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Theater Missile Defense: Issues for Congress

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SUMMARY

U.S. troops deployed abroad and U.S. allies are increasingly threatened by biological, chemical, and even nuclear weapons that could be delivered by ballistic or cruise missiles. Missile production by North Korea and Iran has caused concern and has generated considerable support in Congress to develop and deploy missile defense systems.

For fiscal year 2001, the President requested about $2.5 billion for Theater Missile Defense (TMD), $400 million less than the amount approved the previous year. This sum includes $370 million for procurement, $2.17 billion for Research, Development, Test, and Evaluation, and $1.9 million for military construction. Six U.S. theater missile defense weapon systems being developed are: Patriot PAC-3, Navy Area Defense (NAD), Medium Extended Air Defense System (MEADS), Theater High Altitude Area Defense (THAAD), Navy Theater Wide (NTW), and Airborne Laser (ABL). The request included smaller amounts than last year for THAAD, NAD, PAC-3, and ABL. Pentagon officials have said TMD programs need several hundred millions more than requested to reduce risks and speed development.

The defense authorization act increased amounts in FY2001 for PAC-3, NTW and ABL, approved requested amounts for THAAD and NAD, and cut the amount for MEADS. For FY2000, Congress increased amounts for PAC-3, NTW, and a number of smaller programs. It also required that NTW and THAAD be funded and managed as separate programs, contrary to the BMDO plan to have them compete for funds from a single line.

The Bush Administration announced it would request an additional $1 billion for national and theater missile defense for FY 2002 but detailed budget figures will not be released until various studies have been completed.

THAAD successfully intercepted Hera target missiles on June 10 and August 2, 1999, after having failed six attempted interception test flights. The last failure occurred in March 29, 1999. Patriot PAC-3 intercepted a target missile in October 2000, its sixth consecutive intercept.

Congress has supported NTW, the other upper tier system, and some Members have encouraged a rapid development of NTW because it might provide some strategic missile defense capability.

Congress has also criticized the pace of development and schedules of deployment, redundancy of the various systems, restrictions that the ABM Treaty may apply, and systems management of missile defense. Of the several TMD programs, THAAD and Navy Theater Wide systems have received the most congressional attention.

MOST RECENT DEVELOPMENTS

Secretary of Defense Rumsfeld confirmed reports the administration would request an additional $1 billion for missile defense for fiscal year 2002. In May DoD said it would request an additional $8 billion for missile defense over the next seven years including more for Airborne Laser, sea-based defenses, and space-based defenses. Detailed budget figures may not be released until later this year.

Navy officials indicated in April that existing Aegis destroyers could be deployed in 12 to 18 months with Enhanced Air Defense that could destroy North Korean missiles launched from a coastal site. The system would use the Standard Missiles SM-2 Block IVA that will be used in the lower-tier Navy Area Defense and has a blast-fragmentation warhead. Another Navy proposal would employ SM-3 missiles that are being developed for Navy Theater Wide. Two ships would deploy 50 such missiles in 2008 at a cost of $3.5 billion to $4.5 billion. NTW has failed to intercept a target missile in its two attempts. The proposed use of TMD systems to defend against intercontinental ballistic missiles blurs the distinction between TMD and NMD.

Russia is trying to sell new guided warheads for the Scud missile that it claims has an accuracy of 10-20 meters, can defeat Patriot missile defenses, and is immune to jamming and electronic countermeasures.

BACKGROUND AND ANALYSIS

U.S. troops deployed abroad and U.S. allies are increasingly threatened by enemy biological, chemical, and even nuclear weapons delivered by ballistic and cruise missiles. During the Gulf War, 23 U.S. troops were killed when an Iraqi Scud missile with a conventional high-explosive warhead hit a barracks in Saudi Arabia. Iraq also had biological and chemical warheads that might have inflicted far greater casualties. Three dozen countries have ballistic missiles and scores of countries have various types of cruise missiles — mostly anti-ship missiles. About 11 countries have, or are seeking, offensive biological weapons programs, and about 17 probably have chemical weapons. (See CRS Report RL 30669, *Nuclear, Biological, and Chemical Weapons and Missiles: The Current Situation and Trends.)* There is considerable support in Congress to develop and deploy theater missile defense systems with U.S. forces overseas and to help allied countries achieve effective theater missile defense.

On July 15, 1998, the Commission to Assess the Ballistic Missile Threat to the United States (the Rumsfeld Report), issued its report to Congress as required by P.L. 104-201. The commission report indicated the threat is "broader, more mature and evolving more rapidly" than previously estimated by the intelligence community and that the community's ability to estimate the threat is declining. The commission did not comment on the need for a ballistic missile defense, but some Members of Congress have cited the report as evidence supporting the need for rapid development and deployment of missile defenses.

Justification for missile defense programs (both theater and national) is often based on missiles produced in North Korea that threaten South Korea, Japan, and perhaps even the United States. Some of North Korean missiles have been exported to countries such as Iran, Syria, Libya, and Pakistan. On September 12, 1999, North Korea told U.S. officials it would not test long range missiles while negotiations to improve relations are underway. President Clinton then announced a reduction in the economic sanctions against North Korea. Furthermore, some scientists (such as Richard Garwin of MIT) conclude the U.S. missile defense systems currently under development would be ineffective against North Korean missiles, as well as those of Russia and China, because they would not be able to differentiate warheads form decoys and would not be able to destroy all the submunitions that an enemy missile could deploy in the ascent phase.

