructionist"[77] approach to arms control treaties (or for that matter all treaties), in which any behaviour not specifically forbidden is permitted. Restraints on activities in the penumbra would then be seen by the Soviet Union as a form of unilateral restraint, something which is always difficult for a leadership to achieve in the face of bureaucratic opposition. But the Soviet Union is not alone in this interpretation. The United States sees arms control treaties as contracts, and it is a basic principle of US contract law that: "The very meaning of a line in the law is that anyone may get as close to the line as he can if he keeps on the right side".[78] Therefore the same problem with charges of unilateral restraint can be expected to arise in the USA, and has in fact arisen[79] in connection with a number of arms control agreements.

It is no answer to this problem to design monitoring equipment and procedures which are sensitive only to activities in the core area and somehow capable of filtering out or ignoring activities in the penumbra. This is highly unrealistic because intelligence data generally only make sense when interpreted against the full context of the activities of another state.[80] No responsible decision maker could willingly ignore the possibility of acquiring as much information as possible about the activities of a potential adversary, even if it were feasible (and it most certainly is not) to make clear dividing lines between activities which are strictly prohibited by treaties and those which are merely dubious, not to mention the problem of distinguishing information relevant to militarily important activities from information on unimportant activities.

Political versus military significance

Since ambiguities, errors, false alarms, suspicious activities, and misunderstandings are inevitable companions of arms control treaties, the only practical question one can ask is how they should be responded to when they occur. Here again the answer depends on one's basic evaluation of the arms control process. If it is considered important and worth protecting, then extreme caution is indicated in responding to apparent incidents of non-compliance. If, instead, one is unimpressed by the value of ongoing arms control negotiations and agreements and convinced of the insincerity and malign intentions of the other side, then some domestic political capital can be made by making accusations of violations.

There is no point in attempting to have it both ways. It has been pointed out quite correctly that: "Governments cannot logically carry on negotiations with a nation it [*sic*] has just accused of violating existing agreements on the very same issue".[81] The logic of the situation demands that issues of non-compliance be settled before productive negotiations can be resumed. But public accusations are certainly the least promising avenue for satisfactory resolution of compliance problems, especially when the latter involve, as they invariably do, complex, ambiguous and secret evidence. It does not require a sophisticated political awareness to understand that the making of such charges will erect major obstacles in the path of further negotiations as well as undermine the credibility of existing treaties.

In spite of this obvious difficulty, the Reagan Administration contrived to submit to the Senate its public accusations of Soviet violations during the very same week that President Reagan called for renewed negotiations in a conciliatory speech addressed to both US and European audiences on the opening day of the Stockholm Conference on Confidence- and Security-Building Measures and Disarmament in Europe.[82] For most of 1984 the conflict between the two approaches seemed to be resolved in favour of downplaying the charges of violations as pleas for reopening negotiations have intensified. A later, more comprehensive report on Soviet compliance practices prepared by the President's General Advisory Committee (GAC) on Arms Control and Disarmament was released with the disclaimer that: "Neither the methodology of analysis nor the conclusions reached in this report have been formally reviewed or approved by any agencies of the US Government".[83]

Such a disclaimer could be interpreted as an attempt by the Reagan Administration to distance itself from the extremely negative conclusions the report made about Soviet compliance practices. An official report to the Congress was delayed for several months, but when it was finally submitted in February 1985 it recapitulated all of the charges contained in the original report and the GAC report.[84]

Both the charges themselves and the inconsistent and confusing behaviour of the Reagan Administration towards them have done considerable damage

to the credibility of the arms control process and it is not at all clear that the damage can be easily repaired, either in relation to the Soviet Union or to US and West European public opinion.

There are, of course, many alternatives to public denunciations. One process of resolving ambiguities and minor infractions of treaty provisions has been developed by the IAEA in its nuclear safeguards programme. The Agency maintains a high level of secrecy with respect to safeguarding of nuclear facilities in many states. Although instances of discrepancy and ambiguous evidence arise often,

> It would be counterproductive to point a finger at a particular government for a relatively minor safeguards transgression or in regard to a minor anomaly that has not yet been resolved. The cooperation of governments is essential to the operation and it should not be lightly jeopardized. The charge of non-cooperation should only be made when the government's performance seriously impairs the ability of the IAEA to verify that no diversion is taking place. Moreover, there are so many minor transgressions and anomalies that naming names in public would soon lose any positive effect![85]

Another confidential mechanism for resolving ambiguities and minor infractions is the Standing Consultative Commission created by the USA and the USSR as an integral component of the SALT process (see section IV). This Commission seemed to work quite effectively during the 1970s and even survived some breaches of confidentiality deemed necessary by the Carter Administration to promote ratification of the SALT II Treaty. But the Reagan Administration has made much less use of the SCC, choosing instead to make its accusations public[86] because, according to one Administration official, the violations are "serious issues" and appear to have been premeditated many years in advance.[87]

In both the nuclear safeguards and SCC instances the crucial criterion seems to be the seriousness of the violation. While 'minor' ambiguities and infractions may be handled confidentially, it would appear that 'serious' issues may require public exposure either to force the violator to reform or to brand him as a conscious violator of an agreement. It is in fact the threat of such exposure and the resulting condemnation of world public opinion which are supposed to provide one of the major deterrents to violation of arms control treaties. If the deterrent is to be credible, it is argued, then there can be no alternative to carrying out the threat of exposure when it is warranted by a serious premeditated violation.

Again the inevitable question arises—how serious? Is it possible to specify the criteria which determine the seriousness of a violation and a threshold beyond which public exposure and other forms of retaliation are called for? One interesting attempt to define an appropriate criterion has been made in the context of the highly artificial model referred to in chapter 3 (see chapter 3,

p. 163). The model involves the rotation of some number of ICBMs among some much larger number of silos and includes provisions for the monitoring state to see sample populations of open silos in order to determine on a statistical basis whether a violation of the missile limit has occurred. The author of the model divides possible violations into 'politically significant' and 'militarily significant' categories, defined as follows: "Politically, the deployment of one 'extra' ICBM would be significant, raising doubts about purposes, intentions, trust, etc. Militarily, the significance of cheating would closely depend on aggregate strategic force sizes and perceptions of the existing strategic balance".[88] The purpose of these definitions was to provide a clear definition of 'adequacy' based on a military criterion and to determine the parameters of a monitoring system which would be able to detect militarily significant violations. The simplicity of the model ensures that when the monitoring system is designed in this way, the system is by definition incapable of detecting violations which are politically significant but militarily insignificant. Of course, this renders moot the supposed political significance of such minor violations.

Unfortunately the world is not as simple as this model and it is not possible in real cases to design monitoring systems which automatically filter out politically troublesome but militarily innocuous information. That filtering process must be done by fallible and biased human beings working in political environments which are strongly affected by all sorts of influences beyond the particular compliance problem under consideration. Under such conditions, according to one analyst:

> Verification and compliance arrangements should not only protect U.S. security; they should also instill confidence in the American public that its interests are being protected and that the agreements are functioning fairly and effectively. And public confidence will often depend less on esoteric assessments of whether possible violations are militarily significant than on simple perceptions of whether the Soviets are cheating, regardless of the military significance.[89]

These are heavy demands to place on verification and compliance 'arrangements' if the latter word refers only to the processes of monitoring and analysis this book has discussed so far. It has been amply demonstrated that modern verification systems will regularly turn up many 'possible violations', and recent experience has shown how easy it is for a change in political leadership to switch public attention away from 'esoteric assessments' of military significance to 'simple perceptions' of widespread cheating. What the author of the statement leaves out is the predominant role of the political leadership of any state in defining the psychological and political climate in which the significance of possible violations is evaluated. Such leadership can in no sense be abdicated to some set of technical and administrative

'arrangements': it is in fact the one irreducible ingredient of any compliance mechanism. Whether or not a militarily insignificant 'violation' or ambiguity will be seen as politically significant is very much a matter of political choice. This is not an absolute statement; events can move beyond the control of political leaders. But the contrast in behaviour in regard to ambiguous evidence between the Reagan Administration and those that preceded it illustrates very clearly the wide latitude available to political leaders for influencing public attitudes towards treaty compliance.

This argument strongly suggests that no stable criteria can exist for defining politically significant violations. Any definition of a violation which is going to be strong enough to survive the inevitable swings in political attitudes must be based on more objective criteria, and the only others available are military criteria. Along with this must come a strong recognition of the essential difference between a 'violation' and a 'possible violation'. The frequency of the latter can be expected to far exceed the frequency of the former, and unless the compliance process includes powerful and essentially apolitical means for distinguishing one from the other it can never maintain its credibility over time. Simply put, the concept of innocent until proven guilty must be an integral part of the process, this concept in turn deriving from the element of trust shown to be necessary in the previous chapter.

If military criteria are to be adopted for assessing the significance of violations then there must be a workable political consensus, both domestic and international, on perceptions of the existing strategic balance and on the relative importance of deviations from this balance. In effect, the requirement is for a consensus on military doctrine, precisely the consensus which does not now exist, either between the USA and USSR or within the USA itself. This consensus can only be achieved through informed debate and compromise, but the debate must be about weapons, strategies and goals, not about verification. Far too often verification has served as a surrogate for the more fundamental debate over doctrine, a classic case of setting the cart before the horse.

If a military criterion could be established and if the word 'violation' were in fact used only in cases where violation had been proven beyond reasonable doubt, there would still remain the somewhat arbitrary division into significant and insignificant violations. This separation could be combined with the earlier separation into intentional and unintentional (i.e., either unauthorized or accidental) violations to produce a classification scheme like that of table 8.

The category of significant, intentional violations would contain all efforts to achieve a genuine military advantage by clandestine violations of a treaty. Such violations would call for the most serious response, up to and including abrogation of the treaty and even pre-emptive attack if the violation were sufficiently threatening.

The category of intentional but militarily insignificant violations is one for which a number of examples have already been seen. Such violations can be

Table 8. Classification of violations according to military significance and degree of intent

	Violation	
	Intentional	Unintentional (accidental, unauthorized)
Militarily significant	Clandestine acquisition of clear military advantage ('break-out')	Highly unlikely to be unintentional
	Response: Major diplomatic or military initiative	Response: SCC or direct contact of political leaders
Militarily insignificant	Probe of intelligence capabilities or political resolve ('communication')	Great majority of cases; no threat
	Response: Uncertain, depends on situation	Response: SCC

used as a form of political communication to probe the intelligence capabilities or political resolve of other parties. The party that uncovers such a 'message' can choose to ignore it, presumably to protect intelligence assets, or to respond firmly but confidentially in a forum like the SCC. Or the charges and evidence can be made public, inevitably leading to an even further worsening of the political atmosphere. Any state considering such a probe must take into account the possibly serious political repercussions it could produce. In an already ugly political atmosphere such game playing may seem to carry little cost. However, one suspects that the inhibitions against such behaviour would rise rapidly as the political atmosphere began to improve. This is closely related to the mechanism of trust building described in chapter 3. Given a real commitment by all sides to a building of such trust, the political risks involved in making intentional insignificant violations would come to seem very high, and the tactic would make no sense.

It is virtually impossible to think of an entry for the upper right-hand corner of the table. One can certainly not imagine a militarily significant violation occurring by accident, and it seems highly dubious that such a thing could be carried out by unauthorized persons somehow managing to evade the intelligence agencies of all parties to the treaty, including their own. Of course, this problem could become somewhat more serious at very low levels of armaments, depending on the precise criteria for military significance that were applied. This, however, is a problem that optimists might look forward to dealing with sometime in the future.

Finally, the lower right-hand corner will contain the vast majority of violations, those which are technical, accidental or unauthorized as well as non-threatening, and which can be dealt with easily and confidentially in a consultative body.

