Appendix 15B. Ballistic missile defence

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I. Introduction

The year 2003 witnessed an increase in missile defence-related activities. The United States continued to pursue an ambitious research and development (R&D) programme aimed at building a multi-layer missile defence system to protect the territory of the USA and its allies. The system's architecture will evolve over time as improved interceptors and sensors are developed. In Europe and Asia there was growing interest in regional anti-missile systems as well as in participating in joint missile defence development programmes with the USA.

This appendix summarizes the main developments related to missile defence in 2003.[1] Section II examines current US missile defence programmes, focusing on the initial system scheduled to become operational in 2004. It also highlights concerns about the technological maturity of key missile defence programme elements. Section III considers the international dimension of missile defence. It describes European activities related to missile defence as well as the interest of the North Atlantic Treaty Organization (NATO) in a possible regional missile defence system. It also describes missile defence programmes under way in Israel and Asia, focusing on Japan's decision to develop jointly with the USA a multi-layer missile defence system. Section IV provides the conclusions.

II. US missile defence programmes

In 2003 the US Missile Defense Agency (MDA) continued to pursue plans for an expansive missile defence system. It also accelerated R&D and procurement programmes for key weapon and sensor systems so that it could begin to deploy an initial set of missile defence capabilities in 2004.[2] This goal had been set out in a National Security Presidential Directive signed by President George W. Bush in December 2002.[3] The MDA was instructed to begin deploying in 2004–2005 an initial missile defence system 'to meet the near-term ballistic missile threat' to the USA's 'homeland, deployed forces and friends and allies'.[4] According to the directive, the USA intends to pursue an 'evolutionary approach' to the development and deployment of missile defences.[5] Rather than settling on a final missile defence archi-

[1] See also appendix 12D in this volume.

[2] Prior to Jan. 2002, the MDA was known as the Ballistic Missile Defense Organization (BMDO).

[3] The White House, 'National Security Presidential Directive/NSPD-23: national policy on ballistic missile defense', Washington, DC, 16 Dec. 2002, URL <http://www.fas.org/irp/offdocs/nspd/nspd-23.htm>.

[4] US Department of Defense, 'Missile defense operations announcement', News Release no. 642–02, 17 Dec. 2002, URL <http://www.defenselink.mil/news/Dec2002/b12172002_bt642-2.html>.

[5] The White House (note 3). See also The White House, Office of the Press Secretary, 'National policy on ballistic missile defense fact sheet', Washington, DC, 20 May 2003, URL <http://www.whitehouse.gov/news/releases/2003/05/20030520-14.html>.

Table 15B.1. Funding for the US Missile Defense Agency, fiscal years 2002–2006

Figures are for authorized funds, in US $m. at current prices.

FY 2002	FY 2003	FY 2004	FY 2005[a]	FY 2006[b]
7 648	7 230	7 674	9 169	8 701

[a] Requested.

[b] Estimated.

Sources: US Missile Defense Agency (MDA), 'Fiscal year (FY) 2005 budget estimates overview', Press Release (n.d.), URL <http://www.acq.osd.mil/bmdo/bmdolink/files/budget05.doc>; and US MDA, 'Fiscal year (FY) 2004/FY 2005 biennial budget estimates submission', Press Release (n.d.), URL <http://www.acq.osd.mil/bmdo/bmdolink/pdf/budget04.pdf>.

tecture, the USA will deploy an initial set of capabilities that will evolve over time to meet 'the changing threat and take advantage of technological developments'.[6] This capabilities-based acquisition process, also called 'spiral development', departs from the traditional US approach to weapons procurement in that the MDA cannot estimate the overall cost of the missile defence system or determine its final capabilities; the size and composition of the system's architecture will change over time as new layers of increasingly capable weapons and sensors are added. The spiral development process also departs from usual practice in that the MDA intends to deploy individual systems before they are fully tested, in order to speed up the deployment of an initial anti-missile capability.[7]

The MDA has grouped US missile defence programmes into a single Ballistic Missile Defense System (BMDS). The previous US Administration's distinction between theatre missile defences (those designed to intercept short- to medium-range ballistic missiles) and strategic defences (those designed to intercept long-range missiles) has been dropped. In 2003, the MDA reorganized its programme activities into two-year time windows, or blocks, consisting of specified 'packages of capabilities' (e.g., Block 2004 represents capability goals to be achieved in 2004–2005, Block 2006 represents 2006–2007, etc.). These will be transferred sequentially to a BMDS Test Bed (integrated testing infrastructure) for component testing and system integration work as part of the spiral development process.[8]

Under the Bush Administration, missile defence has been a top spending priority for the Department of Defense (DOD). Most spending has been on research, development, testing and evaluation (RDT&E) programmes. To finance plans for the short-term deployment of a rudimentary anti-missile capability, the MDA has requested for fiscal year (FY) 2005 an increase of nearly $500 million over planned spending, to $9.17 billion.[9] In FY 2004, a total of $7.67 billion was authorized for MDA programmes.

