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Missile Defense Options for Japan, South Korea, and Taiwan: A Review of the Defense Department Report to Congress

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ABSTRACT

This report reviews the unclassified 1999 Department of Defense (DoD) report to Congress on U.S. theater missile defense systems that could protect, and could be transferred to, Japan, South Korea, and Taiwan. It summarizes the DoD report and, for clarification, some of its unstated assumptions. It further analyzes policy implications of the report's findings and assumptions, and outlines U.S. options for missile defense in East Asia. Because the DoD report is unclassified, written on a tight time deadline, and limited in scope, it does not address certain key issues that are raised and discussed here. The ability of these systems to defend against all missile threats remains questionable, and it is not clear what would be required to link three separate systems for Japan, South Korea, and Taiwan into a regional system. DoD was not asked to address political, strategic, or economic issues, but this CRS Report identifies several such issues that emerge as possible topics for further congressional examination. For more information on related legislation, see CRS Issue Brief IB98028, *Theater Ballistic Missile Defense*. This CRS Report will not be updated.

Missile Defense Options for Japan, South Korea, and Taiwan: A Review of the Defense Department Report to Congress

Summary

The FY 1999 National Defense Authorization Act (P.L. 105-261) required the Secretary of Defense to study the U.S. missile defense systems that could protect, and could be transferred to, Japan, South Korea, and Taiwan. The Secretary was directed to describe these missile defense systems and the factors used in the study in separate classified and unclassified reports to Congress. In May 1999, the Department of Defense (DoD) transmitted the unclassified report which provides a discussion of five missile defense systems that are currently being developed by the United States and could be provided to Japan, the Republic of Korea, and Taiwan: systems similar to the U.S. Patriot PAC-3, Navy Area Defense (NAD), Theater High Altitude Area Defense (THAAD), and Navy Theater Wide (NTW) Phase I with Standard Missile-3 Block I, and Phase II with Standard Missile-3 Block II. The report weighed various combinations of these systems, stating what number of missile defense units "could reasonably be expected to provide area coverage ... against a limited attack...." DoD's analysis of the individual characteristics and limitations of the five systems showed they would provide different results for different areas. For Japan, an option like NTW Block II proved best. The differing geography of South Korea and the threat it faces indicated a combination of THAAD-like and PAC-3-like systems would be most effective. According to the DoD report, Taiwan could be protected by one system similar to THAAD, NTW Block I, or NTW Block II. However, Taiwan's defense may well require a combination of lower-tier systems like PAC-3 or NAD and upper-tier systems like NTW (Block I or II) or THAAD for layered defenses.

Information in the DoD report was constrained because it was unclassified, the reporting requirement was narrow, and DoD had relatively little time to complete the study. The DoD report focuses on the TMD requirements for coverage of particular areas, considering the minimum number of firing units needed for maximum coverage. It therefore remains unclear how well these U.S. TMD systems would protect East Asia against the missiles of North Korea and China. For instance, the report does not explain the net capabilities of the defense systems against fast missiles, low-flying missiles, a large number of missiles, missiles carrying weapons of mass destruction (WMD), or missiles with penetration aids, multiple warheads, or submunitions. Some of these issues relate to the different perspectives among foreign leaders, as well as U.S. citizens, as to the technical distinctions between strategic missiles and theater missiles, and between national missile defense and theater missile defense. It was also beyond the scope of report requirements to evaluate the international political, strategic and tactical military, or foreign and domestic economic advisability of transferring particular missile defense units to Japan, South Korea, or Taiwan. In a context broader than that presented by the DoD report, there are issues and options concerning alternative ways in which the United States could provide missile defense to East Asia. For instance, it could unilaterally deploy TMD systems with U.S. troops in Asia; sell TMD systems to one or more parties; or co-develop and co-produce TMD or NMD systems with one or more allies or friends.

Contents

List of Tables

This analysis was originally prepared at the request of the Honorable Frank H. Murkowski, and is being reprinted by CRS for general congressional distribution with his permission.

Missile Defense Options for Japan, South Korea, and Taiwan: A Review of the Defense Department Report to Congress

Overview of the Department of Defense Report

Legislative Requirement

The FY 1999 National Defense Authorization Act[1] required the Secretary of Defense to study the U.S. theater missile defense systems that could protect, and could be transferred to, Japan, South Korea, and Taiwan. The Secretary was directed to describe these missile defense systems and the factors used in the study in separate classified and unclassified reports to Congress. In February 1999, Congress received the classified report, and in May it received the unclassified[2] report. The following Congressional Research Service report reviews the Department of Defense (DoD) unclassified report to Congress, summarizing key information and unstated assumptions upon which the report is based, analyzing policy implications, and outlining U.S. options for missile defense cooperation in East Asia.

The text of the legislative reporting requirement follows:

SEC. 1533. REPORT ON REQUIREMENTS FOR RESPONSE TO INCREASED MISSILE THREAT IN ASIA-PACIFIC REGION.

(a) Study.--The Secretary of Defense shall carry out a study of the architecture requirements for the establishment and operation of a theater ballistic missile defense system in the Asia-Pacific region that would have the capability to protect key regional allies of the United States.

(b) Report.--(1) Not later than January 1, 1999, the Secretary shall submit to the Committee on National Security of the House of Representatives and the Committee on Armed Services of the Senate a report containing--

(A) the results of the study conducted under subsection (a);

(B) the factors used to obtain such results; and

(C) a description of any United States missile defense system currently deployed or under development that could be transferred to key allies of the United States in the Asia-Pacific region to provide for their self-defense against limited ballistic missile attacks.

(2) The report shall be submitted in both classified and unclassified form.

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[1] P.L. 105-261, H.R. 3616, signed into law on October 17, 1998.

[2] U.S. Department of Defense. Report to Congress on Theater Missile Defense Architecture Options for the Asia-Pacific Region, May 1999, 15 pp. (The unclassified report.)

In addition, the conference report on H.R. 3616 (H.Rept. 105-736) said for the purposes of this requirement, the term "key regional allies" refers to Japan, the Republic of Korea, and Taiwan.