The neatness and clarity of this scheme should not be overrated. It depends for its success on clear criteria for military significance and the willingness to

presume innocence until guilt is proven. Neither of these preconditions will be easy to achieve, but to place the burden on them has at least the virtue of removing an impossibly heavy burden from the compliance process.

The essential conclusion of this analysis of the many forms of non-compliance is that the single most important determining factor in the significance of a violation is the political atmosphere in which it occurs. This is perhaps most vividly illustrated by an arms control agreement which has survived more than 165 years in spite of repeated violations by both sides, many of which were judged militarily significant by the standards of their time. The agreement is the Rush–Bagot Treaty whose purpose was to demilitarize the Great Lakes separating the USA and Canada, the latter being at the time still a British colony and very much the object of US expansionist ambitions.[90]

The Rush–Bagot Treaty limits each state to "one vessel, not exceeding 100 tons burden, and armed with one 18 pound (8.2 kg) cannon"[91] on each lake. Since its entry into force in 1818 it has been violated by both the US and Canadian governments, even to the point of a rumoured US proposal in the early 1960s to deploy nuclear-armed intercontinental missiles on the Great Lakes. According to the author of the study,

> Even the most seasoned manipulators of the *clausula rebus sic stantibus* might blush while pronouncing the presence of scores of weapons, each of the destructive equivalent of 50 million tons of TNT, to be consistent with the spirit of an Agreement forbidding the presence of anything in excess of the normal amount of ammunition for four 18 pound cannon. But that is not to say they could not have done it.[92]

There are no violations of the SALT or other US–Soviet treaties that are anywhere near as blatant or obvious as those that have threatened the Rush–Bagot Treaty over more than 150 years. Yet relations between the USA and the USSR remain hostile and unproductive while those between the USA and Canada are cordial and mutually beneficial. This should leave little doubt as to the controlling variable in the process. The recognition of mutual interest and the shared commitment to achieving relaxation of tension are far more critical to the success of arms control than the absence of treaty violations. It is far too easy to forget this basic truth in the face of the obsessive concern for verifiability which exists today.

IV. Co-operative measures

Far too often in discussions of verification the term "co-operative measures" serves as little more than a "euphemism for on-site inspection".[93] However, it is shown in chapter 1 that there are many more ways for states to co-operate in reassuring each other of their compliance with arms control agreements,

and it is important that these other methods get the attention they deserve. Therefore this section focuses on those co-operative measures which do not require the presence of foreign inspectors on the territory of a state, and the special case of on-site inspection is treated separately in the next section.

Measures involving direct communication

There are a number of ways in which states can communicate with each other to reduce suspicions and monitor compliance with agreements. These range from the need for rapid, unobstructed contact in times of serious crisis to the need for a continuous diplomatic and technical dialogue to anticipate and resolve problems which arise in the arms control process.

At the crisis end of the spectrum is the concept of the 'hot line', a direct telecommunications link between the highest political officials in the USA and the USSR. The need for such a device was clearly demonstrated by the difficulties in communication between Moscow and Washington during the Cuban missile crisis of October 1962, and by June 1963 a working hot line between the two capitals was in operation.[94] This link has been upgraded twice since that time, once in 1971 when satellites were added to telephone cables as the transmitting devices,[95] and in July 1984 when a facsimile transmission capability was added. The current system is capable of transmitting teletype text at a rate of 67 words per minute as well as pages of text, maps or charts in facsimile form.[96] It should be emphasized that the communication link uses teletype machines and printed text or graphics, not telephone conversations as is often suggested in popular or fictional accounts. There have been recent suggestions by a number of US Senators to further improve the hot-line system by creating 'risk-reduction' or 'crisis' centres which would permit instantaneous voice communication between US and Soviet political and military leaders.[97]

There can be no question that the hot line is an important innovation and that even more opportunities for effective communication in times of crisis would be desirable. However, the primary value of such arrangements is their ability to reduce tension, suspicion and misunderstanding in dangerous crises, not their contribution to the day-to-day task of monitoring compliance with arms control treaties. For example, it does not make sense to think of the hot line as a means by which a US president and a Soviet general secretary might resolve a problem of compliance such as an ambiguous radar under construction or a series of suspicious seismic events. Since these kinds of problem often involve sensitive and complex intelligence information and the skills and interests of a number of military, diplomatic and intelligence agencies, they can only be resolved by a mechanism which takes into account such bureaucratic interconnections and operates on a longer time-scale and on a more formal diplomatic level. Any attempt by the leadership of the two states to resolve such issues by informal exchanges might produce some short-term benefits,

but would soon encounter powerful bureaucratic opposition, and could lead to serious or embarrassing errors. While such an assumption of discretionary power by the top leadership is acceptable in a crisis, it is not a characteristic operating procedure in a modern bureaucratic state.

Exchange of data

Proposals for the international exchange of information are one of the most common types of verification mechanism suggested for a wide variety of arms control measures.[98] The actual form of the information exchange could be an open public declaration of existing stocks of weapons or materials, confidential submissions to an agency empowered to monitor a treaty, or direct exchange between states But all such proposals have in common the assumption that each state will assemble the necessary data unilaterally, submitting it voluntarily to whatever agency or other states are specified in the treaty.

A number of existing treaties incorporate various forms of information exchange. The SALT Treaties require each side within the context of the Standing Consultative Commission to "provide on a voluntary basis such information as either Party considers necessary to assure confidence in compliance with the obligations assumed".[99] During the negotiations for SALT II the United States insisted on, and eventually succeeded in achieving, a so-called "agreed data base".[100] The Soviet Union agreed to provide its own numerical data on those weapons covered by the Treaty, a concession both sides considered to be of historic significance (see chapter 3, p. 123).

Far more elaborate provisions for information exchange are included in the US–Soviet Peaceful Nuclear Explosions Treaty (PNET). In addition to the usual specification of national technical means of verification, this Treaty requires each of the parties to "provide to the other Party information and access to sites of explosions and furnish assistance in accordance with the provisions set forth in the Protocol to this Treaty".[101] The information specified in the Protocol is quite extensive, amounting to an essentially full disclosure of the purpose, location, yield and geological environment of the explosion.[102] The Threshold Test Ban Treaty (TTBT) also contains provisions for significant information exchange, including detailed data on two nuclear weapon tests at each distinct test site for the purpose of calibrating the seismological detectors of the other side.[103]

These provisions represent significant advances over previous treaties and point to one clear advantage of information exchange mechanisms: they are considerably more acceptable politically than such intrusive measures as on-site inspection. Their acceptance by both sides (assuming that the United States finally ratifies the treaties) would indicate that both sides accept the premise that voluntary provision by a state of information on its military capabilities provides a significant degree of reassurance that the state is complying with its commitments.

There are two major factors which act to inhibit states from supplying false information in violation of a treaty. First, the state itself needs accurate information on its own military capabilities, so if it is to supply false information to others it must in effect keep two sets of accounts. If this is to be done for a militarily significant violation then it will almost certainly require the active involvement of a substantial number of people in various agencies. The risk of exposure of the fraud would therefore be strongly correlated with its military importance. Second, it must be assumed that other states will continue to use their own intelligence apparatus to get an independent check on the data provided. To submit false data would be to risk exposing a discrepancy with data gathered by others.

These advantages are important, and they constitute a strong argument for including mechanisms for information exchange in future arms control treaties. But some reservations are in order, mostly in connection with inescapable problems of ambiguity which plague virtually all compliance mechanisms.

One source of ambiguity lies in the definitions of items to be counted or characteristics to be measured. Unless there is an agreement on precise definitions, even honest reporting by one side can be subject to challenge by the other. The importance of clear and mutually acceptable definitions makes them worth some struggle to achieve, but the process can be carried to counterproductive extremes. A good example of the latter is the exchange of troop data in the MFR talks in Vienna. NATO and the Warsaw Treaty Organization long ago began to exchange data on troop deployments, but after much argument the USA and USSR have still not been able to agree on what constitutes deployed military forces.[104] While it would be wrong to attribute the lack of progress in the negotiations to this argument alone, it is still true that such a dispute over definitions can provide a very convenient excuse for stalling the process.

A second problem is the inevitability of errors, either by the state doing the reporting or by the intelligence apparatus of the other side. Such errors would show up as disagreements in the data of the two sides, and it could be very difficult to find a way to reconcile the discrepancy. In order to confront the reporting state with the discrepancy the other state would have to reveal the extent of its knowledge of the reporting state's capability and could thereby compromise valuable intelligence assets. But in the absence of such a confrontation the error might go uncorrected and suspicions persist that the false report was intentional, either as an attempt at concealment or as an attempt to probe the other side's intelligence capabilities.

Neither of these difficulties is insurmountable, but they imply that information exchange can never by itself provide an adequate level of assurance of compliance.[105] Not only must it function in co-operation with other methods, but it is particularly vulnerable to changes in the political atmosphere. The kinds of ambiguity and potential for manipulation which are an inevitable part

of an information exchange process make it far too fragile to survive a hostile political environment and incapable on its own of acting as a confidence-building measure.

In addition to the direct exchange of information there are a number of other co-operative measures which work to facilitate the monitoring process (see chapter 1). These include agreements not to engage in deliberate concealment activities or interfere with the national technical means of other states in such a way as to impede verification. Other such measures included in the SALT Treaties are agreed counting rules (e.g., the number of warheads on a MIRVed missile is taken to be the largest number with which the missile has been tested), and common understandings on so-called 'functionally related observable differences' which allow one side to distinguish similar systems which serve different purposes (e.g., bombers and aerial refuelling tankers).

All of these measures derive from the inherent limitations of national technical means. They are genuinely co-operative in that they represent an attempt by two parties to reassure each other that these limitations will not be exploited. But they are also extremely vulnerable to changes in the political climate and to honest differences in interpretation. For example, because of the effectiveness of satellite monitoring, states will want to use camouflage and other forms of deception to conceal military activities uncontrolled by treaties. Such activities are quite legitimate, yet it is inherent in the nature of camouflage that the observer be deceived about the true nature of what is being hidden. How can the suspicious observer be reassured that what is being hidden is *not* a violation of a treaty? This is the crux of the current dispute over Soviet encryption of missile telemetry (see above), but the paradox applies to a wide variety of other verification problems and demonstrates the self-fulfilling quality of the assumption that states party to a treaty will cheat whenever the probability of detection can be reduced to a low level. This one-sided view of the monitoring process neglects both the mutual recognition of common interest inherent in a treaty and the genuinely inhibiting effect on a state which has publicly committed itself to such a treaty of even a small probability of being detected in a major violation or a pattern of minor violations. It is the factor of common interest in preserving the treaty that motivates the kinds of co-operative measure discussed here. If for any reason this recognition of common interest is lost, co-operative measures become the first casualties to suspicion and ambiguity.

Standing Consultative Commission

It was realized early in the SALT negotiating process, in November–December 1969, that some kind of 'special arrangement' would be required to address problems of implementation of any agreements that might be achieved.[106] The arrangement ultimately took the form of a standing commission made up of diplomatic, military, technical and intelligence personnel of both parties and

required to meet in Geneva at least twice each year to:

> (*a*) consider questions concerning compliance with the obligations assumed and related situations which may be considered ambiguous;
>
> (*b*) provide on a voluntary basis such information as either Party considers necessary to assure confidence in compliance with the obligations assumed;
>
> (*c*) consider questions involving unintended interference with national technical means of verification;
>
> (*d*) consider possible changes in the strategic situation which have a bearing on the provisions of this Treaty;
>
> (*e*) agree upon procedures and dates for destruction or dismantling of ABM systems or their components in cases provided for by the provisions of this Treaty;
>
> (*f*) consider, as appropriate, possible proposals for further increasing the viability of this Treaty, including proposals for amendments in accordance with the provisions of this Treaty;
>
> (*g*) consider, as appropriate, proposals for further measures aimed at limiting strategic arms.[107]

This list of duties, in particular items (*c*) and (*e*), was elaborated somewhat in the SALT II Treaty as other weapon systems besides ABM were brought under limitations.