[6] The White House (note 3).

[7] Hitchens, T. (with Samson, V.), 'Technical hurdles in US Missile Defense Agency programs', ed. C. Moltz, *New Challenges in Missile Proliferation, Missile Defense and Space Security*, Occasional Paper no. 12 (Center for Nonproliferation Studies and Mountbatten Centre for International Studies: Monterey, Calif., July 2003), p. 12, URL <http://cns.miis.edu/pubs/opapers/op12>.

[8] Statement of Lt Gen. Ronald Kadish, United States Armed Forces Director, MDA, Missile Defense Program and Fiscal Year 2004 Budget before the Senate Armed Services Committee, 18 Mar. 2003, URL <http://www.senate.gov/~armed_services/statemnt/2003/March/Kadish.pdf>.

[9] US MDA, 'Fiscal year (FY) 2005 budget estimates overview', Press Release (n.d.), URL <http://www.acq.osd.mil/bmdo/bmdolink/files/budget05.doc>.

In 2003 a number of countries in Europe and Asia indicated that they would participate in the US missile defence system. In addition to decisions by NATO members Denmark and the United Kingdom, which paved the way for key US radar facilities based on their territories to be used as part of the system's sensor architecture (see below), Australia announced in December that it would take part in the evolving US programme. Its participation could include detecting ballistic missile launches, developing ship- or ground-based sensors or contributing to other R&D work.[10] In early 2004 Canada, another NATO member state, agreed to hold further discussions with the USA aimed at formalizing its participation in US missile defence activities.[11]

The initial defence capability

The current focus of the MDA's RDT&E activities is on new land- and sea-based interceptors and associated sensors which are scheduled to be deployed for operational use in 2004–2005. These will be supplemented by the Patriot Advanced Capability-3 (PAC-3) system being deployed by the US Army.

The centrepiece of current US missile defence plans is the Ground-based Midcourse Defense (GMD) system. The GMD will provide an initial capability to defend US territory from long-range ballistic missile attack, beginning in late 2004. It will also be used as part of a missile defence test bed for improving weapon systems and sensor technologies. The MDA estimates that it will spend $21.8 billion over the period 1997–2009 to develop the GMD element. This includes $7.8 billion to develop and deploy the GMD Block 2004 capability and to develop the GMD portion of the test bed over the period 2000–2005.[12]

The GMD will use a multistage Ground-Based Interceptor (GBI) missile carrying an exoatmospheric hit-to-kill vehicle to collide with and destroy incoming long-range ballistic missile warheads in the mid-course phase of their flight trajectories. The MDA will begin placing six interceptors in silos at Fort Greely, Alaska, in the summer of 2004, to be followed by 10 more in 2005. Four interceptors will be deployed at Vandenberg Air Force Base (AFB) in California beginning in late 2004.[13]

In order to provide sensor support, the MDA is upgrading the Cobra Dane early-warning radar at Shemya Island, Alaska, as well as the early-warning radars at Beale AFB, California, and Fylingdales, UK. The US DOD's request to use the UK's radar at Fylingdales as part of the GMD system had been the subject of public debate in the UK.[14] The MDA also plans to modify its early-warning radar located at Thule,

[10] 'Australia volunteers for missile defense', *Arms Control Today*, vol. 34, no. 1 (Jan./Feb. 2004), URL <http://www.armscontrol.org/act/2004_01-02/newsbriefs.asp#Australia>.

[11] Ruppe, D., 'Canada agrees to more missile defense talks with the US', Global Security Newswire, 16 Jan. 2004, URL <http://www.nti.org/d_newswire/issues/2004_1_16.html#BB8EEB0E>.

[12] US General Accounting Office (GAO), *Missile Defense: Additional Knowledge Needed in Developing System for Intercepting Long-Range Missiles*, GAO-03-600 (GAO: Washington, DC, Aug. 2003), p. 3.

[13] Graham, B., 'US missile defense set to get early start', *Washington Post* (Internet edn), 2 Feb. 2004, URL <http://www.washingtonpost.com/wp-dyn/A4411-2004Feb1.html>.

[14] On 5 Feb. 2003, British Minister of Defence Geoff Hoon announced that the British Government had agreed to the US request to upgrade the UK's early-warning radar at Fylingdales for missile defence purposes. British Ministry of Defence, 'MOD responds to US request to upgrade RAF Fylingdales', Press Notice no. 025/03, 5 Feb. 2003, URL <http://news.mod.uk/news/press/news_press_notice.asp?newsItem_id=2271>.