For fiscal year 2001 the President requested $2.8 billion for Theater Missile Defense (TMD), almost $440 million less than last year. The amount requested for Theater Missile Defense is 60% of the total BMDO program — the Administration also requested $1.9 billion for National Missile Defense. and almost $450 million in supporting areas. The TMD request includes $444 million for procurement, $2.4 billion for Research, Development, Test, and Evaluation, and $370 million for military construction. These amounts include funds for six U.S. theater missile defense weapons programs: Patriot (PAC-3), Navy Area Defense (NAD) defense, Medium-Extended Air Defense System (MEADS), Theater High Altitude Area Defense (THAAD), Navy Theater Wide (NTW), and Airborne Laser (ABL), and several supporting programs. Funding for the development of Airborne Laser (ABL) is included in the Air Force Budget. In addition, BMDO's budget includes funds for National Missile Defense, advanced research, international cooperation, and support programs. Described below are the six major U.S. theater missile defense systems that are currently being developed. At the end of that discussion is a table showing funding levels for TMD and its elements.

Patriot PAC-3 (Patriot Advanced Capability-3, MIM-104 Patriot/ERINT)

The Patriot PAC-3 is the U.S. Army's primary medium-to-long-range air defense missile system and is the closest developmental missile defense system to being fielded. It is a major system improvement of the Patriot used in the Gulf War, and of the subsequent PAC-2. It will target enemy missiles in their mid-course or descent phase in the lower atmosphere, and will be used in conjunction with the longer-range THAAD. It has completed the Demonstration/ Validation phase and is continuing improvement in the Engineering and Manufacturing Development phase of the acquisition process, while it proceeds in low-rate initial production (LRIP) under a third-phase contract with Lockheed Martin. When all changes have been made, the PAC-3 will have a new hit-to-kill interceptor missile (the ERINT), improved communications, radar, and ground support systems. Early versions have been deployed and the first unit to be equipped with the final version is scheduled to be deployed in the fourth quarter FY2001. Full-rate production was also scheduled to begin in late 2001 but may be delayed.

In April 2000, the Pentagon projected costs of PAC-3 had increased by $102 million to $2.9 billion because of increased reliability and spares costs. A GAO report issued in July 2000 showed PAC-3 total program costs increased from $3.9 billion for 1,200 missiles planned in 1994 to $6.9 billion for about 1012 missiles in the current plan. In April 2001,

BMDO estimated the PAC-3 acquisition costs to be $10.1 billion. BMDO and the Army are attempting to cut the current cost of the missile to allow the purchase of additional missiles. In September 2000, the Pentagon told Congress it could afford only 32 PAC-3 missiles in FY2001 rather than the 40 for which funds had been requested despite heavy funding in the authorization and appropriation acts and an additional $35 million in the FY2000 supplemental. In November, DoD indicated it would buy the 40 PAC-3s but would have to buy fewer launchers and associated equipment. One article estimated most of the cost increase could be eliminated by increasing the rate of production (Army Times, October 2, 2000). In December, the Army announced it had restructured the program to finish testing and begin full-rate production earlier. It also plans to increase the numbers purchased in the years 2003-2007.

For FY2001, the Administration requested $365.5 million for procurement and $81 million for further development of the PAC-3. The defense authorization act (H.R. 4205, P.L. 106-398) added $152 million for further development and $65 million for procurement. In 1999, Congress expressed concern about the increasing unit procurement cost, directed the Army Secretary to prepare a report on the capabilities of Patriot Anti-Cruise Missile (PACM) and the opportunity costs of its further development, and added $152 million for PAC-3 R&D and $60 million for procurement. In 2000, Congress again expressed concern in the conference report about the cost growth and schedule delays in the PAC-3 program.

In May 2000, DoD decided to stop development of PACM because PAC-3 and improvements being made to PAC-2 systems provide a more cost effective defense against ballistic and cruise missile threats. The decision has been controversial, particularly among companies that would have produced PACM. But the conference report on the FY2001 authorization bill noted no funds had been requested for PACM and instructed the Secretary of Defense to determine if PACM production is warranted. If he so determines, $35 million of authorized funds would be available to retrofit existing Patriot missiles.

On March 15, 1999, a PAC-3 intercepted a Hera target missile over White Sands Missile Testing Range in a test of its homing guidance system. On September 10, a modified PAC-2 successfully intercepted a cruise missile target for the second time in two tries. On September 16, 1999, a PAC-3 again intercepted a Hera target missile and another intercept was achieved on February 5, 2000. PAC-3 completed its sixth consecutive intercept of a ballistic missile target on October 14, 2000. It detected and destroyed a maneuvering Storm target missile even though other objects were in its field of view. A PAC-2 flight tested on the same day failed to intercept a cruise missile-like drone. On July 22 and 29, 2000, PAC-3 missiles intercepted low-flying cruise missiles. On March 31, 2001, a salvo of two PAC-3 missiles attacked a Hera target missile. The first PAC-3 destroyed the target so the second PAC-3 self-destructed. This completed the developmental testing phase with all nine flight tests (seven intercepts) successful. The same day a PAC-2 destroyed another Patriot designed to imitate a Russian SS-21.

In March 2000, it was reported that a large number of PAC-2 systems deployed with U.S. forces in Kuwait, Saudi Arabia, and South Korea needed to be replaced because the targeting data links tended to fail after extended periods of being on alert. The Army discovered two other problems with the missiles and is studying whether Raytheon is liable for the malfunctions.

Russia has developed a guided warhead for the Scud missile that it claims has an accuracy of 10-20 meters, can defeat Patriot missile defenses, and is immune to jamming and electronic countermeasures. It was reported in March 2001 that Russia is offering this warhead for sale to a number of countries in the Middle East that have Scud missiles.