The above list makes clear that the responsibilities of the SCC extend far beyond the handling of compliance issues. Such complex technical agreements as the SALT Treaties require a great deal of detailed definition of procedures for implementation. For example, the SALT II Treaty (article XI) requires that weapons in excess of agreed limits "shall be dismantled or destroyed under procedures to be agreed upon in the Standing Consultative Commission".[108] This means that neither side has the right unilaterally to determine the means of getting rid of excess weapons—the process has been made co-operative.[109]

In spite of this important implementation function it has been the role of the SCC in handling compliance issues that has received the most public attention. According to a former SCC Commissioner from the United States the essence of the SCC task in compliance-related questions is: "to head off potential gross dislocations or irretrievable circumstances by acting early enough and finding mutually-acceptable clarifications and implementing understandings, as well as inducing unilateral changes in troublesome activities, to sustain intact the agreements".[110]

The essential intent of this procedure is to *preserve the agreement*. Members of the SCC must "operate on the assumption that the agreement is to be sustained as negotiated, and ... it is their task to resolve any problems that arise for the continued functioning of the agreement".[111]

It is important to emphasize this conservative role of the SCC. It is in no sense intended as a device for detecting and prosecuting violations, but in fact

must operate on the assumption that ambiguities or apparent violations are 'problems' to be resolved by discussion and compromise. This places a high premium on early identification and discussion of problems before they get out of hand, on confidentiality to prevent the premature imputation of culpability, and on a continued mutual commitment to the preservation of the treaty despite the inevitable problems which arise in its implementation.

The Standing Consultative Commission is probably the single most creative and significant product of the SALT process. It was used during the 1970s to resolve a continuous series of compliance issues and was judged by most observers to be generally successful as long as its limited mandate to deal only with ambiguities and misunderstandings is kept in mind.[112] Not only has the SCC resolved many problems of implementation,[113] it has also been used to clarify and specify detailed rules for future conduct to prevent disputes from recurring.[114]

The SALT SCC is now under serious political pressure, as are all aspects of the SALT process. The SCC is no more immune to the effects of a corrosive political atmosphere than any other co-operative measure. Yet the concept is a solid one and the experience gained with the SALT SCC has led many to suggest that this model can be adapted to other arms control treaties as well,[115] and even extended from a bilateral to an international context.[116] It is safe to predict that the great majority of future arms control agreements will be accompanied by something resembling the SALT SCC.

V. On-site inspection

From the earliest days of the nuclear arms race the problem of on-site inspection has been one of the major obstacles to the achievement of arms control or disarmament agreements. Indeed, in the 1940s and 1950s, before the arrival of reconnaissance satellites, sensitive seismic networks and other national technical means, 'inspection' was the word generally used to refer to what is now called verification.[117] It is interesting to note that the change to the modern term 'verification' coincided quite closely with the advent of artificial Earth satellites.[118]

It is pointed out in chapter 3 that on-site inspection has been primarily a preoccupation of the United States. Soviet leaders have always been sensitive to criticism of their society as 'closed' or excessively secretive and have generally seen proposals for on-site inspection as polemic devices used by the United States to score points in world opinion.[119]

It is certainly true that when the USA proposes on-site inspection, and the Soviet Union rejects it, a contrast is suggested between the 'openness' of Western societies and the 'closedness' of Eastern. For example, US Secretary of Defense Casper Weinberger asserted in a radio interview: "We need a lot better verification methods than we've had in the past. We need on-site

verification which we've always offered, which the Soviet Union has always refused, which says quite a lot about the difference between the two societies".[120] Such statements are intended to highlight the differences between the two societies and to imply that a reluctance to accept on-site inspection is tantamount to an admission that one cannot be trusted to live up to agreements. However, such statements are never accompanied by a careful examination of the many technical, legal and political difficulties inherent in on-site inspection proposals.

It is remarkable, given the frequency with which elaborate on-site inspection schemes are proposed, how little such careful analysis has been made by the proposers. For example, the current US proposal for an 'open invitation' system of compulsory on-site inspection in connection with a chemical weapons treaty (see chapter 3) does not appear to have behind it a thorough (or even superficial) analysis of how such a scheme might work in practice. Without such an analysis the proposal is effectively empty, having all the earmarks of an attempt to gain the high ground in the propaganda battle.

This book is not the place for an analysis of the many specific proposals for on-site inspection. Instead, the following discussion will focus on a number of inherent problems in the concept of on-site inspection, focusing on its technical, legal and political feasibility as a realistic verification tool, using specific proposals as illustration.

Forms of on-site inspection

The analysis must begin with the recognition that on-site inspection can take many forms. It can be bilateral or international and it can be conducted in a variety of ways. One attempt at a comprehensive list has been made in the context of the chemical weapons treaty negotiations in the CD. On-site inspection might be conducted:

> (*i*) 'on an immediate basis', i.e., involving the presence of inspectors as soon as feasible,
> (*ii*) 'on a continuous basis', i.e., involving the presence of inspectors at all times during an operation,
> (*iii*) 'on a periodic basis', i.e., involving regular visits to an operation at fixed intervals,
> (*iv*) 'on a quota basis', i.e., involving an agreed number of regular visits ... on the basis of agreed criteria and data communicated by States,
> (*v*) 'on a random basis', i.e., involving an agreed number of visits which follow an irregular pattern with limited advanced warning,
> (*vi*) on any other agreed basis.[121]

This list includes inspections which would be conducted as a matter of routine (e.g., continuous, periodic) or on a non-routine basis requiring some sort of demand or challenge (e.g., immediate or quota). From a practical point

of view routine inspections must be limited to so-called 'declared' sites and facilities, that is, those which are named specifically in a treaty or agreed to in some other way by the parties concerned. Challenge or demand inspections might also be confined to declared sites, but could in principle also be extended to any facility if such a provision were written into a treaty. Random inspections might be applied either to declared or undeclared sites.

The difference between routine and non-routine inspection has proved to be a crucial one historically. Routine inspections such as those carried out under IAEA safeguards have proved acceptable to many states, and even the nuclear weapon states which are not required to submit to such inspections have volunteered to do so in order to strengthen the system's legitimacy. All parties to the chemical weapons negotiations have now accepted the principle of continuous on-site verification of destruction of declared chemical weapon stockpiles, removing an important obstacle to the conclusion of a ban on chemical weapons.

Routine on-site inspection mechanisms are inherently more acceptable for a number of reasons. They are technically easier to carry out because they focus on a limited number of known sites for which standard monitoring devices and operative procedures can be implemented. They are politically easier to accept because they carry no accusatory connotations and because they strictly limit the freedom of movement and access to information by foreigners in the state under inspection.

However, such routine inspections do not prevent possible violations of treaty provisions at undeclared or clandestine sites. For example, IAEA safeguards inspectors have no authority to visit undeclared facilities which they suspect might be engaged in activities associated with nuclear materials or devices, even in states which have signed the Non-Proliferation Treaty. This means that in principle it is possible for a state to produce a nuclear weapon clandestinely while outwardly demonstrating full compliance with the NPT.

Another contingency not covered by the routine inspection of declared facilities is the possibility that the initial declarations were inaccurate or intentionally misreported. For example, a facility dedicated to the destruction of a declared stockpile of chemical weapons could perform exactly as required by the Treaty, but because some stocks of such weapons were not declared initially, the objective of complete chemical disarmament of the state would not be achieved.

It is the possibility of such activities that has led many people to advocate on-site inspection measures which would be instigated on a challenge or demand basis. In some such plans it is sufficient for one party to demand an inspection on the basis of evidence which it believes suggests the possibility of a violation. Other plans would require some kind of independent or neutral commission to review the evidence before recommending or refusing a challenge inspection. The latter procedure would tend to inhibit the making of capricious or politically motivated challenges as well as those for which the

gathering of intelligence is a more important objective than monitoring compliance.

Legal problems

So far in the history of arms control efforts no such non-routine on-site inspection system has been adopted, and the prospects for any such scheme becoming acceptable in the foreseeable future are virtually nil. However, it would be wrong to attribute the unacceptability of such plans to a lack of a sincere desire for meaningful arms control agreements. In fact, much of the resistance to non-routine on-site inspections derives from their genuine legal, political and technical difficulties.

The legal problems are best illustrated by the US 'open invitation' proposal for a chemical weapons treaty.[122] In the US proposal only government-owned facilities were at first to be subject to inspections, and this was later amended to include private industries operating under government contracts. However, this still left most of the US and other Western chemical facilities uncovered, making the treaty highly unequal in its treatment of private enterprise and socialist economies.

When questioned about this asymmetry US officials conceded that it gave an advantage to the USA, but they claimed that such inequality was unavoidable because of the prohibition embodied in the Fourth Amendment to the United States Constitution against "unreasonable search and seizure" of private property.[123] This objection was analysed carefully many years ago, and a number of arguments were suggested as to why it should not prove to be an insurmountable obstacle to a realistic and effective inspection plan, even if unannounced searches of industrial plants without warrants were involved.[124] The only kind of facility which might remain immune from inspections under the Fourth Amendment would be the so-called 'button factory', that is, a plant nominally engaged in activities unrelated to the treaty and for which insufficient evidence of illegal activity exists to allow the foreign inspectors to obtain a search warrant from a US court.

As interesting as such legal niceties might be, they are not truly relevant to the problem of adequate verification of arms control agreements. Even if it were shown to be legally possible for Soviet inspectors to drop in unannounced on US button factories to look for chemical weapons, no one seriously imagines that such things would be done. It is highly unrealistic to imagine a scheme involving hundreds of foreign inspectors roaming about a country searching random industrial facilities without good reason to expect they will find something incriminating. And if such random searches are indeed illegal under the US Constitution, then it makes no sense, either logically or politically, to demand that the Soviet Union submit to them anyway.

If instead of focusing on remote and irrelevant hypothetical cases, attention is focused on inspection schemes that are politically realistic and technically

feasible, then the difficulties do not appear to be insurmountable. The US Constitution seems to be flexible enough to permit a significant amount of on-site inspection by foreigners.[125]

Analogous studies of the Soviet legal system also reveal some potential obstacles to the implementation of an on-site inspection system but conclude that "Soviet law... presents a generally suitable framework for overcoming a great many of these obstacles"[126] and that "the Soviet leadership has at its disposal the necessary means to ensure full compliance with an arms inspection policy".[127]

It is important to emphasize that these assessments of the adaptability of the two legal systems assume the desire on the part of the national authorities to implement a system of inspection. All of the above studies also point out that if the leadership is opposed to or ambivalent about such a system, the legal systems can provide any number of means of interfering with it. On the one hand the Soviet system "contains inherent obstacles that could be unobtrusively set in motion by opposing factions to inhibit the inspection process without officially denouncing the arms control agreement".[128] On the other hand, in the United States the Congress must pass laws implementing any inspection scheme,[129] and there is ample evidence in US history to show how this Congressional process can delay and even destroy the implementation of a law or treaty.

But these are not legal problems; they are political problems deriving from the difficulty in establishing a domestic consensus in support of something so unprecedented and controversial as the inspection of the territory and economic and military assets of a sovereign state by foreigners, at least some of whom might be representatives of hostile states. Such yielding of sovereign powers to foreigners or international bodies is not a normal activity of national leaders, who tend to see their purpose in life as implementing and extending the power of their nation, not giving it away. Without a clear and stable national consensus on the desirability of such a yielding of national sovereignty, it would take a rare act of political courage for a national leader to take the risks involved in such a step. It is difficult to find such a consensus in any state, let alone in the two great powers.