Table 15B.2. Summary of the principal US missile defence programmes, as of 1 January 2004

Programme	System	Status
Interceptor systems		
Patriot Advanced Capability-3 (PAC-3)	Land-based, air-transportable launcher, equipped with single-stage hit-to-kill interceptor missile, and associated radar and engagement control station[a]	Acquisition programme accelerated in 2003; US Army to receive a total of 238 PAC-3 missiles by end of 2004
Theater High Altitude Area Defence (THAAD)[b]	Truck-mounted launchers equipped with hit-to-kill interceptor missiles, mobile ground-based radar, and battle management, command and control (BMC2) system	Passed Critical Design Review in Dec. 2003, following comprehensive design changes; flight testing halted in 1999, to resume in late 2004
Ground-based Mid-Course Defence (GMD)	Multistage Ground-based Interceptor (GBI) missiles carrying hit-to-kill vehicle for intercepting long-range ballistic missiles; GMD Fire Control and Communications (GFC/C) system	6 interceptors to be deployed in silos at Ft Greely, Alaska, by Sep. 2004 and 4 at Vandenberg AFB, Calif., by end of 2004; 10 more interceptors will be based at Ft Greely by end of 2005
Sea-Based Mid-course Defence	Aegis cruiser equipped with reconfigured AN/SPY-1 radar and 3-stage Standard Missile-3 (SM-3) hit-to-kill interceptors for intercepting short- to medium-range ballistic missiles[c]	3 Aegis cruisers to be equipped with 'up to 10' SM-3 missiles during 2005; 10 cruisers to receive radar upgrades. 4 interception tests conducted with SM-3 in 2003, 3 were termed successful
Airborne Laser (ABL)	Modified Boeing 747 aircraft carrying a modular, megawatt-class chemical laser, designed to shoot down ballistic missiles in boost phase[d]	Serious technical problems with laser; 'lethality demonstration' scheduled for 2005; modified aircraft flight tested in 2002
Sensors[e]		
Space Tracking and Surveillance System (STSS)[f]	Constellation of low-earth orbit satellites for tracking post-boost and mid-course re-entry vehicles and for 'discriminating' warheads from decoys	Two satellites to be launched in 2007 as part of Ballistic Missile Defense System (BMDS) Test Bed;[g] size of operational system not determined
Space-Based Infra-red System–High (SBIRS–High)	4 satellites in geosynchronous orbit to provide early warning of ballistic missile launches	First satellite to be launched in 2007
Sea-based X-band Radar (SBXBR)	High-resolution radar based on off-shore platform for detecting incoming missiles and providing tracking data	Radar to be completed in 2005 for the BMDS Test Bed[g] and initial defensive operations

[a] The Patriot is designed to intercept short- to medium-range ballistic missiles, in the terminal phase of their flight trajectories inside the earth's atmosphere.

[b] THAAD is designed to intercept short- to medium-range ballistic missiles above the earth's atmosphere, in the mid-course phase of their flight trajectories, as well as inside the atmosphere.

[c] Pentagon plans call for the Aegis system to eventually be able to intercept long-range ballistic missiles using an upgraded interceptor missile.

[d] That is, the interception of the target missile occurs during the powered, ascent phase of its flight.

[e] The MDA also plans to upgrade several existing early-warning radars, including those based at Beale Air Force Base, Calif.; Fylingdales, UK; and Thule, Greenland.

[f] The STSS was formerly known as the Space-Based Infrared System–Low (SBIRS–Low).

[g] The Ballistic Missile Defense System Test Bed is intended to assess the various elements of the layered missile defence architecture and how they function together.

Sources: US Missile Defense Agency (US MDA), 'Fiscal year (FY) 2005 budget estimates overview', Press Release (n.d.), URL <http://www.acq.osd.mil/bmdo/bmdolink/files/budget05.doc>; US MDA, Fact sheets (various), URL <http://www.acq.osd.mil/bmdo/bmdolink/html/factsheet.html>; and Arms Control Association, 'US missile defense programs at a glance', Fact sheet, Sep. 2003, URL <http://www.armscontrol.org/factsheets/usmissiledefense.asp>.

Greenland, to be able to track incoming missiles, following the Danish Parliament's approval in May 2003 of a government proposal to open talks with the USA on modernization of the radar facility.[15] In addition, the MDA is building a sea-based X-band (SBX) radar which is to be located on a platform off the coast of Alaska and will be 'fully integrated and available' by the end of 2005.[16]

As part of the initial defence capability, by the end of 2005 three Aegis cruisers carrying 'up to 10' Standard Missile-3 (SM-3) interceptors will be placed on alert.[17] An additional 10 Aegis warships will be modified with a reconfigured AN/SPY-1 radar for improved missile detection and tracking capabilities.[18]

The MDA has accelerated its efforts to achieve an initial operating capability by the autumn of 2004, despite a number of design and engineering problems in key programmes. A series of technical setbacks and accidents in developing the GBI has significantly delayed the selection and flight testing of the booster missile.[19] This means that the MDA is likely to place the initial GMD interceptors on alert with relatively little flight testing.[20] The MDA has also been forced to reduce the number of SM-3 interceptors planned for delivery in Block 2004 because of technical problems with the kill vehicle.[21]

[15] Agence France-Presse, 'Danish Parliament approved missile defence talks with USA', International Network of Engineers and Scientists for Global Responsibility, 27 May 2003, URL <http://www.inesglobal.com/whats_new_in_ines/wn17_03.html#Danish>.