Germany, the Netherlands, Japan, and Israel have Patriot systems and are in various stages of upgrading them. Japan produces Patriots under license. South Korea is considering buying Patriots or some other missile defense system. Taiwan is acquiring a modified Patriot system from U.S. defense industries. See the section below on issues for Congress for a brief discussion of an Asian regional missile defense.

Navy Area Missile Defense

The Navy Area Defense (NAD) system, formerly known as Navy Lower Tier, is based on modified Aegis air defense ships and improved Standard missiles. It is in the Engineering and Manufacturing phase. On June 29, 2000, Defense Department conducted the first of eight tests in the Engineering and Manufacturing phase of the Standard Missile Block IVA. The missile's guidance, auto-pilot, and aerodynamic stability were successful. On August 24, 2000, a successful flight test demonstrated the missile's structural integrity, maneuverability, auto-pilot, and stability. NAD is scheduled to have intercept flight tests in 2001 and the first ship is to be equipped in 2003. A draft DoD report in November 2000 indicated NAD development had slipped 13 months and would not meet the initial deployment by 2003.

In September 1997, the Navy announced a new "evolutionary deployment approach" in which it will attain initial operating capability for Navy Area Defense and Navy Theater Wide systems as soon as possible rather than waiting to develop and deploy the highest levels of technology. The Navy plans to use new acquisition techniques to speed the deployment of missile defense using current Aegis and vertical launch capabilities, and Standard missiles (with slight modifications to the Block IV system). It may double the number of ships equipped with Navy Area defense in the first few years. Subsequently, the Navy will modify the warhead and, perhaps, other subsystems.

The Administration requested 274.2 million for NAD development in FY2001 and the defense authorization act approved that amount. BMDO requested $272.2 million for RDT&E in FY2000 but H.R. 1401 shifted $55 million from procurement to development. In 1999, Congress added $41.8 million for Navy Area R&D. In April 2001, BMDO estimated NAD acquisition costs to be $7.3 billion.

Medium Extended Air Defense System (MEADS)

The Medium Extended Air Defense System (MEADS), formerly the U.S. Army's Corps Surface-to-Air (Corps SAM), is a multinational, ground-based, mobile, air and missile defense system. It is essentially a composite of existing technologies with either similar or enhanced capabilities. It will cover the lower-tier of the layered air and theater missile defense and will operate in the division area of the battlefield to protect key maneuver units against various airborne threats. As an integral part of the air and missile defense family of systems, MEADS complements the other lower- and upper-tier systems and provides some overlap in ballistic missile defense. One of the distinguishing characteristics of MEADS is its ability to maneuver and deploy quickly. It will be able to accompany troops within the theater and will require

less manpower and logistical support to operate than other missile defense systems. Of the various TMD systems, only MEADS will provide 360-degree coverage. MEADS will use the Patriot PAC-3 missile with its hit-to-kill warhead, designed to intercept multiple and simultaneous short range ballistic missiles (SRBMs), low cross-section cruise missiles and aircraft, and unmanned aerial vehicles. MEADS will eventually replace the aging HAWK air defense system.

The Ballistic Missile Defense Organization (BMDO) serves as the acquisition executive authority and is responsible for program direction and system architecture and integration. The Army will operate the system. In addition to fulfilling operational requirements for limited air defense, the program is also expected to reinforce interoperability of NATO forces and to reduce the U.S. burden of cost for helping to maintain European defense.

Under the initial May 1996 Memorandum of Understanding, Germany and Italy committed to fund 25% and 15% of the program, respectively, for the next 10 years. According to press accounts, Germany and Italy have committed to 45% of the costs, and in March 1999, DOD asked the Europeans to assume 50% of the costs. Responding to congressional criticism of the program's costs for FY 2001, Pentagon officials suggested that Germany and Italy coproduce the Patriot PAC-3 interceptor for incorporation into MEADS. In April 2000 it was reported that Germany and Italy had tentatively agreed to use the Patriot rather than a new interceptor, but still plan to develop a new seeker radar. In October 1999, the U.S. briefly denied the allies access to detailed information on PAC-3 for security reasons. In late May 2000, U.S. and German officials announced their agreement on a plan to share PAC-3 missile technology for incorporation into the MEADS program.

In October and December 2000, the German military questioned the number of MEADS units it would need and whether it could afford them, the German Parliament balked at approving its share of development costs, and the German government then asked to have the program restructured to reduce its $22 billion cost, even if that requires reduced capability. After discussing the costs and objectives of the MEADS with U.S. Army officials and Secretary of Defense Cohen, German Defense Minister Scharping agreed in early December 2000 to sign an agreement to enter the next phase of the risk reduction effort (RRE). The three-year RRE will cost about $250 million of which the U.S. will pay 55%, Germany 28%, and Italy 17%. The agreement was modified to divide German funding and commitment into three phases to ease the Defense Ministry's negotiations with Parliament. In May 2001, the three countries agreed to extend the definition phase of development three years thus putting deployment off till 2009.

For FY2001, the Administration requested $63.2 million for development of MEADS., $15 million more than last year's request. The defense authorization act decreased the amount by $9.7 million. In 1999, Congress noted the program plans to use PAC-3 missiles and launchers and modified THAAD battle management and encouraged DoD to consider use of radars already in development. The increasing unit costs of PAC-3 missiles (approaching $3million each) could again bring MEADS into question, but additional purchases of PAC-3 will help reduce unit costs.