Political resistance

It is instructive to look back in history to some earlier efforts to establish on-site inspection. When such suggestions were made in connection with enforcing the naval disarmament treaties of the 1920s, the position of the US government was made crystal clear by Secretary of State Kellogg: "The United States will not tolerate the supervision of any outside body in this matter nor be subjected to inspection or supervision by foreign agencies or individuals".[130]

Although the publicly expressed attitudes of the US government have

obviously changed substantially since the 1920s, there still remain doubts as to the ease with which even a relatively non-intrusive inspection scheme could be implemented.

Concern over the relinquishing of national sovereignty is also quite prevalent in the US Congress. This became evident in the early negotiations over a comprehensive test ban treaty when it was proposed that an international commission be set up to make independent judgements on the evidence used to support on-site inspection challenges. Influential members of Congress were very reluctant to agree that any international body could have the power to overrule a determination by US experts that an inspection was warranted by the evidence.[131]

Whatever powers might be given to an international body to deny inspections, it is a certainty that no international body will ever have the power to force a state to submit to an inspection it does not want. And it is also obvious that no state will voluntarily submit to an inspection it anticipates will expose a violation. The bank robber does not invite observers from the police to certify his crime. Therefore the real signal for a violation must be the refusal by a state of an inspection deemed by other states to be warranted by the evidence, and it is safe to conclude that the United States has understood this for a long time: "United States planning proceeded on the basis that in such a case the other party would probably refuse to permit the exercise of inspection rights, *and that in itself would be the treaty breach.* In other words, inspection would operate not as an information-getting device but as a trigger mechanism".[132] But there are other reasons for refusing an inspection besides an attempt to hide illegal activity, for example, the protection of legitimate, military or commercial secrets or the knowledge that the demand for inspection is motivated more by a desire to harass and embarrass than by a real suspicion of misbehaviour.

If such legitimate refusals to permit inspection are automatically to be interpreted as *prima facie* treaty violations, then there are substantial risks involved in signing a treaty to be verified by challenge inspections. False challenges could also be used by a state desiring to abrogate the treaty but at the same time wanting to shift the blame for the abrogation to the other side.

Such concerns are evident in the Soviet approach to on-site inspections. At one point in the SALT I negotiations the United States

> raised the possibility of *ad hoc*, on-site inspections, on a 'request' basis, called selective direct observation (SDO). The Soviets objected. They had no trouble with the concept of inspection if a nation invited it, but they were concerned with the political consequences of denying inspections requested by the other side, *even though it would be understood that this did not constitute a violation of the agreement.*[133]

The proviso at the end of this quote is, of course, in direct conflict with the similarly emphasized segment of the previous statement. Since both quotes are

from active and knowledgeable participants in the US arms control establishment, the contradiction perhaps indicates some ambivalence in US thinking on this issue. Nevertheless, the first statement has a more authentic and plausible ring, while the second smacks of the kind of hypothetical conjecturing that often takes place in negotiations. The prevailing US view was clearly expressed by a US Senator as follows: "I want to make that clear. No other nationality, no other group of people can overrule any decision made by our scientists that a given location is the epicenter. If for any reason at all the Russians decide we can't go in there then we know it is about time to call the whole thing to an end".[134]

The problem of equating a denied inspection with a violation is most acute in bilateral treaties. It can be alleviated to some extent in international treaties by the use of an impartial commission to evaluate challenges before they are formally made. Even if no formal veto power is given to such a commission, its refusal to certify a challenge as warranted by the evidence would be a significant inhibiting factor against capricious or poorly documented challenges.

In conclusion, there can be no question that the acceptance by a state of a treaty provision involving non-routine or challenge on-site inspections is a genuine signal that the state intends to live up to its obligations under the treaty. Such signals are very significant and greatly to be desired from all states. But at the same time an acquiescence to such a provision represents an assumption of trust that other parties will not abuse the challenge process by using it to gain military or political advantage. This second factor is rarely mentioned in discussions of on-site inspection, but it is crucial to their acceptance and emphasizes again the fundamental role of trust in the verification process. On-site inspection, the mechanism which might produce the greatest degree of confidence building, demands for its acceptance an already relatively high level of mutual confidence. If the logic of this is taken just a bit further it might be concluded that as on-site inspection becomes more feasible it becomes correspondingly less necessary. While such a neat conclusion may be somewhat oversimplified, it is certainly more realistic than the idea that elaborate challenge schemes for on-site inspection are feasible in an early stage of arms control.

Technical obstacles

To the legal and political constraints on non-routine on-site inspection methods must be added a pragmatic appraisal of their technical feasibility. What can actually be learned from on-site inspections with a reasonable investment in instruments, personnel and time? As is shown in chapter 3 there has been a growing recognition in the United States that the potential benefits of on-site inspection have been exaggerated. For example, both US and Soviet experts have criticized as easily evadable early US proposals for on-site inspections in connection with limitations on MIRV deployments.[135] More recently

a former US negotiator has argued that "on-site inspection is vastly over-rated for everything except the Comprehensive Test Ban Treaty".[136]

The tendency to exaggerate the usefulness of on-site inspection has its political and propaganda aspects, as has already been noted. But it can also be attributed partly to hopes that such inspections would provide useful 'collateral information' (precisely the objection the Soviet Union has traditionally raised against US on-site inspection proposals) and partly to "exaggerated analogies drawn from on-site inspection's unquestionably substantial potential role in monitoring Soviet compliance with any potential Comprehensive Test Ban Treaty".[137]

It is significant that two of the above criticisms of on-site inspection exempt the comprehensive test ban from their negative evaluations. The US insistence on on-site inspections on demand as part of a comprehensive test ban (CTB) goes back to the earliest days of test ban negotiations and seems still to be a precondition to ratifying the treaty.[138] Belief seems to be widespread in the arms control community that this is one area in which the concept is both necessary and practical. Therefore it is worth examining it in more detail here from the point of view of its technical feasibility and usefulness in monitoring compliance, assuming that some day on-site inspection proves acceptable to all parties to a CTB.

There is surprisingly little in the way of technical assessment of on-site inspection of a CTB in the open literature. One tends to assume that careful technical studies have been made on the way in which such a system would operate, but if such studies exist they have not been made public. Instead one finds only a few very sketchy, almost offhand, references to the problem, most of which generate considerably more scepticism than confidence.

The problem faced by a CTB on-site inspection system is to identify a small seismic event as either an earthquake or nuclear (or possibly chemical) explosion by visiting the site where the event occurred and making various kinds of observation. It must be assumed that the event is of small magnitude ($m_b \leqslant 4$), since a network of remote seismographs is generally argued to be capable of reliably identifying events larger than this (see chapter 2). It can also be assumed that the event will occur in a seismically active area where small earthquakes are common. It would make no sense to conduct a clandestine nuclear explosion in a seismologically quiet area where it would immediately attract attention.

One relatively detailed description of how an inspection would be carried out envisages a team of about 20 people who would carry out visual inspections of the areas, sample radioactivity, set up seismometers to monitor aftershocks and take rock samples. The 'host' nation would be expected to provide transportation to, at and from the site as well as indigenous labour at the site.[139] The make up of the team is summarized in table 9. This inspection team must be well trained, have its equipment available and be ready to spend roughly six weeks at the site. Several tonnes of equipment would be necessary,

Table 9. Typical inspection team composition and functions

Inspection tasks	Personnel	Functions performed, etc.
Visual inspection (air and ground)	3 natural scientists	Team leadership; aerial and surface conventional photography; scientific detective work
Gamma spectrometry (air and surface)	2 engineers (plus 2 local labourers)	Aerial radioactivity survey followed by surface inspection
Broad-spectrum photography and magnetometer survey	1 photo interpreter, 1 geophysicist, 1 helicopter pilot	Coverage flown during airborne visual inspection; data reduced on ground; pilot is operations officer
Seismic monitoring	1 seismologist, 2 technicians	Seismic monitoring of aftershock signals
Shocked rock sampling	1 physicist (plus 1 local labourer)	Gathering and inspection of rock samples for crystal deformation
Technical support and maintenance	2 mechanics/technicians, 2 radio men, specialists	Maintenance of equipment and power units; communications and record keeping
Logistic support	1 interpreter, 1 medical technician, 2 cooks and bakers	Provide liaison, administration, health services; assist on inspections; provide familiar food, etc; receive and use 1 000 kilograms of food and fuel per week
Host nation support		Transportation to, at and from the site; indigenous labour at site; permit courier communication service

Source: Developments in Technical Capabilities for Detecting and Identifying Nuclear Weapons Tests, Hearings before the Joint Committee on Atomic Energy, US Congress, 5–12 March 1963 (US Government Printing Office, Washington, DC, 1963), p. 424.

especially if the team were required to visit a remote Arctic site, and something like one tonne per week of supplies, rock samples and other cargo would have to be flown in and out.[140]

However, it remains unlikely that the evidence uncovered by such a team would provide conclusive evidence that a nuclear explosion had taken place. Such an explosion would be small and buried deep underground precisely to prevent easy detection by surface observations. Although it is possible that radioactive gases from the explosion could seep to the surface through small rock fractures, the host country would surely monitor this on its own and, if such incriminating evidence had leaked to the surface, find some way to delay or refuse the inspection.

The unlikelihood of finding incriminating evidence on the surface means

that the inspecting states must retain the option of drilling beneath the surface, since such drilling "remains the only way to get incontrovertible evidence of a fully contained nuclear explosion".[141] But a decision to drill for evidence would involve a far more substantial commitment of equipment and personnel as well as an extension of the inspection period by four to six months, according to one estimate.[142]

Some idea of the magnitude of the drilling operation can be obtained by comparing the size of the area to be searched with the size of the cavity created by a nuclear explosion. The size of the area to be searched depends on the precision with which remote seismographs can locate the epicentre of the event. The size of this area has decreased as the quality and quantity of seismographic data have increased. In 1963 the assumed area to be searched was of the order of 500 km^2,[143] and in 1971 it was 250 km^2.[144] A more recent estimate claims an accuracy in position of 10–25 km using a network of stations and selecting those which produce high-quality seismic data.[145] This suggests a minimum area of uncertainty of roughly 100 km^2, although a recent Swedish proposal contemplates searches over areas 10 times as large.[146]

A 5 kt nuclear explosion, certainly the largest that might be mistaken for an earthquake if detonated without special provisions to disguise it (see below), would be set off at a depth of at least 200 m and would create a cavity with a diameter of 30–40 m in granite.[147] However, the cracking of rocks and other effects might spread out to 20 times this distance, that is, a diameter of 700 m.[148] The collapse of rock into the cavity would create a 'chimney' with a height 4–6 times the cavity radius, roughly 80 m.[149] This would put the top of the chimney more than 100 m beneath the surface, thereby preventing to a high level of confidence both the formation of a subsidence crater and leakage of radioactivity to the surface. If it is assumed that drilling anywhere into the full 700 m diameter of the fractured region will produce the necessary evidence of a violation, then the area in which a successful drilling must be localized is roughly 0.4 km^2. The most optimistic estimate for the area in which test drillings must be made is 100 km^2. Therefore the probability that a single drilling will find the evidence is at best 1 in 250, probably considerably less. So 125 holes would have to be drilled to be 50 per cent certain that no test had occurred, and 225 holes to be 90 per cent certain. If the project is to take only 4–6 months then this means that at least one hole per day would have to be drilled to a depth of 100–200 m.