Summary of the DoD Report

The unclassified DoD report provides a discussion of five missile defense systems that are currently being developed by the United States and could be provided to Japan, the Republic of Korea, and Taiwan: systems similar to the U.S. Patriot PAC-3, Navy Area Defense (NAD), Theater High Altitude Area Defense (THAAD), and Navy Theater Wide (NTW) Phase I with Standard Missile-3 Block I, and Phase II with Standard Missile-3 Block II. For Japan, South Korea, and Taiwan, the report lists a number of options, with each option stating what number of missile defense units of which type "could reasonably be expected to provide area coverage for each defended area against a limited attack by the different types of TBMs likely to be arrayed against it."[3] In describing their technical methodology, the authors of the report state:

> The report quantifies the architecture force structure needed to provide coverage against specific theater ballistic missile threats to most of the territories for Japan, South Korea, and Taiwan. This defense also provides protection of the critical assets identified by the U.S. intelligence community.[4]

The report stressed that potential recipients would also need a source of early warning such as "a combination of overhead surveillance and long range phased array early warning radars," and a communication system.

To determine the number of TMD units needed by each country, DoD used the following methodology:

- chose potential launch sites of various types of theater ballistic missiles
- overlaid a grid on the map of each defended territory
- estimated the required TMD systems and deployed them on the map
- portrayed the ability of threatening missiles to strike each grid of defended territory
- determined if deployed TMD systems could intercept missiles and protect grids
- repeated the process to achieve the greatest defended area with fewest TMD units.

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[3] Report, p. 5.

[4] Ibid.

Department of Defense officials point out that:

- the options discussed in the report are "illustrative architectures based on each country's unique political and threat environment,"
- the report "is not intended to be a comprehensive analysis of TMD in the region,"
- the report "does not suggest or imply a region-wide architecture network,"
- the report "does not advocate/recommend deployment of any specific TMD architecture."
- "Because the focus of this study is possible TMD architecture, it does not address their feasibility or desirability from political, economic, or other security perspectives."[5]

Analysis of the DoD Report and Issues Beyond Its Scope

The following sections analyze and discuss the general approach and assumptions of the DoD report and particular aspects of the report that apply to Japan, the Republic of Korea, and Taiwan. In the process, this paper raises some issues important to Asian missile defense that were considered to be beyond the scope of the DoD report. This paper will then discuss TMD options for each of the three potential recipients, discuss implications of the DoD findings, review additional issues for U.S. cooperation in regional TMD, and list options that are available to the United States.

TMD System Requirements

The DoD report provides a useful analysis of the types and numbers of TMD systems that would be required to cover the areas of Japan, South Korea, and Taiwan. It demonstrates that the unique geographic characteristics of the three and the threats posed against them lead to different TMD requirements. It also points out some of the limitations of the TMD systems that were considered. The limited nature of the reporting requirement, the short time allowed, the security classification of specific characteristics and capabilities of the TMD systems, the political sensitivity of regional missile defense cooperation, and other factors prevented DoD from discussing some other related issues.

What Are Limited Ballistic Missile Attacks?

The term "limited ballistic missile attacks" is ambiguous as to the nature and scope of the limitations. In the debate on **national** missile defense, the term is used with reference to unauthorized or accidental attacks by a major power, or attacks of the type and scale considered possible for new missile powers. Such attacks would

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[5] The Report and, Theater Missile Defense (TMD) and East Asia TMD, Briefing for Congressional Research Service, Ballistic Missile Defense Organization, March 18, 1999.

presumably consist of fewer than 200 warheads and might not include sophisticated penetration aids.

The DoD report does not use this meaning of the term but considers limited missile attacks against Japan, South Korea, and Taiwan to be attacks by a few (less than five) missiles with ranges and speeds less than those of ICBMs (i.e., with ranges and speeds of tactical or theater ballistic missiles).[6] The DoD report considers theater ballistic missiles to be those with ranges less than 3,500 km (2,170 mi). For this report, DoD also limits the threat to missiles with conventional warheads – not nuclear, biological, or chemical. Conventional warheads are often much larger and heavier than warheads designed to deliver weapons of mass destruction (WMD). If the Defense Department had included missiles armed with nuclear warheads, for instance, some missiles would have had longer ranges and faster speeds and would have been more difficult to intercept with a TMD system.

The report also does not consider missiles with penetration aids, countermeasures, or altered trajectories, all of which would have decreased the effectiveness of the TMD options presented. There are clearly benefits, but also risks, of designing a system to defend against such a limited ballistic missile attack but not against a more robust attack. Some analysts consider this limited threat more plausible than some more sophisticated options. (The nature of the threat is discussed further in the country sections of this report.) The extent to which the attack is limited is key to findings of effectiveness of the missile defenses considered, so it is important for all policy makers to agree on the meaning of the term "limited ballistic missile attacks."

Key Issues Regarding the Threat. Several aspects of the future missile threat have received only limited attention in public reporting, and the DoD report does fill these gaps:

- What types of missiles, with what characteristics, are likely to threaten Japan, South Korea, and Taiwan in the year 2008?
- How many missiles might be launched against Japan, South Korea, or Taiwan simultaneously? At what rate will potentially hostile countries be able to launch missiles and how long are they likely to be able to sustain missile attacks? These factors are important because missile defense systems are limited on the number of hostile missiles they can engage at once and over time.
- Will the missile systems of potentially hostile countries have penetration aids, such as chaff, decoys, infrared emitters, jamming equipment, multiple reentry vehicles, or submunitions?
- What warheads will the hostile missiles likely deliver?
- Could North Korea use IRBMs and ICBMs on a high (lofted) trajectory against South Korea or Japan in order to achieve higher speed reentry, or on a fast and low trajectory, that TMD systems may not be able to intercept?

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[6] BMDO interview.

- Will North Korea be able to produce reentry vehicles and warheads that can withstand the forces and temperatures of high-speed reentry or extensive flight within the atmosphere? What testing would North Korea require to have confidence in such reentry vehicles or warheads?
- How effective will allied missile forces and other forces be in deterring missile attacks?

The Ballistic Missile Threat and Asian Counter Forces

The table below shows the ballistic missiles of North Korea and China that DoD considered to be potential threats in the analysis of TMD requirements for Japan, South Korea, and Taiwan. These North Korean and Chinese short range ballistic missiles (SRBMs) and medium range ballistic missiles (MRBMs) are limited in the ways discussed in the previous section.[7]

Table 1. "Threat Missile" Inventory

	Type	Range (km)	Payload (kg)	Status
NORTH KOREA				
Scud-B variant	SRBM	300	1,000	In Service
Scud-C	SRBM	500	700	In Service
Nodong	MRBM	1,000-1300	1,000	In Service
Taep'o-dong-1 Two stage	MRBM	1,500- 2,000	1,000	Tested with solid fuel third stage on 8/31/98
CHINA				
CSS-5 (DF-21)	MRBM	1,800	? Conventional	In Service
CSS-6 (DF-15/M-9)	SRBM	600	500	In Service
CSS-7 (DF-11/M-11)	SRBM	300	500	?
CSS-8 (M-7/8610)	SRBM	180	190	In Service

SRBM = Short-range ballistic missile, 70-1000 km (43-620 mi.)
MRBM = Medium-range ballistic missile, 1001-3000 km (621-1860 mi.)