Since May 1995, MEADS has been at the Project Definition-Validation (PD-V) stage of research and development. The Lockheed-Martin Corp. and the Hughes Aircraft and Raytheon Company consortium represented the U.S. partners of two competing international

teams. Alenia of Italy, and European Aeronautic Defence and Space Company (formerly Daimler-Chrysler Aerospace) of Germany, represent the European group. In May 1999, the three governments selected the team headed by Lockheed Martin to develop MEADS. Target production and fielding dates were set for 2006 but have slipped to 2009.

In May 1996, France rescinded its initial commitment to fund 20% of the MEADS program. Despite budgetary constraints, however, it is still interested in developing ballistic missile defense (BMD) capabilities, perhaps an indigenous system. The United Kingdom is not a participant in the program and to date has taken no official position on BMD. The Government is, however, concerned about the proliferation of weapons of mass destruction and is considering options for countering this potential threat. The Netherlands and Turkey have also considered participating in the joint endeavor.

Theater High-Altitude Air Defense (THAAD)

The Theater High-Altitude Air Defense (THAAD) is the U.S. Army's weapon system designed to destroy non-strategic ballistic missiles before they reenter the atmosphere or in the upper atmosphere. It uses a single stage, solid propellant rocket and a hit-to-kill interceptor that is to destroy the target missile with the kinetic energy of impact. Unlike the lower-tier, short-range systems (Patriot PAC-3, MEADS, and Navy Area Defense), THAAD is intended to help protect wide areas against missiles and falling debris of missiles and possible nuclear, biological, or chemical materials. In April 2000, the Pentagon released the Selected Acquisition report stating the projected costs of THAAD had increased by $898 million to $9.5 billion because of a revised estimating methodology. In April 2001, BMDO estimated THAAD acquisition costs to be $16.8 billion and the life cycle costs to be $23 billion.

THAAD entered the Engineering and Manufacturing Development phase on June 28, 2000 (progressing from the Program Demonstration/Validation phase) and is to be deployed in 2007. In an accelerated development proposal being studied by the Army in October 2000, the first THAAD unit equipped could be moved from FY2007 to FY2006. A more advanced version designed to defeat missiles employing countermeasures is scheduled for 2011. DoD is relaxing the requirement that THAAD be able to intercept targets both within and outside the atmosphere, raising the altitude at which it must be able to conduct an intercept.

Earlier technological problems in THAAD's development jeopardized support for the system. On August 2, 1999, for the second time, a THAAD missile successfully intercepted a target missile. The first success was achieved on June 10, 1999 after THAAD had failed in six previous interceptor flight tests. In those six unsuccessful intercept flight tests, a different subsystem failed in each test.

After the second successful intercept, Lockheed Martin had submitted a proposal for moving THAAD into Engineering and Manufacturing Development (EMD) but the Army Space and Missile Defense Command rejected the proposal in early April 2000 because of management and testing plan deficiencies. Lockheed Martin responded to the problems, and the Army later recommended the Defense Acquisition Board (DAB) begin its review of THAAD advancing to EMD.

Because of concerns that the THAAD and NTW were not being tested against target missiles with the speed and other characteristics of likely enemy missiles (such as the North Korean Taep'o-dong 1, Representative Vitter introduced legislation in 1999 (H.R. 2596) that would require BMDO to use target vehicles with the speed of a Taep'o-dong 1 and to adjust program management and consider making adjustments in the characteristics of NTW and THAAD systems to improve the likelihood of successful intercepts.

In a similar vein, H.R. 4205 requires BMDO to modify its defense systems to be able to counter ballistic missiles with ranges between 1,500 and 2,500 miles. The HASC report indicated current TMD systems would be able to counter missiles with ranges of 1240 miles (2000 km) while North Korea and Iran are both developing missiles with greater ranges.

[In November 2000, Russia demanded the U.S. stop using the Hera target missile in tests and destroy its stocks, claiming the Hera is a medium range missile banned under the INF Treaty. Further more they argue, the Hera is based on two stages of the Minuteman-2 missile and uses the guidance system of the Pershing-2 which were banned.]

The FY1999 Defense Authorization Act, as enacted, required the Secretary of Defense to conduct competition for the development and production of the THAAD interceptor missile. It also eliminated the $323,942 requested for engineering and manufacturing development (EMD) but added nearly $30 million to the demonstration/validation phase to assist in conducting competition for a developer and producer. The act also directs DoD to establish appropriate cost sharing with the contractor in case of future flight test failures. The appropriation bill also eliminated EMD funding and cut funding for the demonstration and validation phase. In response, DoD planned to evaluate the flight tests of THAAD and those of NTW in 2002 and to give the bulk of funds from a new upper-tier program element to the more successful program. Such funding would accelerate the more successful program while continuing the other program at a slower rate. However, the FY2000 defense authorization required THAAD and NTW to be funded and managed as separate programs. The bill reduced THAAD development funds by $83.8 million, and allowed the DoD to proceed to Engineering and Manufacturing Development (EMD)of THAAD without completing three successful intercepts. In September 1999, DoD announced a revised plan to develop THAAD and NTW in parallel, potentially speeding the deployment of both programs.

For FY2001, the Administration requested $549.9 million for THAAD development, which is planned to move from Demonstration/Validation to Engineering and Manufacturing Development. The House and Senate Defense Authorization bills and House and Senate Appropriation bills approved the recommended amount.

NATO countries have agreed to study their need for missile defense in addition to German and Italian participation in MEADS. Participation in THAAD is a possible outcome, but European cooperation with the United States in another major acquisition program may be colored by the progress of MEADS.