[16] US MDA, 'Sea-based X-band radar (SBX)', Fact sheet, 30 Jan. 2004, URL <http://www.acq.osd.mil/bmdo/bmdolink/pdf/sbx.pdf>.

[17] US MDA (note 9).

[18] US MDA (note 9).

[19] A 3-stage booster built by Orbital Sciences Corp., a Boeing subcontractor, will be used for the initial GMD deployment of up to 10 ground-based interceptors. Orbital was awarded a contract in Mar. 2002 to build an alternative boost vehicle after the original contractor ran into significant problems and delays. US Department of Defense, 'Missile Defense Agency booster rocket programme', Press Release no. 831–03, 7 Nov. 2003, URL <http://www.defenselink.mil/releases/2003/nr20031107-0626.html>.

[20] The first GMD integrated flight test, using the Orbital booster, took place on 26 Jan. 2004. Several additional ground and flight tests are planned for 2004, including at least 2 intercept tests. US MDA, 'Missile defense booster test is successful', 27 Jan. 2004, URL <http://www.acq.osd.mil/bmdo/bmdolink/html/ift13b_test.html>.

[21] US MDA (note 9).

There have also been significant delays in developing key sensor components for Block 2004. The GMD interceptors were to have been guided by a new X-band radar, to be built at the Shemya Island facility by 2004.[22] Because of schedule slippages caused by the technical problems, the MDA appears to have shelved the planned radar, at least for the time being. The new $900 million SBX radar will not be completed until the end of 2005 at the earliest. In the meantime, the MDA plans to upgrade the older Cobra Dane radar located on Shemya Island, which was originally designed to track missiles launched from the Soviet Union, for use in the initial missile defence capability scheduled for 2004. However, the upgraded radar will have only a limited ability to track missiles launched towards the USA from the Democratic People's Republic of Korea (DPRK, North Korea), and there are no plans to use the radar in integrated flight-tests before FY 2007.[23]

In 2003 the Bush Administration's decision to proceed with deployment of a short-term missile defence system continued to come under fire from critics for abandoning traditional DOD procurement standards and practices by deploying weapon systems before they had been tested and shown to operate effectively.[24] In his annual review of major new weapons, Thomas Christie, the current head of the US DOD's Office of Operational Testing and Evaluation, expressed concern about the decision to begin deploying an initial missile defence capability in 2004, before it has been demonstrated that key weapon systems and sensors can function in realistic operational tests designed to simulate real-world conditions.[25] He noted that, because of a limited testing schedule hampered by engineering setbacks, 'it is not clear what mission capability will be demonstrated prior to initial defense operations'; much of the current assessment is 'based primarily on modeling and simulation' and tests of sub-systems rather than 'end-to-end operational testing of a mature integrated system'.[26] A similar concern had been expressed in a report released in April 2003 by the US General Accounting Office (GAO). The report warned that the MDA's decision to begin 'system integration of its first block with immature technology and limited testing', which was driven by the presidential directive to deploy an initial defence system by the autumn of 2004, placed it 'in danger of getting off track early and impairing the effort over the long term'.[27]

[22] In 2002, MDA officials testified before Congress that a GMD without an X-band radar would not have any meaningful capability to intercept incoming missiles. Hitchens (note 7), p. 11.

[23] US General Accounting Office (note 12), pp. 16–17. It is unclear whether the planned software upgrades to the Cobra Dane radar will give it the real-time data processing and communications capabilities needed for this new defensive role.

[24] See, e.g., Coyle, P., 'Is missile defense on target?', *Arms Control Today*, vol. 33, no. 8 (Oct. 2003), p. 9. Critics charge that the 'spiral development' approach limits the ability of Congress to oversee spending on key MDA programmes by circumventing the usual DOD acquisition process.

[25] Graham, B., 'Missile defense testing may be inadequate', *Washington Post* (Internet edn), 22 Jan. 2004, p. A4, URL <http://www.washingtonpost.com>; and Richter, P., 'Missile defense system doubts', *Los Angeles Times*, 22 Jan. 2004, p. A8.

[26] Quoted in Graham (note 25).

[27] US General Accounting Office, *Missile Defense: Knowledge-Based Practices are Being Adopted but Risks Remain*, GAO–03–441 (GAO: Washington, DC, Apr. 2003), p. 2.