[7] CRS analysts compiled the table based on unclassified reports of the government, public media, and institutional data bases.

North Korea, China, and Russia currently have other missiles in their inventories or in development that are capable of reaching Japan, South Korea, or Taiwan. Also because it will be several years before the United States, Japan, South Korea, and Taiwan can deploy effective missile defenses, it is important to predict the missile capabilities of potentially hostile countries several years from now. The characteristics of other deployed missiles and missiles in development that were not addressed in the DoD report are described in Table 2. Intercontinental ballistic missiles (ICBMs) and submarine launched ballistic missiles are included in this listing even though TMD systems have little or no capability to defend against them. (This point is discussed later.) Surface-to-surface missiles deployed or being developed by South Korea and Taiwan are listed because of their possible use as deterrent or counterforce. U.S., British, and French missiles are excluded from the chart.

Table 2. Other Missiles in the Region

	Type	Range (km)	Payload (kg)	Status
NORTH KOREA				
Taep'o-dong-2 Two stage	IRBM	4,000-6,000	?	In Development
CHINA				
CSS-2 (DF-3/3A)	MRBM	2650/ 2800	2,150	In Service
CSS-3 (DF-4)	ICBM	5,500	2,200	In Service
CSS-4 (DF-5/5A)	ICBM	12,000/ 13,000	3,200	In Service
CSS-5 (DF-21)	MRBM	2,500	600 Nuclear	In Service
CSS-N-3 (JL-1)	SLBM	1,700	600	In Development
DF-31/JL-2	ICBM/ SLBM	8,000	700	In Development; Tested 8/2/99
DF-41	ICBM	12,000	800	In Development
RUSSIA				
SS-1 Scud	SRBM	300+	1,000	In Service
SS-19 Stiletto	ICBM	10,000	43,500	3 Deactivated
SS-21 Scarab	SRBM	120	482	In Service
SS-24 Scalpel	ICBM	10,000	40,500	Modernized w/ one warhead

	Type	Range (km)	Payload (kg)	Status
SS-25 Sickle	ICBM	10,500	1,000	In Service, One Warhead
SS-27 Topol M	ICBM	10,500	?	In Production
SS-N-20 Sturgeon	SLBM	8,300	2,270	In Service
SS-N-23 Skiff	SLBM	8,300	1,360	In Service
SOUTH KOREA				
NHK-1	SRBM	180/250?	300	In Service
NHK-A (Hyon Mu)	SRBM	300-665	300	In Development
ATACMS	SRBM	160	1670	Ordered
TAIWAN				
Ching Feng (Green Bee)	SRBM	130	400	In Service
Tien Chi (Sky Halberd)	SRBM	300	500	SSM version of Sky Bow II SAM. Tested 2/97
Tien Ma (Sky Horse)	SRBM	600-950	500	In Development

MRBM = Medium-range ballistic missile, 1001-3000 km (621-1860 mi.)
IRBM = Intermediate-range ballistic missile, 3001-5500 km (1861-3410 mi.)
ICBM = Intercontinental ballistic missile, 5501+ km (3411 + mi.)
SLBM = Submarine launched ballistic missile

Capabilities and Limitations of U.S. TMD Systems

The DoD report describes some of the characteristics of the various TMD systems and their ability to cover the terrain with some degree of protection. It is constrained by its unclassified status, limited time, and international political sensitivities, and therefore does not describe the detailed capabilities of the missile defense systems it considers for use by Japan, South Korea, and Taiwan. A reader cannot determine how well the illustrative TMD systems would defend the potential recipients, because the DoD report does not indicate:

- what specific missiles each TMD system is expected to be capable of defeating, nor generally what types of missiles with what speeds, ranges, trajectories, warheads, and penetration aids;
- where the TMD units would be located, especially the ship positions;

- what precise geographic area each TMD system is capable of defending;
- how many incoming missiles each system could track and defeat at one time;
- how quickly the system can be reloaded;
- how secure each system is from enemy attack and countermeasures; or
- what percent of incoming missiles is likely to be defeated by the TMD systems described or, asked another way, what the probability is that all incoming missiles would be defeated.

The report and other DoD sources indicate NTW can intercept only those missiles flying at more than 100 km altitude and that THAAD can intercept only those missiles flying at altitudes of at least 40 km. Using a maximum range trajectory, ballistic missiles with a range of 300 km or less will have a maximum altitude well below 100 km; using a depressed trajectory (described at pages 11 and 12) short and medium range missiles may be able to reach some targets without exceeding a maximum altitude of 40 km. Therefore it may be possible for some theater ballistic missiles to fly under the coverage of the upper tier systems if they do not have to fly long distances in the relatively heavy atmosphere. However, if North Korea or China were to depress the trajectory of SRBMs or MRBMs, they would have to redesign the guidance and control systems, the structural components, and the reentry vehicle.[8] As discussed elsewhere, TMD systems also have a very limited capability against fast, long-range missiles (such as ICBMs).

There are differing views on the issues of saturation and exhaustion of TMD systems. Many analysts have raised concerns about the large inventories of missiles and missile launchers being accumulated by North Korea and China, as well as several Middle Eastern countries. They argue that a simultaneous attack by scores of missiles on a relatively small target area could overwhelm (saturate) allied missile defenses and that over time, the supply of defensive missiles could be exhausted in attempting to intercept all the incoming missiles. Some calculations by DoD refute this contention: a multiple-layer missile defense, using a series of upper tier TMDs (in a shoot, look, shoot engagement) and a salvo of lower tier TMDs, would minimize the enemy's ability to destroy a target, even if it launched a large number of missiles simultaneously. Therefore, an attacking force would require a very large number of missiles and launchers to mount an effective missile attack and may well be deterred from doing so by the presence of an effective missile defense system. Enemy decoys and countermeasures could increase the number of interceptors required for an adequate defense. Offensive and defensive missile systems will continue to evolve and the balance between them will be difficult to judge, at least until the specific systems have been produced and tested in a realistic combat environment.