Navy Theater Wide Defense

The Navy Theater Wide (NTW) missile defense system, formerly known as Navy Upper Tier, is in the program Definition and Risk Reduction phase, is scheduled for flight intercept tests in 2001, and is to have the first ship fully equipped by 2010. NTW will consist of the

Standard Missile-3 carrying the Lightweight Exo-Atmospheric Projectile (LEAP) launched from Aegis air defense ships. Originally, the Navy was to deploy an initial version (block I) capable of attacking known medium-range missile threats (such as the Al Hussein, M-9, and Nodong) during their ascent, mid-course, and descent phases. Later, a Block II missile was to be built to defeat new threats. In early 2001, the Navy discarded the block development program and decided to go to the fully capable system directly. With this change the Navy planned to shift $121 million in FY 2002 and 2003 from NTW to NAD. Standard Missile and Lockheed Martin are the primary contractors and Raytheon and UDS are major subcontractors. In April 2001, Raytheon said it could produce NTW missiles "by the `04 time frame" using the block approach, noting the program is merely "funding constrained." (Defense Daily, April 11, 2001.)

In April 2000, the Pentagon released the Selected Acquisition report stating the projected costs of NTW had increased by $590 million to $5 billion. In April 2001, BMDO estimated NTW acquisition costs to be $5.5 billion.

The Administration requested $382.7 million for NTW in FY2001. The defense authorization act (P.L. 106-398) added $80million for NTW consisting of $65 million for the Standard Missile III and $15 million for the kill vehicle. In 1999 and 1998, Congress also added funds to the requested amounts for NTW.

Navy witnesses have told Congress NTW could be fielded as early as 2002 if additional funds are provided and additional risks accepted. A number of advocates, including Congressmen and Senators, contend NTW should be deployed soon as a national missile defense. But BMDO officials suggested the risks may be too great, the development time would be long, and that necessary funds are probably not available. The Wall Street Journal (April 10, 2000) said a classified Pentagon study concludes a ship-based NMD system is technically possible. The article asserted, "one country's TMD is another country's NMD," missing the distinction that TMD protects against slower medium-range theater missiles and NMD protects against fast intercontinental ballistic missiles. Secretary Cohen said in the April issue of *Seapower* that an Aegis sea-based missile defense with significant modifications could complement the NMD system but the land-based system can be deployed sooner. In March 2001, the former head of the DoD test office said NTW is not considered a viable national missile defense option and would not be in the near term (five years). NTW has failed to intercept a target missile in its two attempts. On January 25, 2001, an Aegis cruiser successfully flight tested a Standard Missile-3.

In September 1999, the first two stages of NTW were successfully tested. In June 2000, DoD reported that inadequate materials were causing failures in the complex Divert and Attitude Control System (DACS) of the kinetic kill vehicle. The DACS has eight thrusters that propel and guide the warhead to the target but have generated more heat than the system can withstand. In a flight test on July 14, 2000, the Lightweight Exoatmospheric Projectile failed to separate from the second stage of the SM-3 Standard launch missile.

The General Accounting Office issued a report on May 31, 2000 (GAO/NSIAD-00-121) that found that additional funds provided by Congress were used by the Navy to reduce technical risks and speed development of NTW, but that significant risk still exist. GAO recommended, "the Navy revise the proposed funding profile and test schedule for the Navy

Theater Wide program to ensure that the Navy can undertake initial operational testing before producing most of its missiles."

Airborne Laser (ABL)

Systems Description. Modified Boeing 747-400 aircraft will use a multi-megawatt laser to destroy missiles within 30 to 140 seconds after launch from a range of 300-600 km (160-230 nautical miles). At that point the target missile will have climbed to about 38,500 feet and passed through cloud cover, but still be in the ascent stage, often still over enemy territory, and would not have deployed separating warheads or countermeasures. The Air Force is also examining whether ABL could be adapted to defend against sophisticated cruise missiles.

ABL is budgeted and managed by the Air Force in coordination with BMDO. The program, which is in the definition and risk reduction phase, calls for production of seven aircraft with lasers by 2008 — three may be in service by 2006. In April 2001, BMDO estimated ABL acquisition costs to be $6.4 billion. Twenty-year costs for development, production, operations and support of the fleet are estimated at $11 billion. Boeing won a contract to build a prototype aircraft, TRW will develop the chemical oxygen-iodine laser, and Lockheed Martin will develop the laser beam control system. In September 2000, the first Boeing 747-4000 reached the midpoint of the modification program and is scheduled to be completed in 2002. The system will attempt to down a missile in 2003.

For FY2001, the Air Force requested $148.6 million for ABL, less than half the amount requested and approved last year. An Air Force official said the cut would delay the program several years. The defense authorization act (H.R. 4205, P.L. 106-398) added $85 million and requires BMDO to approve any major changes to the Air Force's Airborne Laser program and to report to Congress an assessment of the program. (The House bill had originally called for shifting the ABL program to BMDO because the Air Force had tried to cut funding.) The appropriation bill (H.R. 4576, P.L. 106-259) approved the requested amount. In January 2001, the Air Force announced it would seek congressional approval to transfer an additional $38 million in FY 2001 funds to ABL. Additionally, the three contractors each agreed to use $20 million of their own funds, to be reimbursed next year. This additional $98 million is reportedly needed to prepare for the lethal demonstration in 2003.

In April 2001, it was reported the Track Illuminator Laser, one of four lasers in the ABL, was tested successfully.