This simple calculation should not be taken too seriously. It probably underestimates the area which would have to be covered by an inspection, but overestimates the density of holes that would have to be drilled. The explosion would create an extended period of aftershocks, so it might be possible to establish the existence and location of the cavity by sensitive seismic monitoring. The inspection team might also employ active local seismic methods such as those used to locate oil deposits or other distinctive subterranean features.

However, depending on the area of uncertainty, these could still involve considerable drilling and the use of underground explosions.

In any event, the size and expense of such an operation would be substantial, to say the least. Ambassador Averell Harriman, who represented the USA in negotiations of the Partial Test Ban Treaty in 1963, was deeply impressed by the technical demands of such an inspection effort. As he testified in 1973:

> At the same time some of our experts thought three inspections would be adequate because it would give us a spot check which would make the Soviets unwilling to run the risk of detection... But then when I saw the details of what our experts would demand in the way of the kind of inspection..., the large area over which we would have helicopters range, and the number of holes we would have to drill, and that sort of thing ... I am satisfied they would never have agreed to it... The Russians accepted onsite inspection as a principle, but I am satisfied we would never have come to an agreement on what was really needed in the way of onsite inspection.[150]

Not only would these inspections have constituted a vast intrusion on Soviet territory, demanding substantial Soviet co-operation in transport, labour and logistical support, but they would almost certainly have had to take place in Soviet Central Asia where earthquakes are frequent. But this area of high seismicity happens to coincide with one of the most sensitive military-strategic areas in the Soviet Union.[151] How such inspections might be managed without the Soviet Union risking the disclosure of collateral information was apparently not thoroughly analysed.

The point of this argument is not to determine whether the Soviet Union or any other state would ever permit such a massive intrusion on its territory by foreigners, but whether, even if it were permitted, it makes any sense. There is ample reason to conclude that it does not. One professional assessment of on-site inspection concluded that "visual inspection and radiochemical analysis are the only useful techniques" and that "sufficiently deep burial will preclude surface effects and seepage of radioactive gas to the surface".[152] Another study employing analytical decision theory and published data on nuclear explosions concluded that the use of the $m_b : M_s$ discriminant based on seismic network data (see chapter 2) was more reliable in deterring violations than a scheme involving one or more on-site inspections per year.[153] Advances in seismic technology since 1970, when this assessment was made, have undoubtedly added strength to this conclusion. Even better identification capabilities could be obtained with seismic stations, manned or unmanned, deployed at selected locations in the states to be monitored. The Soviet Union agreed to the use of such stations on its territory at an early stage of the test ban negotiations.[154]

A number of techniques have been suggested for disguising or hiding nuclear tests from a seismic network.[155] These include exploding the device in

a large cavity in order to reduce the intensity of the seismic wave produced (decoupling), hiding the explosion in the seismic background created by a natural earthquake, or setting off multiple explosions in such a way as to simulate the seismic-wave pattern of an earthquake. Whatever the potential utility of such schemes may be, and careful analysis indicates that it is likely to be very small, on-site inspection has very little to do with deterring or detecting them. The first two evasion techniques are designed to prevent detection of the event, and it is only when an event is detected but not unambiguously identified that on-site inspection would be called for. The third technique, simulating an earthquake, is assumed to be detectable but not properly identifiable. But there is no experimental evidence that such a simulation can be conducted,[156] and seismological theory is far too uncertain to give any potential violator the confidence that such a trial could fool a sophisticated seismic network, not to mention the satellite observations that could detect the preparations for the test.

This analysis raises very serious doubts about the "unquestionably substantial potential role" for on-site inspection in monitoring a CTB (see above).[157] In fact the utility of on-site inspection in such a treaty is highly questionable on both political and technical grounds. For most professional seismologists "it is difficult to see why on-site inspection, in the way it has been proposed, is regarded as a necessary verification method to achieve an adequate verification of a CTB".[158]

Conclusion

It is important to keep in mind that this critique of on-site inspections is directed to non-routine, challenge inspections, not to routine on-site monitoring (either by people or instruments) of declared facilities, or to *ad hoc* inspections at the invitation of an offended party as, for example, when Iran invited an international expert group to verify its charges that Iraq had used chemical weapons. Such inspections have also been agreed to as part of the Environmental Modification Treaty.[159] It is only the concept of demand on-site inspections which appears to pose insurmountable obstacles, at least as long as the world continues to be made up of sovereign states.

VI. Internationalizing verification

Introduction

The strong focus in this book on unilateral and bilateral verification mechanisms reflects the historical and political realities of their evolution. Nevertheless, table 1 (pp. 4–5) lists a number of multinational or international

treaties which contain significant verification provisions, and it is noted in chapter 3 that many states have made serious efforts to promote a more international approach to verification.

It is therefore important to examine both the existing and proposed international verification mechanisms to assess both their virtues and limitations. In keeping with the theme of this chapter the assessment deals with both technical and political factors as well as with their interaction. Also in keeping with the more general theoretical approach of this book there is no attempt to examine the many treaties and verification provisions in detail. Instead the aim is to identify the major problems and trends with a view towards anticipating how well future efforts at internationalizing verification are likely to succeed.

It is possible to identify three major trends, or what might be called 'traditions', in the development of international verification measures. One such tradition can be seen originating in the Antarctic Treaty of 1959 and progressing through the Outer Space Treaty of 1967, the Sea-Bed Treaty of 1971, the Biological Weapons Convention of 1972 and the Environmental Modification Treaty of 1977. Current negotiations in the Geneva Conference on Disarmament towards a chemical weapons treaty can be identified as an outcome and potential propagator of this tradition. A second tradition began with the earliest attempts to control the spread of nuclear explosive technology by monitoring the testing of nuclear weapons and the inventories of nuclear explosive materials in the non-military nuclear fuel cycle. The third tradition has been focused on the regional security problems of Europe and has proceeded along the parallel tracks of the Mutual Force Reduction negotiations in Vienna and the so-called Helsinki Process which involves continuing negotiations on security- and confidence-building measures in Europe. These three traditions are analysed separately for the particular verification problems they present as well as for the contributions they have made to the evolution of international verification techniques and institutions. In reading the following analyses the reader may find it helpful to refer to table 1.

The chemical–biological–environmental tradition

The characteristic that most distinguishes this tradition from the others is the relatively low military significance of the regions and weapons controlled and the relatively low priority placed on verification in their implementation. At the same time it is also possible to see a gradual increase in the military significance of the agreements over time, and a correspondingly slow increase in the extent and effectiveness of verification arrangements. The progression in both military significance and the need for effective verification are quite evident when one compares the problem of chemical weapons control to the problem of preventing military activities in Antarctica, a region few if any have ever believed to be of military significance to anyone.

In one sense the Antarctic Treaty achieves the ideal verification system.[160]

All parties to the treaty are entitled to appoint observers who will have free access to all areas, installations, ships, aircraft, and so on in Antarctica as well as the right to inspect them without interference (article VII). These observers also remain under the control and protection of their national governments at all times and places in Antarctica (article VIII). A similar openness characterizes the Outer Space Treaty[161] which requires that: "All stations, installations, equipment and space vehicles on the moon and other celestial bodies shall be open to representatives of other States Parties to the Treaty on a basis of reciprocity" (article XII).

The political equality implied by these provisions is, of course, illusory because of the vast technological and economic inequalities among the parties to the treaties. That the United States and Mauritius (both parties to the Outer Space Treaty) should agree to open their installations on the Moon to each other on the basis of reciprocity unfortunately lends itself more to mocking equality than to enhancing it, as well as to providing evidence in support of the proposition that agreement on verification is always easiest to achieve when it is most irrelevant. Further evidence for the proposition can be found in the failure of the Treaty to mention bodies in Earth orbit under the reciprocal inspection provision. The military significance of objects in Earth orbit is well established, so the concept of open inspection is considerably less attractive to states who control such satellites. This has the effect of making the major provision of the Treaty—that nuclear weapons are prohibited from being placed in orbit (article IV)—essentially unverifiable.

Compared to this situation, the Sea-Bed Treaty, which was signed four years later, represents measurable progress[162]. This treaty not only gives the right to each party to observe on its own the activities of other states on the ocean floor but provides for consultations and co-operation among parties in the verification process as well as "through appropriate international procedures within the framework of the United Nations and in accordance with its Charter" (article III, paragraph 5). This last clause is significant in that it represents the seed from which the concept of international consultative committees has grown.[163] So, while the Sea-Bed Treaty differed little from the Antarctic or Outer Space Treaties in its military significance or practical contribution to international equality (see chapter 3, pp. 137–38), it at least represented a small evolutionary step towards a more effective international approach to verification.

The convention on biological and toxin weapons was signed in 1972 and entered into force in 1975.[164] It contains a vague and ineffectual verification clause (article V) which includes the right to "consult one another" if problems arise and also includes the "appropriate international procedures within the framework of the United Nations" clause of the Sea-Bed Treaty. These procedures are not further defined except to specify that any state which finds another state guilty of a violation can lodge a complaint with the UN Security Council (article VI). However, the language implies that the state bringing the

complaint must have sufficient evidence to demonstrate guilt; it does not provide for an independant investigation on the basis of suggestive evidence to determine if a violation has in fact occurred.

This weakness in the Biological Weapons Convention has led to serious problems in connection with allegations of violations, both in the case of the so-called 'yellow rain' incidents in Indo-China and an outbreak of anthrax near the city of Sverdlovsk in the Ural Mountains of the Soviet Union.[165] Both of these incidents are highly controversial, and in neither case is the evidence of violation at all convincing. Yet in both cases it is clear that if an 'appropriate international procedure' had existed to gather and evaluate evidence and receive relevant data and testimony from the concerned parties, a more satisfactory resolution of the problem would have been obtained. As it happened, an investigation of the 'yellow rain' incidents was ordered by the UN Secretary General after an intense debate in 1980, but the expert group was not able to make its first interviews of witnesses before October 1981 and never was allowed to visit the sites of the alleged attacks.[166] Their report was, not surprisingly, inconclusive.[167]

Despite this result the appointment of a commission of experts to investigate charges of misconduct was an important precedent. Based on this precedent the Secretary General was able to respond promptly to a request by Iran in 1984 to investigate the alleged use of chemical weapons by Iraq in the war between the two states. A committee of experts on chemical weapons was appointed and allowed by Iranian authorities to visit the sites of the alleged attacks and take necessary samples and data. The result of this investigation was far more conclusive, stating unequivocally that chemical weapons had been used and identifying two distinct types. The expert commission could not identify the state which had carried out the attacks.[168]

Seven years before this successful use of a "consultative committee of experts", a provision for just such a body was included in another international arms control treaty, the Environmental Modification (Enmod) Convention.[169] In article 5 of the Enmod Convention the phrase "appropriate international procedures" is amplified by suggestion of the use of "appropriate international organizations" as well as a Consultative Committee of Experts to be appointed at the request of any party by the Secretary General within one month of the request.

The responsibilities and rules of procedure for the Consultative Committee are spelled out in an annex to the Treaty. Members are required to confine themselves to making appropriate "findings of fact" and to provide "expert views" relevant to the problem under investigation. The full committee is permitted to decide procedural questions but not "matters of substance".

These restrictions are clearly intended to ensure that the Consultative Committee confines its work to the gathering and analysis of data and stops short of making judgements about the guilt or innocence of various states or even the degree of seriousness of the violation.[170] Similar restraint is evident in the

report of the committee investigating the charges of chemical weapon use against Iraq (see above). This attempt to separate the analytical and evaluative functions is quite similar to that made by many national intelligence agencies and is seen as the best way to maintain a high level of confidence in the objectivity and integrity of the committee (see chapter 3, pp. 154–56). It would be all too easy for the work of such a committee of experts to be undermined by disputes over "matters of substance", that is, those questions which require political judgement.