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[8] According to DoD officials, the guidance system would have to be altered to set the missile on a depressed course and the missile body and reentry vehicle would have to be altered to withstand greater forces and heat generated while traveling in the atmosphere.

Three TMD Systems Versus a Regional Missile Defense System

The legislation called for a study of "a theater ballistic missile defense system in the Asia-Pacific region that would have the capability to protect key regional allies of the United States." The requirement could have been interpreted to call for a study of a single integrated regional TMD system. DoD officials have stated they did not "suggest or imply a region-wide architecture network."[9] For several reasons the DoD report considered separate systems for Japan, Korea, and Taiwan. According to the report, the study was "based on the unique political and military threat environment confronting each one." (p. 4) Also, if DoD had discussed an integrated regional program, it would have risked damaging U.S., Japanese, Korean, and Taiwanese relations with China, while at the same time raising extensive technical and political issues involved in making the various command, control, and communication systems interoperable.

Japan, Korea, and Taiwan apparently have no plans to cooperate with each other in developing or acquiring missile defense systems; indeed they have little cooperation in any area of national security. In August 1999, Japan and Korea conducted their first combined naval exercise. But the lack of current cooperation would not necessarily preclude the United States from transferring some TMD assets to each recipient, then integrating them with U.S. early warning satellites and radars, communications, battle management, and firing units to establish a missile defense system that could span the region.[10] However, it would be political necessary for Japan, South Korea, and Taiwan to agree to this integration. The United States already shares early warning data with Japan, but it is unclear that Japan could currently apply it to a TMD system.

In summary, the development of a regional system would raise a number of political and economic issues, as well as military and technical issues, but might produce more effective and efficient missile defense than would the three separate systems. Additional resources might be required to form a regional TMD network, or savings might be achieved by sharing certain systems and capabilities when integrating three separate systems into a regional system. Many of these issues are beyond the scope of the study requirement and the DoD Report but are raised in the three sections of this report on Japan, South Korea, and Taiwan, and in the section on *U.S. Considerations in Cooperative Missile Defense*. In its future deliberations, it will be important for Congress to know if there are fundamental problems that render a regional missile defense infeasible, impractical, or unaffordable, as well as if there are significant benefits of regional cooperation.

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[9] Ballistic Missile Defense Organization, "Theater Missile Defense (TMD) and East Asia TMD Briefing for Congressional Research Service," March 18, 1999.

[10] Some transfers might be prohibited by the Missile Technology Control Regime (MTCR) or the Anti-Ballistic Missile (ABM) Treaty or constrained by other factors.

U.S. Missile Defense Systems That Were Not Evaluated

While section 1533(a) of the reporting requirement calls for "a study of the architecture requirements for the establishment and operation of a **theater ballistic missile defense** system in the Asia-Pacific region that would have the **capability to protect key regional allies** of the United States," section 1533(b)(1)(C) states the report shall include: "a description of **any United States missile defense system** currently deployed or under development that could be transferred to key allies of the United States in the Asia-Pacific region **to provide for their self-defense against limited ballistic missile attacks**." Based on its reading of the legislative requirement, DoD studied only U.S. **theater** missile defense systems and, therefore, limited its discussion to systems similar to **five primary** U.S. TMD weapon programs: PAC-3, NAD, THAAD, NTW Phase I and NTW Phase II. Because section 1533(b)(1)(C) refers to **any** U.S. missile defense system, some may suggest that additional U.S. missile defense systems and programs should be considered, such as Airborne Laser (ABL). However, according to DoD, the ABL or Space-based Laser (SBL) systems are not being considered for transfer out of the United States, and for that reason and because of time constraints were not included in the study.

Because the legislation calls for a study of **any U.S. missile defense system** to provide key allies with a defense against **limited ballistic missile attacks,** it may have been appropriate to consider systems that would protect Japan, Republic of Korea, and Taiwan against all classes of missiles rather than just some classes of missiles. Because the territories are relatively small and relatively close to the likely attacking countries, some may have assumed that theater missile defense systems are effectively national missile defense systems and would protect these countries against all or most ballistic missile attacks. Japanese, Chinese, and Russian officials have indicated confusion over the terms or over the capabilities of TMD systems.[11] Actually, Japan, South Korea, and Taiwan could be attacked by intercontinental ballistic missiles (ICBMs), as well as by intermediate-range, medium-range, and short-range ballistic missiles. TMD systems generally are not considered effective against ICBMs because of the speed of the attacking missiles. The United States plans not to test its TMD systems against targets traveling faster than 5 km/sec or with ranges greater than 3,500 km, so will not be confident of their effectiveness against ICBMs.[12] (See page 14 for further discussion.) When the U.S. **national** missile defense (NMD) system is developed, it may have the technology that, if transferred or extended, could protect Japan, South Korea, and Taiwan against all limited missile attacks. Not only does the DoD report exclude discussion of certain missile defense systems (ABL and NMD), it also does not discuss the vulnerability

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[11] Ministry of Foreign Affairs spokesman Numata said, "the Americans call it theater missile defense (TMD). We call it ballistic missile defense (BMD). There is a difference there in the sense that the United States tends to think of it in theater-wide terms, whereas we think of it purely in the context of the defense of Japan for the purpose of self-defense." March 2, 1999. Chinese and Russian officials have complained that TMD systems in Asia may degrade their strategic deterrence or violate the ABM Treaty.

[12] Many analysts contend that NTW with additional sensors for early warning and long-range tracking would be able to intercept ICBMs.

of Japan, South Korea, and Taiwan to attack by high-speed missiles such as ICBMs, after the hypothetical acquisition of the TMD systems discussed.

How Are the Examples Different From U.S. TMD Systems?

The report indicates the illustrative TMD systems are similar to U.S. systems under development, but it does not say how they might differ from U.S. systems. DoD officials explained that they used the illustrative systems in the unclassified report because the precise characteristics and capabilities of the TMD systems are classified and because of the little time that was available to coordinate the report throughout DoD. They also stated the characteristics of the illustrative systems were relatively close to those of the systems being developed by the United States and that differences did not have a profound effect on the results of the study.

How Would U.S.-Deployed TMD Contribute to Asian Defense?