Regional Theater Missile Defense Options

NATO or Russian TMD Cooperation. In addition to MEADS, which the United States, Germany, and Italy are co-developing, in July 1999 NATO began studying the feasibility of developing a low-to-high altitude TMD employing ground stations, ships, aircraft, and satellites. NATO officials predict ship-based defense against low-level missiles will be available within a couple of years. In June 2001, NATO is to decide on two$13.5 million, 18-month contracts to study the feasibility of a multilateral layered TMD system and examine costs, risks, timing, and types of systems that might be used. In 2004 NATO should

be ready to select a TMD system for deployment, and it could be fielded by 2010. NATO countries are generally less interested in high-altitude missile defense although the United States is encouraging its allies to acquire such systems.

The U.S. Navy in the fall of 2000 is encouraging international partners, in addition to Japan, to cooperate in the development and production of a future maritime missile defense system. Three multinational groups are developing the Evolved Sea Sparrow, the Aster 1, and the Principal Anti-Air Missile System, which could provide NATO ships protection against aircraft and missile attacks. Germany, the Netherlands, and Italy meet quarterly with the U.S. as members in a Maritime TBMD Forum. Representatives of the navies of Australia, Canada, and Spain attend as observers.

Representative Curt Weldon visited Russia in February and proposed that the United States, Russia, and Europe cooperate on developing Russia's S-500 theater missile defense system. On returning to the U.S. he said it is time to call Russia's bluff and charged that Russia's calls for cooperative missile defense were merely efforts to drive a wedge between the United States and Europe. (Inside Missile Defense, March 7, 2001; Defense News, February 26, 2001.)

The Israeli "Arrow" and Regional Defense. The Arrow Anti-Tactical Ballistic Missile (ATBM) system was jointly funded and developed by the United States and Israel, with the requirement to demonstrate a theater missile defense system capable of intercepting Scud B, Scud C, and SS-21 Scarab short range ballistic missiles, and hopefully the Iraqi Al-Hussein and the longer range Chinese CSS-2 missiles that are currently deployed in Saudi Arabia. The Arrow II, which was declared operational in October 2000, is believed to have a maximum intercept altitude of 50 km, with a maximum range of 90 km, and a speed of just under 3 km per second. The system also includes the *Green Pine* early warning and target acquisition system that was developed by an Israeli Aircraft Industries subsidiary, and the *Citron Tree* fire-control and battle management system developed by Tadiran. In December 2000, Israel Aircraft Industries selected Boeing to coproduce Arrow in the United States.

The FY2001 U.S. budget request includes $81.2 million for Israeli cooperative missile defense projects which support continued acquisition of a third Arrow battery. In the authorization act, Congress added $8 million for the Arrow System Improvement Plan (ASIP) which is intended to develop a defense against missiles such as the Shahab 3 that has a range of about 1500 km (930 miles). In mid-November 2000, the Administration requested a $750 million supplemental appropriation to support Middle East Peace. The package included $200 million for Israeli defense systems such as Arrow II, boost phase intercept, and radar aircraft. In December 2000, the U.S. and Israel signed a memorandum of agreement covering the first year of the ASIP in which a feasibility study will examine the technological improvements needed. This first phase will cost $16 million; the total ASIP will run through FY 2007 and cost about $380 million. Israel is expected to request an additional $700 million in March 2001 for work over the next five years on Arrow and on a system to attack missile launchers with an unmanned aerial vehicle.

Israel is also developing a Boost-Phase Intercept (BPI) system which will intercept missiles shortly after they have been launched. The BPI employs an unmanned aerial vehicle that fires a modified air-to-air missile at the ascending ballistic missile. Israel decided not to develop BPI as a joint program with the United States. Another new concept is being

referred to as Pre-Launch Intercept (PLI) or Boost Phase Launcher Intercept (BPLI) which could be designed to detect and destroy ballistic missile launchers. The BPLI also reportedly involves Israeli unmanned aerial vehicles that could hover over enemy territory, identify and strike missile launchers with heat seeking air-to-surface missiles. Israel has sought U.S. political and financial support to develop the BPLI but was turned down because U.S. officials said it did not qualify as a missile defense program and some in Congress thought it could not work without good intelligence. (*Jane's Defence Week*, July 26, 2000: 28)

In April 1999, Moshe Arens, then Israeli Minister of Defense, suggested the Arrow may be used to provide protection not only for Israel but for Turkey, Jordan, and the Palestinian Authority as well. Identifying the threat as a "serious regional problem," Arens said the Arrow's range is sufficient to protect Jordan. However, a Jordanian official reportedly stated that Amman has never expressed any interest in the Arrow, and does not plan to engage in regional defense with Israel. Also, a representative for the Palestinian Authority reportedly discarded the idea.

Turkey has expressed an interest in acquiring the Arrow, however, Israel is restricted from transferring the Arrow system because of the U.S. role in funding and developing the system. Israel could export some of the technologies associated with the project, but only with prior U.S. agreement. Turkey and Israel have signed a memorandum of understanding to study the Turkish need for an ATBM. system. Turkey is also interested in PAC-3. However, Turkey apparently see the missile threat as a long-term concern and currently has higher defense priorities. The U.S. hosted a meeting on TMD with Israel and Turkey in late November 2000.

Gulf Cooperation Council Theater Missile Defense. In 1997, the defense ministers of the Gulf Cooperation Council (GCC) states agreed on a collective purchase of a $500 million ground-based early warning system that would link the GCC states' radars and communication systems. More recently, the Clinton Administration has been promoting further cooperation through the deployment of a GCC-wide theater missile defense (TMD) system to counter the threat of increasing Iranian ballistic missile capabilities and of any missiles retained by Iraq. (See CRS Report RL30093, *The Persian Gulf: Issues for U.S. Policy, 1999*, by Kenneth Katzman.) In his October 1998 visit to the Gulf, Secretary of Defense William Cohen, told the GCC states that it was "imperative" that they cooperate with Washington in the funding of the TMD system in order to counter the mentioned threats.