III. International missile defence developments

The proliferation of short- and medium-range ballistic missiles has sparked a growing interest in missile defence systems in countries other than the USA.[28] Several countries, including India, have programmes under way to develop missile defence systems.[29] The Republic of Korea (South Korea) has indicated that it is considering the creation of an independent missile defence capability.[30] Other countries are modifying existing air defence systems to give them some anti-missile capability. In Russia the S-400 air defence system has been touted as being at least as capable as the PAC-3. There are also several missile defence development programmes under way which involve significant international cooperation with the USA.

Europe

Efforts to create a common European missile defence capability took an important step forward on 13 November 2003 when the European Joint Armaments Cooperation Organization (Organisation Conjointe de Coopération en Matière d'Armement, OCCAR) awarded a contract, on behalf of France and Italy, for a new air defence system with some capability to counter short- and medium-range ballistic missiles.[31] The €3 billion (*c*. $3.4 billion) contract was awarded to Eurosam, a joint venture of MBDA and Thales, for the full-scale development and production of the land-based SAMP/T (Sol-Air Moyenne Portée/Terrestre) Block I interceptor system. Scheduled to enter into service in 2007, the Block I system is intended to provide area defence in support of European rapid-reaction forces. The contract calls for the delivery of 18 missile batteries to France and Italy.[32]

In 2003, transatlantic industrial cooperation on missile defence remained largely inchoate. Although European and US companies have signed several memoranda of understanding on missile defence collaboration, ventures have yet to progress beyond the preliminary phase.[33] There have been a number of factors limiting joint European–US missile defence programmes. These include a reluctance by the DOD to share classified advanced technologies with European partners; the concern of US defence contractors about losing work to European rivals; the limited capabilities of European industries in key areas of missile defence technology; and the unwillingness of European governments to devote more resources to defence.[34]

[28] See, e.g., Western European Union, Interparliamentary European Security and Defence Assembly, 'Missile defence: the need for a common European initiative', document A/1843, 3 Dec. 2003.

[29] 'India: New Delhi increases efforts to develop indigenous missile defense system', Global Security Newswire, 18 Aug. 2003, URL <http://www.nti.org/d_newswire/issues/2003/8/18/11p.html>.

[30] Yoo, Y., 'Missile defense set to take off', *Chosun Ilbo* (Internet edn), 11 June 2003, URL <http://english.chosun.com>.

[31] Taverna, M. and Nativi, A., 'A missile shield for Europe', *Aviation Week & Space Technology*, vol. 159, no. 20 (17 Nov. 2003), p. 28. The SAMP/T Block I is another designation for the Aster 30 air-defence missile designed for shooting down cruise missiles and Scud-type ballistic missiles.

[32] Thales Group, 'Thales strengthens its position in weapon and missile systems', Press Release, 13 Nov. 2003, URL <http://www.thalesgroup.com/press/press_releases/1_6123_236_8663.html>.

[33] Kington, T., 'Hurdles slow US–Europe missile defence', *Defense News*, vol. 18, no. 37 (6 Oct. 2003), p. 10.

[34] Kington (note 33); and Kington, T. and Ratnam, G., 'Europe wary of US missile defense promises', *Defense News*, vol. 18, no. 38 (13 Oct. 2003), pp. 1, 8.

NATO

In 2001, as part of its 1999 Defence Capabilities Initiative, NATO decided to deploy a missile defence system by the year 2010.[35] However, the organization has moved slowly in determining the design of the system architecture. In September 2003, NATO awarded a contract worth €15 million (*c*. $17 million) to a transatlantic consortium, led by Science Applications International Corporation (SAIC), for a study of a missile defence system to protect the territory of its European member states and its peacekeeping forces from attack by short- to intermediate-range ballistic missiles.[36] The aim of the study is to examine 'the technical feasibility, costs and timescales' for a multi-layer missile defence system, which 'may lead to future decisions on proceeding with such a system of systems'.[37]

The main missile defence-related programme under way within NATO is the Medium Extended Air Defense System (MEADS).[38] This is a joint German–Italian–US air defence programme designed to defend forward-deployed troops against short-range ballistic missiles, cruise missiles and aircraft. In 2003 the MEADS programme completed a three-year risk-reduction effort, with a four-year development phase due to start in 2004.[39] The MEADS development programme was combined with that of the PAC-3 in 2003 with the aim of creating an integrated PAC-3/MEADS capability.[40]

Russia and missile defence cooperation

In 2003, Russia and the USA continued to discuss possibilities for cooperation on missile defence. Russian President Vladimir Putin and US President Bush declared at a summit meeting in St Petersburg, Russia, that they intended to 'advance concrete joint projects in the area of missile defense which will help deepen relations between the United States and Russia'.[41] However, a bilateral working group subsequently made little progress in identifying specific projects, reportedly because of disagreements about financing arrangements and political concerns about transferring

[35] Bell, R., 'The pursuit of enhanced defence capabilities', Address by the NATO Assistant Secretary General for Defence Support to the European Defence R&D, Brussels, 24 Jan. 2002, URL <http://www.nato.int/docu/speech/2002/s020124b.htm>. On the Defence Capabilities Initiative see Sköns, E. *et al*., 'Military expenditure', *SIPRI Yearbook 2002: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 2002), pp. 255–57.