Any TMD systems the United States deploys now or in the future with its ground, sea, and air forces in Asia and the Pacific are likely to contribute to missile defense of the region. U.S. TMD systems deployed in or near Japan, South Korea, and Taiwan could provide them some missile defense, and the TMD systems they acquire could contribute to the defense of U.S. forces. Whether one is studying a region-wide system or three separate systems, the effects of relevant U.S. missile defense systems fit the context of discussion.

What Territory Would Be Considered Protected?

The DoD report describes the TMD systems required to protect Japan, South Korea, and Taiwan but does not clarify what territory would be protected. The report and DoD briefing materials imply that the study refers to TMD systems that would protect the four largest islands of Japan, but not necessarily the entire Ryukyu Archipelago, Sakishima-gunto (the archipelago that stretches almost to Taiwan), Senkaku Islands, Iwo Jima (Io To), or the Ogasawara (Bonin) Islands. The systems discussed for the defense of Taiwan apparently do not protect the islands off the Chinese mainland – particularly Quemoy and Matsu that are within artillery range of the mainland. The systems described for South Korea may or may not protect the islands Cheju Do or Ullung Do, and, according to the report, would not protect Seoul from all North Korean missiles. If all the territories of the three countries are included, the coverage of South Korea's and Taiwan's TMD systems would probably overlap with Japan's and might benefit from coordination through a regional TMD system.

How Would TMD Affect the Regional Military Balance?

Although TMD systems are inherently **defensive,** they can also affect a regional military balance by reducing the effectiveness of other countries' deterrent and offensive combat capabilities. The TMD systems may also provide missile technology and command, control, communication, and battle management technology that the recipients could apply to their offensive capabilities. An imbalance could lead to an arms race including missiles, missile defenses, WMD,

and advanced conventional weapons. China and North Korea are particularly concerned that regional TMD and U.S. NMD will threaten their security systems. Russia is also concerned about the effect of a U.S. NMD on its strategic forces. Therefore, some U.S. analysts think missile defense can be destabilizing. Some analysts suggest that by encouraging Japan and South Korea to acquire missile defense systems to counter North Korean missiles, the United States is undercutting its own efforts to persuade Pyongyang to relinquish its long range missiles. Regional TMD efforts, according to these analysts, send signals of containment and military supremacy, while U.S. diplomatic efforts are trying to draw North Korea into normal relations. Others insist TMD will deter or defeat missile attacks and are therefore stabilizing. Other countries, in their view, should not be offended by our defenses. Such factors were not within the scope of the DoD report but may be of interest to Congress as it considers the advisability of supporting regional TMD programs.

How Do TMD Options Suggested Compare to Other Options?

The five missile defense options discussed in the mandated DoD report address only one aspect of missile defense: active defense. DoD has defined TMD as comprised of four operational pillars: active defense, passive defense, attack operations, and command, control, communications, computers, and intelligence (C4I) (essential for any of the other pillars).[13] Although it is beyond the scope of the legislative requirement for the DoD report, the limitations of not having all aspects of missile defense discussed in a single report are worth noting. Similarly, the missile defense options were not presented in the broader context of policies to counter WMD and missiles. These broader policies might include detecting and monitoring, preventing proliferation, deterring deployment and use, defending against WMD, and reducing world WMD inventories.

Assessment of DoD Report for Japan

The Missile Threats to Japan

North Korea, China, and Russia have the capability to attack Japan with ballistic missiles. Tokyo's immediate interest in TMD is based on the threat from North Korea.[14] North Korea's Nodong 1 MRBM with a range of 1,000-1,300 km (620-800 mi.) could reach most of Japan and the two-stage Taep'o-dong 1 MRBM with a range of 1,500-2,000 km (900-1,200 mi.) could reach all of Japan. On August 31, 1998, North Korea fired a three-stage rocket (apparently a Taep'o-dong 1 with a solid-fuel third stage) over Japan ostensibly in a failed attempt to launch a satellite. If it is ultimately successful, the three-stage rocket might have a range of more than 5,000

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[13] DoD, "Doctrine for Joint Theater Missile Defense," Joint Pub 3-01.5, February 22, 1996.

[14] In response to North Korea's August 31, 1998 ballistic missile shot over Japan, Sadaaki Numata, spokesman for Japan's Foreign Ministry said: "We are seriously concerned about this because the deployment of missiles by North Korea does affect Japanese security and it also affects peace and stability in Northeast Asia." *New York Times*, September 1, 1998.

km (3,100 mi.).[15] North Korea is also reportedly developing a two-stage Taep'o-dong 2 with a range of 4,000-6,000 km (2,500-3,700 mi.) and might extend its range by adding a third stage. North Korea reportedly is developing, or has developed, nuclear, chemical, and biological weapons that it may be able to deliver with its ballistic missiles.

The extensive ballistic missile inventory of the People's Republic of China, too, is a potential threat to Japan. Officially, the Japanese leadership has not made any public statements suggesting any connection between China's ballistic missiles and Tokyo's current interests in TMD.[16] However, a security specialist with the Institute of International Policy Studies in Tokyo believes that "North Korea provides a good excuse [for TMD], but as a matter of fact the primary target is China."[17] China has two medium-range ballistic missiles that can hit Japan: the CSS-2 with a range of 2,800 km and the CSS-5 with a range of 1,800 km (conventional warhead) or 2,500 (nuclear). China's CSS-3 (5,500 km) and CSS-4 (12,000/13,000 km) ICBMs could also reach Japan, and the PRC continues to improve its missile force with the development of at least one new mobile ICBM (DF-31), submarine launched missiles, and new cruise missiles. China has nuclear and chemical weapons and probably has biological weapons. It is known to have nuclear warheads for its strategic missiles.

China could attack Japan with ICBMs which may fly too fast for the proposed TMD systems to intercept reliably. Also, it is possible that North Korea could modify the trajectory of its missiles to increase their effectiveness against a missile defense system in Japan. Conceivably, North Korea could launch a three-stage Taep'o-dong 1 or a Taep'o-dong 2 on a very steep (lofted) trajectory to a high altitude, so that it would enter Japanese airspace at such a high speed (over 5 km/sec) that planned TMD systems could not reliably intercept it.[18] On a lower (depressed) trajectory, Taep'o-dong missiles could theoretically attack Japan at a very high velocity while spending less time above 100 kilometers of altitude where they might be vulnerable to NTW. A depressed trajectory could deliver a missile from North

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[15] CBS Evening News, CBS Worldwide Inc., [http://www.wusatv9.com], Sept. 15, 1998; *New York Times*, September 15, 1999.