While Secretary Cohen described the GCC response to his proposal as "quite positive so far", the Gulf states are somewhat mistrustful of each other and have preferred to buy whole systems individually rather than collectively. Criticism over Cohen's statement came from France, whose Defense Minister stated that a TMD system would serve as an incentive for the development of more advanced missiles by other states, and would only escalate the arms race in the region.

East Asia Theater Missile Defense. In the FY1999 National Defense Authorization Act (P.L. 105-261, H.R. 3616, Sec. 1533), Congress required the Administration to study "the architecture requirements for the establishment and operation of a theater missile defense system in the Asia-Pacific region" and report the results to Congress. The Department of Defense submitted a classified report in February and an unclassified report in May 1999. The unclassified report stated the number of theater missile

defense units (similar to THAAD, NTW Phase I and II, NA, and PAC-3) would be required to defend Japan, the Republic of Korea, and Taiwan. It did not discuss the implications of such TMD deployments, did not discuss boost phase intercept programs, and did not discuss the ability of TMD systems to overcome enemy countermeasures or to destroy long range ballistic missiles. (See CRS Report RL30379 and CRS Report 97-391.)

Issues for Congress

Among the significant issues in congressional consideration of TMD have been program funding (amounts committed for long-term spending and annual budgets), the pace of development and schedules of deployment, redundancy among the programs, any restrictions that the ABM Treaty may apply to TMD, and systems management. Of the several TMD programs, THAAD and Navy Theater Wide systems have received the most congressional attention. MEADS has been the most vulnerable to budget cuts.

TMD Funding. Congress was long dissatisfied with the Clinton Administration funding of theater missile defense and regularly approved additional funds. NTW received the most frequent increases. Congressional support for THAAD has fluctuated with the failures and successes of the program. In the late 1990s, Congress cut funds for ABL and MEADS, but in the FY2001 act it restored funds for ABL that the Air Force had cut. In April 2001, BMDO estimated the acquisition cost for PAC-3, NAD, THAAD, NTW, and ABL to be $46 billion. It did not provide acquisition estimates for MEADS, Joint TMD, Family of Systems, Navy Cooperative Engagement Capability, or the U.S. contribution to Arrow and THEL. Also unstated are the life cycle costs for all TMD systems.

Pace of Development and Schedules of Deployment. Several Members of Congress have criticized DoD's theater missile defense program, as well as the national missile defense program, for not developing more quickly. Congress has approved funds, sometimes more than those requested by DoD, to help speed particular programs.

BMDO and two other Pentagon offices sponsored an independent study of the risks of the flight test programs of four hit-to-kill systems: THAAD, PAC-3, AEGIS LEAP Interceptor of NTW, and the National Missile Defense program. The study group, led by former Air Force Chief of Staff, General Larry Welch, reported on February 27, 1998. Among its major findings was the conclusion that the perceived urgency of the need for THAAD and LEAP, "has led to high levels of risk that have resulted in delayed deployments because of failures in their developmental test (DT) programs." Failures "were typically caused by poor design and fabrication, inadequate ground checkout discipline, and pressures to move on to the next step." Lt. Gen. Lester Lyles admitted that the fast-paced testing program, dubbed by the study group as "rush to failure," had deviated from a standard of rigorous testing and evaluation. The group recommended the test schedule be less aggressive — more realistic — and that ground testing be used to resolve as many issues as possible before using test flights for verification.

Redundancy of TMD Systems. Members have questioned whether there is too much redundancy in TMD such as the MEADS, Patriot PAC-3, and HAWK ground-based lower tier systems. BMDO officials contend that all six TMD systems under development, and research on advanced technology are needed to provide adequate missile defense throughout a theater of operation. Although the Army has said it needs MEADS and DoD

values the program as an example of international cooperation, Army officials have not wanted to reduce their other acquisition programs to fund MEADS. In August 2000, George Schneiter, Director for Strategic and Tactical Systems at DoD, said the Pentagon does not have enough money for all the TMD programs and that only the mature programs should continue.

Table 2. Theater Missile Defense Funding

($ in millions)

Program	FY1999	FY2000 Estimate	FY2001 Request
Procurement			
TMD-BM/C3	22.5	0.0	3.9
Patriot PAC-3	187.4	343.8	365.5
Navy Area	42.7	18.1	0.0
Total Procurement	**252.6**	**361.9**	**369.4**
Research, Development, Test, and Evaluation (RDT&E)			
THAAD, Dem/Val	431.9	602.9	549.9
THAAD, EMD	0.0	83.8	0.0
Navy Area, EMD	241.9	307.3	274.2
Navy Theater Wide, Dem/Val	366..3	375.8	382.7
MEADS, Dem/Val	11.7	48.6	63.2
Patriot PAC-3, EMD	237.3	179.1	81.0
Boost Phase Intercept, Dem/Val	6.4	0.0	0.0
Family of Systems	94.4	145.7	231.2
Joint TMD, Dem/Val	204.2	196.6	0.0
BMD Technical Operations	187.2	214.4	270.7
Other Programs	88.1	105.9	144.4
Total RDT&E	**1,789.4**	**2,260.1**	**1,997.0**
Military Construction	**0.3**	**1.4**	**1.9**
Total Theater Missile Defense-BMDO	**2,042.3**	**2,623.4**	**2,368.3**
U.S. Air Force Airborne Laser	253.9	304.2	148.6
U.S. Army JLENS	13.0	24.9	25.1