[36] NATO, 'NATO missile defence feasibility study: transatlantic industry study team selected', Press Release (2003) 109, 26 Sep. 2003, URL <http://www.nato.int/docu/pr/2003/p03-109e.htm>. In 2001 NATO awarded a contract for an initial feasibility study of a European theatre missile defence system.

[37] NATO (note 36).

[38] MEADS is a mobile, land-based air defence system based on the PAC-3 missile. The system includes launchers, surveillance and fire-control sensors, and battle management/communications centres. The USA has a 55% share in the programme, Germany 28% and Italy 17%. US MDA, 'Medium Extended Air Defense System (MEADS)', Fact sheet, 30 Jan. 2004, URL <http://www.acq.osd.mil/bmdo/bmdolink/pdf/meads.pdf>.

[39] 'MEADS ready for development', *Jane's Missiles & Rockets*, vol. 7, no. 9 (Sep. 2003), p. 5.

[40] US MDA (note 38).

[41] The White House, Office of the Press Secretary, 'Joint statement by President Bush and President Putin', Washington, DC, 1 June 2003, URL <http://www.whitehouse.gov/news/releases/2003/06/20030601-1.html>.

sensitive weapon technologies.[42] Both countries did agree to hold joint exercises using computer simulations in Russia in 2004.

Some progress was made during the year on missile defence cooperation between NATO and Russia. On 4 June, the NATO–Russia Council announced that agreement had been reached on developing a common terminology and conceptual basis for potential future missile defence deployments to support a Crisis Response Operation involving NATO and Russian forces.[43] This would be a follow-up to the first phase of a detailed interoperability study addressing technical requirements and possibilities for cooperation in joint, combined operations. The NRC meeting also announced an agreement on conducting a joint missile defence command post exercise in the USA.[44]

On 15 January 2003 Russian Defence Minister Sergei Ivanov announced that Russia 'will definitely develop theater missile defense systems, as well as space defenses'.[45] Ivanov did not provide information about specific programmes, other than to note that they would be based on existing technologies and that development plans would depend on the country's economic situation. Russia currently deploys several versions of the S-300 and the follow-on S-400 air defence missiles, which have some capability to intercept short- to medium-range ballistic missiles. Russia announced in October 2003 that it had agreed to supply four modernized S-300 missile batteries to Belarus as part of their air defence cooperation.[46]

Japan

In December 2003, the government of Prime Minister Junichiro Koizumi announced that Japan would dramatically increase spending on missile defences and develop and deploy, in cooperation with the USA, a multi-layer missile defence system.[47] The decision marked a major change in Japan's defence policy priorities and came as part of a broader restructuring of the Self-Defense Forces.[48] In 2002–2003 there had been growing Japanese interest in acquiring anti-missile capabilities because of renewed concern about the potential threat posed by North Korea's nuclear and ballistic missile programmes.[49] The annual White Paper of the Japan Defense Agency (JDA) stated that missile defence had become an issue of 'crucial importance'.[50]

[42] 'US–Russia cooperation on missile defense may be slowed', *Missile Defense Newsletter*, Center for Defense Information, 11 June 2003, URL <http://www.cdi.org/newsletter/viewArticle.cfm?documentID=1209&topicID=26&listID=9>.

[43] NATO, 'Statement: meeting of the NATO–Russia Council at the level of Ministers of Foreign Affairs', Press Release, Madrid, 4 June 2003, URL <http://www.nato.int/docu/pr/2003/p030604e.htm>.

[44] NATO (note 43).

[45] 'Ivanov announces intent to build new missile defense systems', *Missile Defense Newsletter*, Center for Defense Information, 22 Jan. 2003, URL <http://www.cdi.org/missile-defense/russia.cfm>; and 'And comments on missile defense', *Russian Foreign Policy and Security Watch*, Radio Free Europe/Radio Liberty, vol. 4, no. 3 (22 Jan. 2003), URL <http://www.rferl.org/reports/securitywatch/2003/01/3-220103.asp>.

[46] 'Russia to supply S-300 missile systems to Belarus', *Russia Journal* (Internet edn), 23 Oct. 2003, URL <http://www.russiajournal.com/news/cnews-article.shtml?nd=40967>.