[16] For example, in the annual Defense of Japan white paper 1998, by the Japanese Defense Agency, under the section detailing number and types of ballistic missiles that China has, no mention is given assessing the implications to Japanese security of the existing Chinese ballistic missile systems, though it is pointed out that the missile force is growing and qualitative improvements are being made.

[17] "The Concept: An Asian Missile Shield," *Christian Science Monitor*, April 8, 1999, p. 12.

[18] Spring, Baker. "Successful Missile Defense Test Shows Technology Works," The Heritage Foundation Executive Memorandum, no. 608, June 18. Mr. Baker contends that neither THAAD nor NTW is capable of downing a Taepo'-dong 1 missile because of its speed. He estimated it had a maximum speed of 7-8 km/sec in the August 1998 launching. U.S. TMD systems have not been and are not planned to be tested against targets that travel over 5 km/sec. The Taepo'-dong 2 will probably have a greater maximum speed. But with sufficient early warning and cueing sensors, NTW might be able to intercept ICBMs with speeds over 5 km/sec, as many analysts have suggested NTW be used for national missile defense.

Korea to Japan very quickly, reducing the time available to locate and identify the attacking missile, obtain authorization to fire the interceptor, and to destroy the attacking missile.[19] However, it is questionable whether North Korea or China will have built missiles, reentry vehicles, or warheads able to withstand the heat and stress of traveling through the atmosphere for the longer periods required by a depressed trajectory. The additional weight of material to strengthen the missile components and protect them from heat could require a smaller warhead or greater thrust. But that additional weight should not be a problem for Taep'o-dong missiles that have enough thrust to send them far beyond Japan. A depressed trajectory also reduces accuracy.[20]

The stress and heat generated in a depressed trajectory, and the possibility of the reentry vehicle colliding with rocket stages and shrouds jettisoned in the atmosphere, might be reduced by a "shaped trajectory," i.e., one that differs substantially from a ballistic trajectory. In this trajectory, a missile ascends on a steep path, then turns "when outside the atmosphere to fly more nearly parallel to the earth's surface," discards used stages in space, and reenters the atmosphere at a selected angle of descent.[21] North Korea or China might in the future be able to defeat proposed theater missile defense systems by modifying the speed, flight time, and altitude of missile attacks. Although these modifications are theoretically possible, and some scientists contend the United States and Russia could accomplish them, there is no publicly available information to indicate China or North Korea will attempt to or will be able to modify their missiles in these ways.

Russia maintains a sizeable missile force consisting of ICBMs, SLBMs, and cruise missiles that could strike Japan. The missile defense system Japan is contemplating and the systems discussed in the DoD report do not appear to respond to the threat of Russian missiles nor would they be well suited to defend against such a threat.

The DoD report does not specify what penetration aids and countermeasures are likely to be associated with North Korean, Chinese, or Russian missiles that may threaten Japan. The effectiveness of missile defenses may be degraded by decoys (including balloons), chaff, submunitions, spin-stabilized reentry vehicles (RVs), RV reorientation, radar absorbing material (stealth), modified trajectories, distracting heat sources, or electronic countermeasures including jammers. The use of multiple launchings or multiple warheads could have a similar effect by requiring the defense to acquire, track, and engage more weapons at one time.[22] The unclassified version

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[19] CRS Report 90-329 F, *Fast-Trajectory Strategic Ballistic Missiles: Characteristics, Military Uses, and Implications*, by Jonathan Medalia, July 10, 1990.

[20] Gronlund, Lisbeth and David C. Wright. "Depressed Trajectory SLBMs: A Technical Evaluation and Arms Control Possibilities," Science & Global Security, v. 3, 1992, pp. 101-160.

[21] Ibid., pp. 9-10.

[22] The DoD report states, "there was insufficient time to examine the effects of suppression of TBMD systems by a potential aggressor, robustness against maximum aggressor raid (continued...)

of the 1999 national intelligence estimate on the ballistic missile threat reported that, "Russia and China each have developed numerous countermeasures and probably are willing to sell the requisite technologies." It also judged that countries such as North Korea, Iran, and Iraq that are developing long-range missiles, could develop such countermeasures "by the time they flight test their missiles."[23]

Potential Capabilities and Limitations of TMD Systems

The DoD report concluded the best missile defense option of those considered to defend Japan against North Korean Nodong or Taep'o-dong 1 missiles would be a shipboard NTW Block II-like system. "One ship position is sufficient to provide full national coverage." (p. 8) This system would be able to fire twice (shoot-look-shoot) at North Korean missiles directed at the central portion of Japan. On the other hand, four ship positions would be required for an NTW Block I-like system to "provide nearly complete coverage of Japan with substantial shoot-look-shoot opportunities over much of Japanese territory." (p. 8)

The report also analyzed two land-based systems based on PAC-3 and THAAD. It found that more than 100 PAC-3-like systems (augmented by a THAAD-like radar) would be required for a country-wide defense of Japan with this system. The report explained the purpose of examining the PAC-3 system "was simply to demonstrate the large number of fire units that would be required to accomplish a ballistic missile defense for Japan." (p. 8) Six THAAD-like systems, or four THAAD-like systems with three additional THAAD-like radars would be required to cover all, or nearly all, of Japan.

The report did not indicate how many Navy Area Defense-like ships would be required to provide lower-tier protection of Japan, although it did evaluate this system for lower-tier protection of South Korea and Taiwan. Probably because of NAD's limited ability to provide protection for inland facilities and population centers, it was not discussed for Japan's defense against Nodong and Taep'o-dong missiles.

The report does not comment on the ability of any of these missile defense systems to defend against a North Korean Taep'o-dong 1 with a third stage, Taep'o-dong 2, Chinese MRBMs with ranges greater than 2,000 km, or Chinese or Russian ICBMs. In keeping with the ABM Treaty demarcation agreement, the United States will not test its TMD systems against targets with the speed of a strategic missile (over 5 km/sec.), so it would not be safe to assume the TMD systems would be effective against these missiles. There was also no indication in the report that Japan would enhance the capability of the U.S. systems or test them against faster missiles. (However, on page 5, the DoD report said a source of early warning, such as overhead surveillance and long-range phased-array early-warning radar is essential

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[22] (...continued)
sizes, or countermeasures which could be employed on theater ballistic missiles (TBMs)." (P. 4)

[23] U.S. National Intelligence Council. "Foreign Missile Developments and the Ballistic Missile Threat to the United States Through 2015." September 1999, p. 14.

for effective TMD.) It would thus appear that the missile defenses analyzed in the DoD report were not considered as a reliable defense against these faster, longer-range missiles. But, if passed, the *Realistic Tests for Realistic Threats National Security Act of 1999*,[24] would require DoD to test NTW and THAAD "against target missiles with velocities not less than the maximum velocity of the Taepo Dong I missile of North Korea." The bill also calls on DoD to review changes to the configuration of NTW and THAAD to increase the interceptor speed beyond three kilometers per second and to allow the interceptors to use a wide variety of sensors.