The consultative committee envisaged in the Enmod Convention is an *ad hoc* committee appointed only when there is reason to believe that a violation has occurred. There have been suggestions that the committee be made a permanent one charged with handling routine exchanges of information on research and development in environmental modification techniques as well as monitoring the many applications of these techniques. However, considering the marginal significance of the Enmod Convention it does not seem worth the political and administrative effort required to create such a permanent committee.[171]

In contrast, a treaty banning chemical weapons would certainly require not only a permanent consultative committee, but a large, well equipped and highly diversified one as well. The need for such a commission in a chemical weapons treaty has been recognized for many years by both the USA and the USSR,[172] and recent versions of such a treaty retain and amplify the concept of a consultative committee as well as provide for a wide variety of other co-operative measures, such as exchanges of information and a carefully worded procedure to be followed when demanding an on-site inspection.[173]

The emergence of the concept of a consultative committee has a complex history, but certainly one of the major stimuli for its promotion came from the apparent success of the Standing Consultative Commission created by the US–Soviet SALT I agreement. In fact, the first proposal for such a committee, in a speech by the Netherlands representative in the CCD (the predecessor of the CD) in 1975, referred to the SALT SCC explicitly.[174] This serves as one more example of the important impact the SCC concept has had on arms control.

International monitoring

Nuclear test bans

The second major tradition in international arms control is the sequence of treaties controlling the testing and proliferation of nuclear weapons. In this tradition there are no analogues to Antarctica, Outer Space and the Sea-Bed on which to conclude marginal treaties, and consequently verification has been a prominent and constant concern from the beginning. This tradition has

evolved from the earliest effort to control the spread of nuclear weapons, and the preoccupation of Western states with effective verification can be seen clearly in the original proposals for international control of atomic energy presented to the United Nations in 1946 by Bernard Baruch.[175]

This tradition also shows an evolution of co-operative measures, but these emphasize on-site inspection instead of consultative committees. Here it is also possible to see progress as testing limits have progressed from the Partial Test Ban Treaty (PTBT) of 1963, through the Threshold Test Ban and Peaceful Nuclear Explosion Treaties of 1974 and 1976 respectively, to current negotiations for a comprehensive test ban treaty. The concept of on-site inspection was incorporated from the beginning in the 1967 treaty prohibiting nuclear weapons in Latin America (Treaty of Tlatelolco) and the Non-Proliferation Treaty of 1968.

The Partial Test Ban Treaty banning nuclear explosions in the atmosphere, in outer space and under water was first agreed to by three of the four nuclear weapon states—the USA, the UK and the USSR.[176] France did not join the Treaty, and in 1964 China indicated its attitude towards the Treaty by conducting its first nuclear explosion in the atmosphere, where it has conducted the great majority of its nuclear tests ever since.[177] France stopped testing in the atmosphere in 1975 but has still never signed the PTBT.[178] However, a great many other states have signed it, and the PTBT ranks second only to the Non-Proliferation Treaty in its number of signatories (112 as against 124 on 31 December 1984).[179]

There is no explicit verification provision in the PTBT, but it was implicit that national technical means were to be used by the parties. These means included satellites and various ground-, air-, space- and sea-based radiation monitors for detecting fall-out (see chapter 2), and since the vast majority of the parties to the PTBT do not possess such means, the lack of verifiability is for them a genuine limitation. Most states who have reason to fear the possible development of nuclear weapons by a rival have no or only very limited independent means of detecting a nuclear test in that state and must therefore depend for such crucial information on those states who do possess these technologies. This problem was highlighted when the Soviet Union and the United States detected and monitored apparent preparations for an underground nuclear test by South Africa in 1977[180] and ambiguous flashes of light somewhere over the South Atlantic in 1979 and 1980.[181] States such as Angola, Zimbabwe or Mozambique, which presumably would have the most reason to be concerned about such a test, had no means to detect these activities on their own.

The alleged South African tests are particularly relevant to the issue of internationalizing the verification process. The data suggesting an atmospheric nuclear explosion were picked up by a US Vela satellite (see chapter 2) and have been kept secret. At least two analyses were carried out by panels of US experts, one convened by the President's Science Advisor, concluding that the

satellite "probably did not see a nuclear explosion".[182] Another group at the US Naval Research Laboratory concluded that "there was a 'nuclear event' on 22 September near Prince Edward Island, South Africa or Antarctica".[183] The dispute over the proper interpretation of the data divided US scientific and intelligence analysts into 'believers' and 'non-believers' and was characterized by charges of "a political motive to ignore uncomfortable facts".[184]

Who is correct in this controversy is not as important for the present discussion as the total inability of other states to make an independent analysis of the data. If suspicions of political motivation could surface within the US intelligence community, then it would not be surprising to find such suspicions in states whose relationship to South Africa is less secure than that of the United States. If the data had been recorded by an internationally controlled satellite and made available to all interested states, then independent analyses would have been possible, and any state would have been free to draw its own conclusions based on the best available data. As it is there is no way to dispel the residual suspicion of political manipulation by the USA even if such suspicion is unwarranted.

The Threshold Test Ban Treaty[185] and the Peaceful Nuclear Explosion Treaty[186] are both bilateral treaties, and their contribution to increased acceptance of co-operative measures by the two leading nuclear weapon states is discussed above. Here it is necessary to emphasize two important reservations concerning the significance of this apparent progress for internationalization. First, the USA has not yet ratified either Treaty and the prospects for ratification do not look bright. This indicates that strong reservations persist in the USA against accepting these arrangements even in a bilateral context. Second, even if the USA did ratify the Treaties, the acceptance of these co-operative measures on a bilateral basis would not necessarily imply a willingness to accept them on an international basis. The need for equal treatment and reciprocity in any such international treaty would qualitatively alter the administrative, technical and political issues which would have to be dealt with, and the process of resolving these issues could take many years and prove to be unwarranted by the benefits to be gained from internationalizing either Treaty, especially since this effort would distract the international community from working towards a comprehensive test ban which would make both the TTBT and PNET unnecessary.[187]

The effort to achieve an international CTB is certainly worthwhile, and here there are considerable grounds for optimism that solutions to its verification problems are well within reach, both technically and politically. An ongoing research programme led by the Swedish delegation to the CD has demonstrated the feasibility of an international seismic network and data exchange system which would allow all states to have access to seismic data on an equal basis.[188] Further experimentation is necessary to improve the capabilities of the system and the quality of the data which can be transmitted, but there appear to be no insoluble technical problems. The real obstacles that still

remain in the path of a CTB are political and have little or nothing to do with verification.

Safeguards

Closely connected with the efforts to ban nuclear tests have been the efforts to prevent the horizontal proliferation of nuclear weapons. Here the effort is by its very nature international, although bilateral agreements between nuclear technology suppliers and recipients also play an important role.[189] The treaties which make up this tradition are (in addition to the PTBT of 1963) the Treaty of Tlatelolco (1967) prohibiting nuclear weapons in Latin America,[190] the Non-Proliferation Treaty of 1968,[191] and the Convention on the Physical Protection of Nuclear Materials adopted in 1980 but not yet entered into force.[192]

Verification of all these agreements is carried out under the Safeguards Programme of the International Atomic Energy Agency (see chapter 2, section IX). At present there are 76 non-nuclear weapon states who have safeguards agreements with the IAEA,[193] and which have therefore agreed to submit their nuclear facilities to inspection by international inspectors. The IAEA safeguards operation in 1984 involved 434 personnel and a budget of almost $34 million, 35 per cent of the total budget of the Agency.[194] While it is easy to criticize the IAEA safeguards programme for its many gaps and weaknesses, and some such criticisms are made below, it is important to keep in mind that this programme represents an unprecedented and remarkable achievement in international arms control, whose benefits considerably outweigh its shortcomings. In its annual report for 1983 the Agency was able to state, as it has in all previous years, that it "did not detect any anomaly which would indicate the diversion of a significant amount of safeguarded nuclear material—or the misuse of facilities or equipment subject to safeguards".[195]

As it stands this record demonstrates the accumulation of much evidence of compliance with the NPT and other non-proliferation agreements. Unfortunately, this record cannot be used to demonstrate conclusively the effectiveness of safeguards. In the words of an IAEA official: "Paradoxically, effective safeguards contribute to the difficulty of measuring safeguards effectiveness by the most simple indicator, namely the percentage of diversion acts or related events during a given period".[196] This paradox is always associated with the attempt to evaluate measures designed to prevent inherently improbable but potentially dangerous events. For example, it shows up clearly in the concern over the safety of nuclear power plants, where those who are favourably disposed towards nuclear power can point to the complete absence of catastrophic meltdown accidents as powerful evidence for the safety of such plants, while those opposed to nuclear energy can argue that it is precisely the absence of such events which makes it impossible to say how safe reactors

really are, and that the potential consequences of a catastrophic accident are too serious to permit the operation of power plants with such ignorance of the risks.

If nuclear power plants melted down at measurable rates the risks could be adequately assessed, as they can be, for example, for car or aircraft accidents. But such a frequency of nuclear accidents would obviously make nuclear power plants socially and economically unacceptable and they would not be built. Similarly, if a safeguards system routinely turned up some low frequency of diversions for weapons or for purposes unknown, the system would be politically insupportable and effectively useless. According to one perhaps excessively pessimistic IAEA official: "Even the diversion of 100 grams of plutonium could result in political disaster because of hysterical reactions from a misinformed public".[197] Although this may overstate the argument somewhat it remains true that the survival of the safeguards system depends critically on its extremely low probability of turning up violations.

This inherent fragility of the safeguards system would be problem enough if safeguards were applied uniformly to all states. Unfortunately this is not the case, and there are at least 14 nuclear facilities in five states which are not subject to safeguards under any agreements,[198] and four of these states (India, Pakistan, South Africa and Israel) have either demonstrated a capability to build nuclear weapons or are generally believed to have or to be within reach of such a capability.

There is nothing the IAEA or its safeguards system can do about this. The IAEA "is not an international police agency. It cannot protect nuclear materials and facilities against misuse. Its safeguards cannot control the future policies of states, but only verify present activities. The Agency cannot physically prevent anything, but only report diversions".[199] These limitations derive from historical and political factors which are important to understand in order to appreciate the obstacles which would have to be overcome before the safeguards system could be significantly extended or before a similar system could be applied in other contexts, for example to a complete ban on the production of nuclear explosives or to a chemical weapons treaty.

To extend the IAEA safeguards programme to cover a ban on production of plutonium or highly enriched uranium for weapons, the following changes would have to be made:

1. The current requirement of safeguards only for non-nuclear weapon states would have to be extended to include *all* states.
2. The current application of safeguards only to commercial facilities would have to be extended to military facilities as well.
3. The current emphasis on material accounting techniques would have to be shifted to a much greater dependence on more sophisticated containment and surveillance techniques.

All of these changes are quite feasible in principle, but they would represent

a major change in the operation of the Agency. Making such changes in an international regime involving dozens of states is extremely difficult. For example, any substantive changes in safeguards requirements for one or a few states would require that the changes be applied equally to *all* states. One estimate suggests this would require the renegotiation of some 50 NPT safeguards agreements concluded since 1970,[200] a bureaucratically and diplomatically long and tedious process.

Extension of the safeguards system to a chemical weapons treaty raises even more difficult problems. If it were only a matter of monitoring the flows and inventories of certain well defined and highly specialized chemical agents and precursors at declared facilities, then the problem would probably be manageable. All countries engaged in the production of lethal substances have a strong interest in keeping good inventory records, and an international monitoring agency could use these national records in much the same way as the IAEA uses national accounts of nuclear materials.[201] Depending on how many chemical substances and facilities were monitored such a scheme could involve a great many inspectors and heavy demands for information storage and processing. But technically it should be manageable.