[47] Pilling, D., 'Japan and US set for joint work on missiles', *Financial Times*, 19 Dec. 2003, p. 5. On Japan's military expenditure see chapter 10 in this volume.

[48] McAvoy, A., 'Japan says it will go ahead with missile defense system', Associated Press, 19 Dec. 2003, URL <http://www.signonsandiego.com/news/world/20031219-0357-japan-missiledefense.html>.

[49] Kamiya, M., 'A disillusioned Japan confronts North Korea', *Arms Control Today*, vol. 33, no. 4 (May 2003), URL <http://www.armscontrol.org/act/2003_05/kamiya_may03.asp>; and Lieggi, S. and Wuebbels, M., 'Will emerging challenges change Japanese security policy?', *Issue Brief*, Nuclear Threat

The new Japanese missile defence plan envisages a two-tier missile defence system against short- and medium-range ballistic missiles. The upper tier will consist of naval destroyers with upgraded Aegis radar systems that will track incoming missile warheads and intercept them, during the mid-course phase of their flight trajectory, with the SM-3. The lower tier will consist of land-based PAC-3 missiles that will intercept warheads inside the earth's atmosphere during the terminal phase of their flight trajectories. As an additional component of the new missile defence system, the JDA has announced that it will develop a new type of early-warning radar and upgrade seven sets of the currently used radar, called the FPS-3, as part of its effort to build an 11-site network to detect and track ballistic missiles.[51]

Because of budgetary and technical constraints, Japan initially will not be able to deploy enough missile interceptors to defend the entire archipelago. JDA planners will reportedly concentrate first on protecting large urban areas and strategic bases, using PAC-3 batteries and at least one Aegis-equipped destroyer, in order to create a 'partial deterrent' to a North Korean attack.[52] This initial system is to be deployed by 2007 and the full system is to be operational in 2011.

The cost of the proposed missile system will depend on its final architecture. The JDA estimates that it will cost 700 billion yen ($6.5 billion) over five years, beginning in FY 2004.[53] However, critics point out that the cost of the missile defence system could exceed 1 trillion yen when operating and maintenance expenses are included. The government has requested 100 billion yen ($928 million) for missile defence in the 2004 budget. This includes money for a joint US–Japan missile defence R&D programme that began in 1999.[54] By comparison, Japan spent 1.9 billion yen ($16 million) for missile defence in 2003 and a total of 13.7 billion yen ($115 million) between 1999 and 2002.[55] The JDA has reportedly discussed with US officials the possibility of joint production of new interceptor missiles.[56]

Israel

The most mature of the collaborative missile defence programmes is the US–Israeli Arrow Weapon System (AWS). The AWS includes missiles, interceptor launcher

Initiative, Dec. 2003, URL <http://www.nti.org/e_research/e3_37a.html>. The concern came at a time when the Japanese public's attitude towards North Korea had hardened because of the controversy surrounding North Korean abductions of Japanese citizens in the 1970s and 1980s.

[50] Japan Defense Agency, *Defense of Japan 2003* (Inter Group Corp.: Nagoya, Japan, 2003), p. 381; and Shimoyachi, N., 'White Paper cites need for missile defense', *Japan Times* (Internet edn), 6 Aug. 2003, URL <http://www.japantimes.co.jp/cgi-bin/getarticle.pl5?nn20030806a2.htm>. See also the JDA's Internet site at URL <http://www.jda.go.jp/e/index_htm>.

[51] Kotani, R., 'Japan's recent step-up in missile defense', Center for Defense Information, 10 Oct. 2003, URL <http://www.cdi.org/friendlyversion/printversion.cfm?documentID=1725>.

[52] 'Japan: proposed missile defenses would build incrementally, official says', Global Security Newswire, 19 Aug. 2003, URL <http://www.nti.org/d_newswire/issues/2003/8/19/10p.html>. In addition, JDA officials are discussing scenarios in which Japan would intercept ballistic missiles flying over its territory, including those that might not be targeting Japan.

[53] Reynolds, I., 'Japan to buy US missile defense system', *Washington Post* (Internet edn), 19 Dec. 2003, URL <http://www.nuclearpolicy.org/NewsArticlePrint.cfm?NewsID=1170>.

[54] The JDA and the US DOD signed a memorandum of cooperation on missile defence R&D. The focus of the research is on 4 components of the SM-3: sensor, advanced kinetic-kill warhead, second-stage propulsions and lightweight nosecone. US MDA, 'Aegis ballistic missile defense', Fact sheet, 30 Jan. 2004, URL <http://www.acq.osd.mil/bmdo/bmdolink/pdf/seabased.pdf>.

[55] Japan Defense Agency (note 50), p. 157.