TMD systems, or at least upper tier TMD systems, would presumably be able to protect against Chinese MRBMs — CSS-5 (1,800 or 2,500 km) and CSS-2 (2,800 km) – fired on a standard trajectory without extensive or sophisticated penetration aides. But, more TMD ship positions or land-based firing units and radars than envisioned in the DoD architecture options would be required to defend against these Chinese missiles and against future Chinese SLBMs because they could be fired at relatively high speeds from a wide range of locations in China, whereas missiles launched in North Korea, "would come from a concise attack area." (p. 7)

The report does not comment on the capability of the various TMD systems to overcome modified trajectories and penetration aids (discussed on page 12 above).[25] Depending on the expected capabilities of the North Korean, Chinese, and Russian missiles, any missile defense system that is to be able to defend Japan must be able to overcome some or all of these countermeasures.

Japanese Considerations[26]

The Japanese have long been intent on maintaining a close security relationship with the United States, based on the Treaty of Mutual Cooperation and Security signed in 1960. More recently, Japan has become interested in supplementing its own self-defense forces with missile defense systems, primarily to counter the North Korean missile threat. In August 1999, the United States and Japan signed an agreement to conduct joint research on four components of the NTW system: nose cone, 2nd stage propulsion, sensor, and kinetic warhead.[27] Japan had committed approximately $8 million to fund their first year of this joint effort and the Japan Defense Agency submitted a preliminary budget request of almost $20 million for the second year.[28] According to DoD officials, the Japanese technological contribution could be significant.

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[24] H.R. 2596, introduced by Mr. Vitter on July 22, 1999.

[25] DoD noted this omission was due to insufficient time.

[26] The DoD report stated, "Because the focus of this study is possible TMD architecture, it does not address their feasibility or desirability from political, economic, or other security perspectives. A detailed discussion of these important facets of the issue is outside the mandate and scope of this paper."

[27] BMDO and "Japan Missile Defense Tops R&D Funding List," *Defense News*, March 22, 1999, p. 14.

[28] Usui, Naoki. "Japan Aims to Boost Ballistic Missile Research Funds," *Defense News*, September 20, 1999, p. 24.

The Japanese are well aware that China objects to the missile defense cooperative program because it signals stronger U.S.-Japan military ties, may portend increased Japanese militarization, might degrade China's capability to project power through missile attacks, and China is particularly concerned that the Japanese missile defense system might cover Taiwan. While Japan does not wish to antagonize China, it has apparently concluded it needs a system that is effective against North Korean missiles, which would also be effective against some of China's missiles.

Japanese leaders have also been constrained by Article Nine of the country's Constitution that renounces war and the threat or use of force as a means of settling international disputes. Japan has traditionally eschewed offensive weapons and foreign deployments. It has also avoided security relationships (including missile defense) with its Asian neighbors and might be reluctant to deploy its missile defenses in a way that would contribute to another country's defense or that would intrude into the territorial waters or airspace of another country. Also, Japan is apparently not currently considering defense systems like the Airborne Laser (ABL) or an equivalent to the U.S. National Missile Defense (NMD), partly because they could be construed as offensive or strategic systems. (However, as mentioned above, the Japanese do not consider the proposed systems to be **theater** missile defense, but missile defense of the country.) But Japan may be able to adopt somewhat more aggressive missile defense measures (such as ABL, Space-Based Laser, or boost-phase intercept) if it approves legislation currently under consideration that would allow pre-emptive strikes against another nation when the threat of attack is imminent.[29]

Japanese missile defense cooperation with its Asian neighbors might also be restricted by the Three Principles of Arms Exports and related guidelines which prohibit arms exports to communist countries, countries under a UN embargo, or countries involved in, or likely to be involved in, armed conflict. Arms transfers to other countries are restrained "in conformity with the spirit of the Constitution and the Foreign Exchange and Foreign Trade Law."[30]

Japan's preference for NTW over THAAD, which may employ space-based sensors, is reportedly partially based on the country's policy against the military use of space. The DoD report acknowledges that some form of early warning and long distance tracking, which could be space-based, would be required for an effective TMD. It would probably need equipment and data in addition to the early warning the United States has been sharing with Japan since 1996. Japan is developing an indigenous Information Gathering Satellite System and is acquiring some U.S. technology for the system.

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[29] *Financial Times*, "LDP debates military strikes strategy," February 22, 1999, pg. 1. In March 1999, the Japanese Prime Minister's deputy press secretary said, "it is legally possible for Japan to exercise the right of self-defense and attack bases of an enemy even when Japan has not yet suffered any realistic damage." Reuters, March 9, 1999.

[30] Anthony, Ian (ed.). Arms Export Regulations. SIPRI., Oxford University Press, 1991, p. 106. Guidelines were first established in 1960, expanded in 1962, proclaimed as the Three Principles in 1967, elaborated in 1976, and interpreted as they apply to the United States in 1983.

Cost is another important factor to the Japanese government. Acquisition and operation of a comprehensive and effective missile defense system would be a large and controversial expense for Japan's Defense Agency and Self-Defense Forces. Additionally, Japanese industry has become leery of joint development projects and sharing its commercially-useful technology, even though the Japanese government wants the benefits of advanced U.S. military technology, and Japanese industry wants the financial and technological gains that can be associated with defense contracts. THAAD would also occupy much more land – a scarce resource in Japan – and would offer less opportunity for Japanese participation in system development than would NTW.