The politics of the situation is another matter, and here it is important to look at the particular political factors associated with nuclear energy that made the IAEA possible in the first place. Historically the IAEA and its safeguards system grew out of the US Atoms for Peace programme, first proposed by President Eisenhower in 1953.[202] The purpose of this programme was to promote the international development of atomic energy for peaceful purposes, and a simultaneous application of safeguards was seen as necessary to prevent the diversion of nuclear technology and materials for military purposes. The USA was able to enforce a system of safeguards because it had control of a technology that other states wanted and were willing to make some political sacrifices to obtain. For example, the Euratom Treaty of 1957 was designed to "constitute a framework for obtaining technological support from the United States"[203] and "to assure the United States that the nuclear materials it supplies are not being diverted to military use".[204]

This same principle, under which the controllers of nuclear technology agree to supply it to others in return for guarantees that it will not be misused, is embodied in the NPT, which promises all states in return for their signature on the Treaty "the fullest possible exchange of equipment, materials and scientific and technological information for the peaceful uses of nuclear energy".[205]

The creation of a safeguards system was possible because it seemed at the time a relatively small price for states to pay in order to gain access to US nuclear technology. The original emphasis of Atoms for Peace was on *development*, with control clearly subordinate. This gave the Agency time to create a safeguards system slowly and relatively free from outside criticism. By the time the NPT was signed in 1968 a certain amount of experience and

credibility had been achieved for the safeguards system, and it could be chosen as the primary instrument for verifying the NPT.

This description of the historical process of adoption of safeguards makes clear the differences between the problems of control of nuclear materials and facilities and of chemical or biological materials and facilities. There is no centralized supplier for these latter technologies which can demand controls in return for information or equipment. The knowledge and raw materials for producing chemical or biological weapons are widely spread throughout the world, and the technological/industrial base required to make them already exists in the great majority of states. Indeed, many fear that current trends in the spread of knowledge and technical capability in the *nuclear* field may eventually overwhelm and destroy the effectiveness of the existing safeguards system.[206]

Simply stated, if safeguarding nuclear energy against the proliferation of nuclear weapons had been the only task of the new IAEA in 1957, it is unlikely that the Agency would have been created. Similarly, if preventing the spread of nuclear weapons to new states had been the only purpose of the NPT in 1968 it is unlikely that the Treaty would have been agreed to. This historical lesson must be kept in mind in thinking about institutional arrangements for verifying a chemical or biological weapons treaty.

The political lessons to be learned from the safeguards system relate to the degree to which states are willing to yield on matters of national sovereignty, even when they perceive they have much to gain from such concessions. On its face the acceptance by non-nuclear weapon states of on-site inspections of their nuclear industry represents a significant sacrifice of national sovereignty, especially when one reads the IAEA Statutes which authorize the agency "To send into the territory of the recipient State or States inspectors . . . who shall have access at all times to all places and data and to any person who by reason of his occupation deals with materials, equipment or facilities which are required by this Statute to be safeguarded".[207]

The reality, however, is far from the ideal envisaged in this statute. In fact, any investigations beyond routine inspections can only proceed with the permission of the state to be investigated, and any refusal to accept an investigation can be dealt with only by arbitration, which may be quite lengthy, or sanctions, which involve at most a report of the state's unwillingness to cooperate and suspension of the state from membership in the Agency and of any assistance the state may be receiving. Other limitations allow states to invoke "unusual circumstances" to limit access of inspectors and to complain if inspections are "being deployed with undue concentration on particular facilities". Another provision allows states to refuse to accept particular inspectors for whatever reasons they choose.[208]

These restrictions are often frustrating, and one former IAEA inspector has expressed his frustration as follows: "The difficult part of the job is that you

must prepare yourself mentally to ignore the many signs that may indicate the presence of clandestine activities going on in the facility adjacent to the reactor, facilities that you were not permitted to inspect".[209]

At the same time it must be noted that the restrictions on IAEA inspections are not static, and improvement is possible. For example, it was assumed for many years that the operators of gas centrifuge enrichment facilities would not permit inspectors to enter the 'cascade' area, that is, the hall where the centrifuges are located.[210] This restriction derived from the desire on the part of the plant operators to protect industrial secrets, but it seriously undermined the credibility of the safeguards system at centrifuge facilities because of the possiblity of modifying the cascade to produce highly enriched uranium without the inspectors' knowledge. Fortunately, there has been some progress in solving this problem, and those NPT states that have centrifuge facilities are showing a greater willingness to consider inspections of the cascade halls.[211] Such progress is important in helping to sustain and improve the credibility of the safeguards system, but much more needs to be done to lift the many restrictions which now prevent inspectors and containment/surveillance devices from applying the most effective possible safeguards to nuclear facilities.

The lesson to be drawn from the safeguards experience is clear: even the most comprehensive and intrusive on-site inspection system yet devised has not succeeded in infringing in any significant manner on the traditional sovereign rights of states.[212] That such infringements are also unlikely in the future can be seen, for example, in the 'first basic principle' of the Soviet approach to verification (see chapter 3, p. 140) which rejects any form of verification that would "prejudice the sovereign rights of states or permit interference in their internal affairs". Any future international verification system will have to do the best it can within the limits established by this principle, which history has shown is not held solely by the Soviet Union.

Satellite monitoring

The previous argument does not prove that progress towards effective international verification of arms control is impossible, only that it will be slow and will depend strongly on the difficult process of relaxing jealously defended concepts of national sovereignty. But these concepts do evolve, and one significant evolutionary change has already been described earlier in this chapter: the acceptance of the legitimacy of satellite reconnaissance as a national technical means of verification. The question immediately arises: if this activity is acceptable as a *national* technical means, why not as an *international* technical means?

Just such a question has been posed by the French proposal at the 1978 UN Special Session on Disarmament to create an International Satellite Monitoring Agency (ISMA).[213] The French proposal noted the international

significance of recent and potential technological progress in this field and proposed that "within the framework of current disarmament efforts, this new monitoring method should be placed at the service of the international community".[214] Such an agency could offer its services to any group of states who needed it to monitor arms control or non-aggression agreements, much in the way that the IAEA offers to implement safeguards agreements between nuclear suppliers and purchasers.[215]

A study of the ISMA concept was commissioned by the UN Secretary General, and a report was published in 1983. Its essential conclusions were:

1. An ISMA is technically feasible and could be built up in stages to include image processing, data transmission and satellite facilities.
2. Nothing in existing international law would prohibit an international agency from carrying out monitoring activities from satellites.
3. The costs, while uncertain and certainly greater than any previous international/technical undertaking, would still be less than one per cent of total annual expenditures on armaments.[216]

As might be anticipated, both US and Soviet reactions to this proposal have been negative. The objections were very similar, both noting that arms control or disarmament agreements must deal with individual weapons and conditions and that the verification measures emphasized must be tailored to fit the special needs of each treaty. Therefore, according to the Soviet representative, "the formation of any supervision and monitoring organs not connected with the implementation of various practical disarmament measures would simply create the appearance of doing something in this sphere".[217] To the US representative, "An agency created to verify arms-control agreements not yet in existence would be premature ... It would be a mistake to create costly capabilities which could prove ill-suited to their tasks".[218] It is ironic that these comments should come from the two states who have deployed vast numbers of nuclear weapons, weapons which "simply create the appearance of doing something" in the military sphere and which have proven singularly "ill-suited to their tasks".

These objections can be characterized as political, arising from a reluctance on the part of the two leading space powers to relinquish any of their dominance in this field. But even if these arguments are discounted there remain serious problems with the concept of an ISMA which must be addressed before much progress can be expected. Many of these problems arise from the fact that the technology required to operate such an agency is highly sophisticated and expensive and requires many skilled and dedicated personnel. This, coupled with the knowledge that the effort to create such an agency can expect little or no help from the two states with the greatest technical and financial resources in this area, means that any ISMA will have to begin on the initiative and resources of smaller, less technically competent states and will have to overcome the wide variations in technical and financial capabilities

in the international community. The IAEA safeguards system gives evidence that these difficulties can be overcome to some extent, but the safeguards system has enjoyed the full support of the superpowers and still suffers from serious difficulties in recruiting qualified personnel from the developing states.[219]

Another problem in creating a fully international satellite monitoring agency would be the absence of any existing international institutional and scientific base on which it could be constructed. This can be contrasted, for example, with the concept of an international seismic monitoring agency which is greatly aided by the long history of international co-operation among seismologists. Such co-operation was from the beginning inherent in the nature of the field in which they did their research.

There is no comparable international scientific community for satellite monitoring. In fact, the institutional base for satellite monitoring has evolved from the field of military intelligence, probably the least international field one can imagine. While one can easily envisage co-operation within the international community of astronomers in looking *away* from the Earth, it is much more difficult to imagine co-operation among intelligence agencies in looking *towards* the Earth. Decades of accumulated bureaucratic habits of secrecy would need to be overcome to make such collaboration possible.

While these problems argue persuasively against any early creation of an ISMA, it has been argued that some activity can at least be started in the form of *regional* satellite monitoring agencies, and here the prospects seem somewhat more promising.[220] The argument here is that some infrastructure for co-operation in space already exists in Europe in the form of the European Space Agency in the West and the Intercosmos Council in the East. There is also the historical precedent of Soviet–French co-operation in space. Of course, any such agency which included Soviet or Warsaw Treaty Organization participation would have to overcome the political objections of the Eastern bloc noted above. These objections have not noticeably softened since 1979, and the WTO states voted as a bloc against a UN General Assembly resolution in 1982 to request a further report on practical measures to implement an ISMA.[221]

A possibly more hopeful development is the embryonic French–West German collaboration on a photographic reconnaissance satellite.[222] Discussions of such a project have already taken place between high-level officials of France and FR Germany, and French research and development on the imaging system is at a relatively advanced stage.

A collaboration on such a militarily sensitive venture between two states whose histories have been marked by frequent wars and deep distrust would be a highly significant step in establishing the credibility of international co-operation in verification. Its success would very likely attract other West European states into participation and thereby ease the considerable financial burden such a system would impose on its members. Even more interesting is

the possibility that the potential success of such a project leading to a diffusion of political control over satellite monitoring data may cause the USA and USSR to reconsider their opposition and attempt to retain their influence on developments in this area by collaborating with the project rather than ignoring or opposing it.[223] There is a historical precedent for this kind of behaviour in the Atoms for Peace programme (see above, p. 232) in which the United States recognized the failure of its attempt to prevent nuclear weapon proliferation by a policy of secrecy and chose instead to attempt to control proliferation by offering collaboration in nuclear energy development. Whether or not the Soviet Union could be drawn into such a collaboration is an entirely different question, but the overall point seems clear: if an international collaboration in satellite monitoring is to be created, the first steps in demonstrating its feasibility and credibility will have to be taken at the initiative and at the expense of non-superpower states. Such a demonstration will be difficult and expensive but it could serve a historically important function if it succeeded in opening up to some degree the field of satellite reconnaissance to participation by a greater number of states.