ABM Treaty Implication. The United States negotiated demarcation agreements with Russia to determine when a ballistic missile defense would be governed by the limits in the 1972 Anti-Ballistic Missile Treaty and when a system, such as a theater missile defense, would not be governed by it. The United States also signed a multilateral agreement extending the treaty to four successor states of the Soviet Union. Administration officials state the demarcation agreements clarify that U.S. TMD systems do not qualify as ABMs and are not governed by the treaty. The interceptors of most U.S. TMDs will not be tested at a velocity

that exceeds 3.0 kilometers/second and are therefore, according to the first demarcation agreement, not governed by the treaty limits as long as they are tested against target missiles with velocities below 5 kilometers/second and at ranges below 3,500 kilometers. The Navy Theater Wide defense, and any future TMD with interceptors tested at velocities greater than 3 kilometers/second are addressed by the second demarcation agreement. These too cannot be tested against target missiles with velocities of 5 kilometers/second or more and ranges of 3500 kilometers or more. Each country must determine whether such TMD systems are tested "in an ABM mode," and therefore covered by the treaty limits. The Clinton Administration has already said Navy Theater Wide is ABM Treaty compliant and not covered by its limits. The FY2001 authorization act requires the Director of BMDO to develop a plan to adapt missile defense systems to be able to counter "longer range medium-range and intermediate-range ballistic missiles." (P.L. 106-398, Sec. 233) (See also CRS Report 98-496, *Anti-Ballistic Missile Treaty Demarcation and Succession Agreements: Background and Issues*, by Amy Woolf.)

Program Management. The missile defense program, particularly the TMD testing program, has been criticized in Congress and the press. To respond to these criticisms, General Lyles, former Director of BMDO, described to Congress a number of management initiatives. BMDO developed a Strategic Plan to focus its efforts toward the successful development, deployment, and follow-on initiatives for NMD and TMD. The centrally organized agency has the mission of developing missile defense systems that are interoperable for all U.S. forces and can also be used to defend friends and allies. BMDO adopted nine Mission Essential Tasks, with implementation plans, to measure its performance, and is committed to complying with the Defense Reform Initiatives. It also created a Systems Architecture and Engineering Board, Planning and Resource Board, and a Management Review Team to review all aspects of its operations. General Lyles also instituted the use of *Cost as an Independent Variable* to guide the acquisition process. The process is complicated by the fact that, under BMDO guidance, all services are involved in the acquisition of several different but related weapon systems. In December 1999, Lt. Gen. Ronald Kadish, BMDO Director, announced a new flattened organizational structure. He eliminated a layer of managers and now has 16 deputies report directly to him.

106th Congress

P.L. 106-259, H.R. 4576

Department of Defense Appropriations Bill, FY2001. Appropriates funds for defense programs including missile defense. Reported as an original bill June 1, 2000 (S. 106-644); amended and passed by the House on June 7 (367 - 58); received in the Senate on June 8; the Senate struck all after the enacting clause and substituted the language of S. 2593; Senate considered on June 9, 12, and 13 and passed with amendment on June 13 (95 - 3); conference report (H.Rept. 106-754) was filed on July 17; on July 17 the House agreed to the conference report (367-58); the Senate agreed on July 27 (91-9); signed into law August 9, 2000.

P.L. 106-398, H.R. 4205

Defense Authorization Bill for FY2001. Authorizes appropriations for defense programs, including theater missile defense. Introduced by request and referred to Committee on Armed Services April 6, 2000; reported May 12 (H.Rept. 106-616); considered May 17 and 18 and passed by the House May 18, 353-63; on July 13 the Senate substituted the

language of S. 2549, passed the bill amended by a vote of 97-3; on October 6, the conference committee issued its report (H.Rept. 106-945); on October 11, the House approved the conference report; Senate approved the report on October 12; signed into law October 30, 2000.

LEGISLATION

H.Con.Res. 39 (Curt Weldon)

Honors the 28 soldiers killed by an Iraqi missile in 1991 and resolves to support appropriate and effective theater missile defense programs. Introduced February 27, 2001; referred to the Armed Services Committee. Considered by House under suspension of the rules and agreed to (395-0, 2 Present); received in the Senate and referred to the Committee on Armed Services on February 28.

H.R. 1281 (Vitter)

Directs BMDO to design and deploy a land-based and sea-based National Missile Defense system capable of defending the national territory of the United States against ballistic missile attack as soon as technologically feasible. Introduced March 28, 2001; referred to the Committee on Armed Services.

H.R. 1282 (Vitter)

Realistic Tests for Realistic Threats National Security Act of 1999. Requires BMDO to conduct at least one intercept test of NTW and/or THAAD against target missiles with flight characteristics, including velocity, of North Korea's Taep'o-dong 1 missile. It also directs BMDO to review changes to the interceptor that would increase its speed well beyond 3 km/sec. and would use targeting data from external sources including shipboard, airborne, ground-based, and satellite sensors. Introduced March 28, 2001; referred to Committee on Armed Services.

H.R. 1283 (Vitter)

Defense Against Regional Threats Act of 2001. Establishes U.S. policy to provide for deployment, as soon as technologically possible, effective systems capable of defending Israel, Japan, the Republic of Korea, Taiwan, and all member nations of the North Atlantic Treaty Organization against ballistic missile attack and to seek agreements to share the costs of those systems. Introduced March 28, 2001; referred to Armed Services and International Relations Committees.

S.Con.Res. 19 (Santorum)

Honors the 28 soldiers killed by an Iraqi missile in 1991 and resolves to support appropriate and effective theater missile defense programs. Introduced February 28, 2001; referred to the Armed Services Committee.