[56] Pilling (note 47).

batteries, tracking radar and fire-control systems. It uses a mobile two-stage interceptor missile carrying a blast-fragmentation warhead. The Arrow-2 has an 'engagement footprint' (i.e., defended area of coverage) between that of the PAC-3 and THAAD.[57] There have been six integrated flight-tests of the complete Arrow system. The most recent of these was carried out on 16 December 2003, when an Arrow-2 interceptor missile successfully engaged and destroyed a target missile simulating a medium-range ballistic missile.[58] The first Arrow-2 battery entered service with the Israeli Air Force in March 2000. The Israeli Air Force currently deploys two Arrow batteries, one near Tel Aviv which became operational in 2000 and the other in northern Israel. A third battery is scheduled to be deployed in the south of the country.

The USA and Israel jointly developed the Arrow-2 and its launcher; Israel developed the rest of the system on its own. The USA is believed to have paid 40–60 per cent of the total development costs, depending on the source.[59] Because the USA helped to develop the interceptor, its agreement is required before Israel can export the AWS to a third country. This became a controversial issue when India made a request to purchase the Arrow-2 system in 2002. By late 2003 the US State Department had not decided how to respond to the request.[60] A key concern is whether the sale of the Arrow to a third country would be consistent with US commitments under the Missile Technology Control Regime (MTCR), which restricts transfers of missiles capable of delivering a 500-kg payload at least 300 km.[61] Since the Arrow interceptor has this capability, it falls under the MTCR's limitations as a Category 1, or most sensitive, technology.[62] In addition, the USA is concerned that the sale of Arrow interceptors to India could spur an arms race on the subcontinent.

IV. Conclusions

By 2003 missile defence was no longer at the centre of an intense debate about arms control restraints and global strategic stability. The USA's withdrawal from the 1972 Treaty on the Limitation of Anti-Ballistic Missile Systems (ABM Treaty) the previous year had elicited restrained international reactions, particularly from Russia.[63] With the Bush Administration determined to press ahead with its ambitious missile

[57] Federation of American Scientists Space Policy Project, Special Weapons Monitor, 'Arrow TMD', 28 June 2000, URL <http://www.fas.org/spp/starwars/program/arrow.htm>.

[58] Hughes, R., 'Arrow 2 test exceeds Israeli expectations', *Jane's Defence Weekly*, vol. 40, no. 25 (24 Dec. 2003), p. 17.

[59] Samson, V., 'Israel's Arrow missile defense: not ready for prime time', Center for Defense Information, 9 Oct. 2002, URL <http://www.cdi.org/missile-defense/arrow.cfm>.

[60] Boese, W., 'Proposed missile defense sale to India still in limbo', *Arms Control Today*, vol. 33, no. 3 (Apr. 2003), URL <http://www.armscontrol.org/act/2003_04/arrow_apr03.asp?print>.

[61] On the MTCR see chapter 18 in this volume. MTCR participants are listed in the glossary.

[62] 'Israel has already sold India the Green Pine radar that tracks incoming missiles and feeds them into the Arrow's battle management system.' Raja Mohan, C., 'US holds back Israeli Arrow', *The Hindu* (Internet edn), 5 Sep. 2003, URL <http://www.thehindu.com/2003/09/05/stories/20030905 05861100.htm>. See also Ahlström, C., 'Arrows for India?: technology transfers for ballistic missile defence and the Missile Technology Control Regime', *Journal of Conflict and Security Law*, vol. 9, no. 1 (spring 2004), pp. 103–25.

[63] The ABM Treaty entered into force on 3 Oct. 1972 and expired as a consequence of the US withdrawal from it on 13 June 2002. For more on the USA's decision to withdraw from the ABM Treaty and the international reaction see Kile, S. N., 'Nuclear arms control, non-proliferation and missile defence', *SIPRI Yearbook 2003: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 2003), pp. 603–605. See also chapter 19 in this volume.

defence plans, the main questions being asked during 2003 were about the cost and technical feasibility of these plans. The USA continued to spend significantly more on missile defence than the rest of the world combined. The administration accelerated key weapon system and sensor programmes in order to be able to begin deploying an initial set of missile defence capabilities by the end of 2004. This raised concerns, *inter alia* within the DOD, about the maturity of the missile defence technologies being developed and about the cost and likely effectiveness of the systems to be deployed.

In 2003 there were signs of growing interest in missile defence systems in countries other than the USA. This differed from the cold war era, when interest in missile defence was limited primarily to the superpowers. The new interest was motivated in part by the desire of some countries to promote their defence industrial cooperation with the USA. More importantly, it was motivated by the proliferation of short- and medium-range ballistic missiles in specific regional settings, namely East Asia, South Asia and the Middle East. The increases in the number and sophistication of missile inventories have fuelled interest in, for example, India, Israel and Taiwan, in acquiring advanced missile defence capabilities. This has given rise to concerns that the introduction of missile defences into these regions will lead to destabilizing arms races between offensive and defensive systems, unless new arms control restraints can be put into place on a regional basis.