If such a multinational space reconnaissance effort is to succeed the problems of data dissemination and secrecy will have to be confronted. The problem of data dissemination and interpretation is already controversial in discussions on the feasibility of an ISMA.[224] One dilemma has been summarized as follows:

> The mere dissemination of data, including auxiliary data, without any interpretation by the Agency, would tend to promote confidence in the accuracy and impartiality of the findings, because no human evaluation would be involved. However, the adoption of this format for the ISMA reports would produce unintelligible information for those users who do not possess appropriate technology and skills to do their own interpretation. This method would clearly discriminate in favour of the technologically more advanced states. It therefore seems that an ISMA's role would be to provide a factual report based on the processing and analysis of the data available to it. The Group also recognized that inconclusive or contradictory interpretation could emerge in the course of analysis of data by teams at the Image Processing and Interpretation Centre (IPIC) and was of the view that in such cases it might be necessary to provide the users with more than one analysis together with data used for such analyses.[225]

This problem is familiar from the earlier discussion of the credibility problem for national intelligence and verification agencies, and there are good reasons to believe it would be at least as difficult to solve in an international context.

Another set of contradictory forces are the legitimate requirements of confidentiality and the need for openness and freedom of access to information by all interested parties. In this case the experiences in applying IAEA

safeguards and in designing an international seismic information exchange give some hope that a solution can be found. The former system has found ways to confine inspectors to certain well defined areas and tasks, sufficient to carry out their safeguards duties while still protecting commercial and technical secrets. The seismic information network contemplates a very open information exchange, but in this area the collateral information acquired beyond what is needed for verification purposes is neither militarily nor commercially sensitive and would in fact be highly useful for scientific research activities.

While such experiences are encouraging they cannot be extrapolated directly to an ISMA. The collateral information collected by high-resolution satellite photography (and the system would have to have a high-resolution capability to be an effective verification tool) can be extremely sensitive both militarily and commercially. An international staff handling and interpreting such information would have to have a high degree of integrity and protection against the inevitable pressures from unauthorized parties or states to obtain information. Data might be encrypted for transmission,[226] and employee clearance systems might be used to limit access to sensitive material, but the more this is done the more cumbersome and opaque the process of analysis and evaluation becomes. The balance, if and when it is found, will be a delicate one just as it is in any intelligence agency.

Confidence-building measures

The two traditions so far discussed began in very different ways and have evolved different mechanisms for international verification, yet they have begun in recent years to converge as problems of greater military significance, such as banning chemical weapons or underground nuclear weapon tests, have been tackled. Alongside this slow convergence, the even slower evolution of a third tradition has taken place, born in the European context but also potentially applicable in a wider international arena. These are the so-called confidence-building measures (CBMs)—now generally referred to as confidence- and security-building measures (CSBMs)—which first appeared as part of the Final Act of the Conference on Security and Co-operation in Europe (CSCE) signed in Helsinki in 1975.[227] In the same tradition, and closely associated with the CSCE process both historically and politically, are the Mutual Force Reduction negotiations which have been going on in Vienna since 1973.[228] The CSCE process has evolved since 1975 through a review conference in Belgrade in 1978, and another in Madrid, which lasted from 11 November 1980 to 6 September 1983.[229] The latter accomplished little more than to arrange for another Conference on Confidence- and Security-Building Measures and Disarmament in Europe, which began its work in Stockholm in January 1984.[230]

Many of the verification issues already discussed in other contexts have

arisen in the course of the MFR talks and there is no need to repeat or amplify what has been said before. Suffice it to say that the parties to the talks have managed to agree on an impressive list of verification provisions which would be included in a future agreement (see table 1, p. 5):

> (*a*) periodic exchanges of data after force reductions;
> (*b*) notification of the beginning and end of reduction steps;
> (*c*) prenotification of large military movements into and out of the reduction zone;
> (*d*) permanent observation posts at the exit and entry points of the reduction zone;
> (*e*) non-interference with national technical means of verification;
> (*f*) the use of on-site inspections; and
> (*g*) establishment of a consultative commission to resolve ambiguities about compliance.[231]

This list of agreed verification provisions, and in particular the agreement in principle to on-site inspections, can be taken as a good measure of the convergence in attitudes of the two major European alliances which have taken place over the years on the issue of verification. Virtually all the crucial elements for an adequate verification regime are present, but, while some have suggested that an agreement is now quite close,[232] others suggest that serious problems still remain and cite verification as the major stumbling block.[233]

The only remaining verification problem which seems at all serious is the amount of on-site inspection which will be acceptable to all parties. The Western side is demanding an annual quota of up to 18 on-site inspections, using both ground and aerial techniques.[234] As usual it is the Eastern side which is most obviously resisting this concept, asking instead for on-site inspections only by invitation in response to challenges by the other side. But it is not only the Warsaw Treaty Organization states who have such reservations. It has been reported that "Some Western countries were already not comfortable with the idea of on-site inspections by the East ... with the more stringent measures, Western agreement on the associated measures was going to be even more difficult".[235] This again illustrates, if any further illustration is necessary, that resistance to on-site inspection is not a uniquely Eastern phenomenon. It also illustrates that, whatever the issue, multilateral negotiations are more difficult than are bilateral ones. In the MFR talks, for example, even if the USA and USSR could agree on an on-site inspection scheme which suited their needs, much political work would remain to be done to convince the central European states, on whose territories and in whose military installations the inspections would take place, that such inspections were in their interests as well.

An even stronger example of the agonizing slowness with which such multilateral negotiations proceed is the CSCE process in which 35 states are participating. The focus of these negotiations has been more political than military, so that verification issues are not prominent. But the process also

recognizes that political progress is far more difficult when military threats are made and/or perceived by the negotiating parties. Hence the recognition of the need for confidence-building measures designed to reduce the perception of military threat in Europe and facilitate political accommodation.

After 11 years of work the CSCE process has produced the following set of confidence- and security-building measures: (*a*) prior notification (minimum of 21 days) of military manoeuvres exceeding a total of 25 000 troops; (*b*) exchange of observers at military manoeuvres on a voluntary basis; and (*c*) voluntary prior notifications of smaller manoeuvres and major military movements.[236]

These are, to say the least, modest beginnings towards a reduction of the perception of military threat in Europe, and the experience of the first eight months of the Stockholm Conference, whose mandate is to strengthen and expand these measures, suggested that progress will continue to be slow and modest.[237]

The record of notification of military manoeuvres under the CSCE stands as a good example of the problematic relationship between verification and confidence building. From 1975, when the agreement entered into force, until the end of 1983 there were 130 notifications of 100 manoeuvres involving a total of several million troops.[238] Yet there was one instance of a failure to notify properly: the Soviet Union's 'Zapad-81' manoeuvres, which were allegedly carried out "to improve co-ordination and co-operation between units from different branches" and which took place in the Byelorussian and Baltic military districts and the Baltic Sea.[239]

The prior notification provision of the CSBM document requires not only that the purpose and location of the manoeuvres be included in the notification but also the 'designation' of the manoeuvre (which seems to mean nothing more than its code name) and the number of troops to be involved.[240] The Soviet Union did not provide the latter two pieces of information and was therefore in technical violation of the treaty.[241] When the USA requested the information through diplomatic channels the Soviet Union is reported to have argued that the provision of such information was voluntary and that the CSBM notification measures in the agreement are 'guidelines', not requirements.[242] While it is true that the Helsinki Final Document emphasizes the voluntary nature of these notifications, the word 'guidelines' does not appear in the Document, and the specification of the information to be provided seems quite unambiguous.[243] If the Soviet Union does view these specifications only as guidelines, it is still remarkable that the Zapad-81 manoeuvre was the only one of many in which the guidelines were violated.

The manoeuvres took place between 4 and 12 September 1981 at a time when political developments in Poland were moving in a direction unpalatable to the Soviet Union, and given the location of the manoeuvres it is difficult to escape the suspicion that the Soviet Union was conscious of their potential political impact on Poland and Europe in general. The purpose of the prior

notification provision is to remove any possible perception of threat in such manoeuvres, and the failure to notify properly, especially in time of political tension, is a serious matter. The United States government has seen it as serious enough to warrant inclusion of this incident in its list of alleged Soviet violations submitted to the Senate in January 1984.[244]

There is no question that a technical violation did occur; but this is not the place to speculate either on the reasons for its occurrence or its overall political significance. What must be noted here, however, is the unpleasant fact that one such technical violation at a politically sensitive moment can go far towards undermining the confidence built up by the record of compliance in more than 100 other cases. Such is the fragility of any verification effort built on the assumption that heavily armed adversaries can somehow gain a sense of security by being allowed a slightly better look at the forces of the other side. As long as a verification system is constrained to operate under such an assumption its role as a confidence-building mechanism will be deeply problematic.

An international verification agency

The three traditions evaluated here evolved towards different forms of international institution for verification. Monitoring of a comprehensive test ban would require an international seismic network; a chemical weapons ban would require a permanent consultative commission; the NPT already uses the services of the IAEA. To this can be added the suggestions for regional or international satellite monitoring agencies.

In view of this proliferation of verification agencies and of the important role played by interactions or synergisms among them, it is reasonable to ask whether it would not be more equitable, effective and efficient to combine all such international verification responsibilities and place them under the auspices of an international verification agency. There have been a number of proposals for the creation of such an agency,[245] one example being the 'International Disarmament Control Organization' suggested by Alva Myrdal in 1974.[246] If such an organization were to be created, "Its immediate function should be to act as an intermediary, or a clearing house, for providing knowledge about the implementation of disarmament agreements".[247] Other possible functions for the organization might be to collate knowledge from scientific journals, production statistics and other open sources and develop standardized techniques of reporting information and data relevant to verification problems.

In order for the organization to function free of political influence, "It would be important ... to maintain a strict separation of powers: the International Disarmament Control Organization should never itself pronounce verdicts. It should only assemble, collate, coordinate and transmit data."[248] In this respect it would resemble such other successful international collabora-

tions whose purpose is to improve communications and international co-operation in fields such as health (World Health Organization), civil aviation (International Civil Aviation Organization) and telecommunications (International Telecommunications Union) and others.[249]

Yet it must be kept in mind that the data and information such an organization would handle are the most sensitive kind—they relate to the national security of states. It is not realistic to imagine that the process of verification can so clearly be divided into an objective component (i.e., assembly, collation, co-ordination and transmission) and a subjective or political component (i.e., analysis, evaluation and response).

Even the act of assembling information has political content, since not all possible information can be assembled and choices must inevitably be made as to what kinds of information are important and what kinds not important. Imagery data from satellites, for example, are inherently selective—it is impossible to photograph the whole Earth at high resolution at regular intervals—which implies that choices must be made as to where to take pictures and what sort of picture to take. Imagery data from states involved in disputes with other states cannot have the same non-political character as other imagery data.[250]

These criticisms do not invalidate the concept of such an organization, and certainly there are powerful moral and political reasons for exploring the possible benefits to be gained from creating it. But the historical record and the current international political climate provide little basis for optimism that it could be created in the foreseeable future. It may well be that once some multinational verification mechanisms have demonstrated their effectiveness and have created a useful record of experience, an organization like the one described would become feasible. But unless it is accompanied by progress in solving the more fundamental problems of war and militarism—the problems that make verification necessary—it could not hope to be very effective.

Conclusion

While the achievements of international verification measures are considerably less than one might hope for, they are at the same time more positive and useful than perhaps one has the right to expect. The three traditions examined in this chapter have been evolving for many years, and in that time a substantial number of creative and useful innovations have appeared and have remained to develop experience and institutional momentum.

Institutions such as the IAEA safeguards system, the Conference on Disarmament, the International Seismic Data Exchange and a number of standing consultative commissions or expert committees, all represent a level of cooperation and concern unprecedented in history. Experience with these institutions is cumulative, and each has produced innovations which not only improve its own performance but which provide models for adaptation in

other arms control contexts. While the centre of gravity of the arms competition still sits squarely between the two great powers, the centre of gravity of pressure for disarmament is substantially displaced into a more international location. It is important that international verification efforts continue to develop and that states other than the USA and the USSR continue to take initiatives and develop creative alternatives to bilateral treaties and national technical means of verification.

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