Assessment of DoD Report for Republic of Korea

Missile Threat to the Republic of Korea

The DoD report used only the North Korean short range ballistic missile capability to represent the threat to the Republic of Korea, while excluding the potential threat from Chinese and Russian missiles.[31] North Korea has hundreds of domestically-produced Scud-B variants (100 and 300 km range) and Scud-C (500 km) missiles that could deliver high explosive or chemical warheads or, possibly, biological warheads.[32] Pyongyang is believed to have sufficient fissile material for one or two atomic weapons and may possibly have produced such weapons.[33] North Korea also manufactures the Nodong MRBM and has tested the Taep'o-dong 1 MRBM, neither of which was considered. The DoD report said that because of the relatively small size of South Korea (380 km north-to-south and 260 km east-to-west), "the ranges of the ballistic missiles that can be used are restricted."

Potential Capabilities and Limitations of TMD Systems

Five TMD options were examined by DoD and discussed in its report. The best option included four THAAD-like systems and seven PAC-3-like systems. This combination would provide coverage of "all of the country beyond the immediate reach of very short-range ballistic missiles."[34]

> The critical feature for the coverage achieved by this architecture is the minimum intercept altitude for the endo-exo upper tier [THAAD] system. Able to intercept TBMs flying to an apogee as low as 40 kilometers, the endo-exo upper tier system could reach most of the threatening trajectories. The lower tier [PAC-3] system would be used to protect Seoul and its environs. ...

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[31] The report describes "the architecture requirements for the defense of the ROK against North Korean missiles...." (P. 10)

[32] U.S. Department of Defense. Proliferation: Threat and Response, November 1997, p. 8.

[33] Unless North Korea has received extensive assistance from another country that has developed and tested nuclear weapons, it is doubtful it has a reliable nuclear warhead for its missiles.

[34] DoD Report, p. 11, and TMD briefing by BMDO.

> In the case of the THAAD-like... system, the high endo minimum intercept altitude would preclude engagements for threats attacking the northern portions of the ROK.[35]

This appears to indicate that THAAD-like systems could intercept North Korean SCUD-Bs and Cs that climb above 40 km, and that PAC-3-like systems deployed around Seoul might intercept some SCUDs that do not reach 40 km altitude. Apparently not covered by the THAAD/PAC-3 combination are very short-range North Korean missiles (perhaps FROGs and other battlefield rockets, as well as very short-range SCUDs) deployed near the DMZ. The very short flight time is another factor that makes it difficult to intercept missiles fired at Seoul from close range. Even some North Korean artillery is within range of Seoul (just 40 kilometer/24 miles from the border with North Korea). As noted, SCUD, Nodong, and Taep'o-dong missiles fired with a modified trajectory may exceed the capabilities of PAC-3 and THAAD.

Less effective options discussed in the report included:

- 25 PAC-3-like units to "cover the assets identified as critical,"
- 11 NA-like ships to provide protection to coastal areas,
- 1 NTW-Block I-like ship and 25 PAC-3-like units,
- 1 NTW-Block II-like ship and 19 PAC-3-like units.

The report notes that a larger deployment of PAC-3s would allow coverage of more of South Korea than just the identified critical assets. The Navy Area Defense-like systems "could not reach far enough inland to defend all critical assets and population centers against all threat trajectories," and the NTW-like system "could not defend the northern two-thirds of the ROK against low-flying short-range TBMs...most North Korean threats...."[36]

The report does not comment on the capability of the various TMD options to overcome modified trajectories and penetration aids, such as decoys, chaff, submunitions, multiple-simultaneous launchings, and electronic countermeasures.[37] Depending on the expected capabilities of the North Korean, Chinese, and Russian missiles, any missile defense system that is to be able to defend South Korea may have to overcome some or all of these countermeasures.

Republic of Korea Considerations

South Korea officials are quite concerned by the North Korea missile threat, and maintain a close military alliance with the United States while they work cautiously toward reunification of the Korean Peninsula. Since 1979, the U.S. Army has maintained one Patriot surface-to-air missile battalion at air bases south of Seoul to protect key U.S. and South Korean fighter aircraft capabilities. Korean officials considered, but were not initially anxious to purchase or participate in U. S. missile

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[35] Ibid, pp. 11, 12.

[36] Ibid.

[37] DoD noted this omission was due to insufficient time.

defense systems. But in early November 1999, DoD announced that South Korea had initiated competition for a missile defense system, the SAM-X program. The system is planned to be able to intercept aircraft at a distance of 60 km and missiles at a distance of 20 km. It will be able to track four targets at once. Raytheon will probably compete with a proposed system of 14 PAC-3 fire units (armed with PAC-2 Guidance Enhanced Missiles) at an estimated cost of $4.2 billion. A follow-on system, the medium-range surface-to-air missile or M-SAM, is to have a 100 km range.[38]

North Korea's strident opposition to South Korean missile defense was apparently not a significant factor in Seoul's initial reluctance. Missile defenses were not the top priority of the ROK military, partly because of their inability to guarantee the safety of Seoul and adjacent military units. Also, the Asian financial crisis reduced funds even for higher priority military programs. ROK officials considered acquisition of the Russian S-300 theater missile defense system, which it might have been able to obtain in exchange for relief of Russian debt to the country. The United States strongly urged South Korea not to acquire the Russian system that would not be compatible with U.S. military equipment. Seoul also considered the development of its own missile force to deter a North Korean missile attack. ROK officials are currently negotiating to release Seoul from its 1979 agreement with the United States not to develop a missile with a range greater than 180 km. South Korea would prefer to join the multilateral Missile Technology Control Regime and be allowed to produce missiles with ranges of 300 km or more.

Assessment of DoD Report for Taiwan

Missile Threats to Taiwan

Scale of Attacks. The missile threat posed by the People's Republic of China (PRC) to Taiwan is wide-ranging, uncertain, and expanding. As the DoD report pointed out, Taiwan faces an "evolving threat" from "multiple directions." (p. 14) Short-range ballistic missiles (SRBMs) and medium-range ballistic missiles (MRBMs) could be launched from many areas in the large territory of the PRC. Moreover, the DoD report noted that the PRC has a range of options, including: limited firings of 1-3 missiles, medium-scale firings of several missiles at Taiwan's military targets, and large-scale firings against many targets. However, the DoD analysis considered only attacks of a few (less than five) SRBMs or shorter range MRBMs.[39] At the same time though, the DoD report warned of a PRC missile buildup, saying that the threats faced by Taiwan from PRC short- and medium-range ballistic missiles "are expected to increase significantly over the next several years."

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[38] *Jane's Defence Weekly*, September 29,1999, p. 17; Inside Missile Defense, Nov. 17, 1999, p. 3.

[39] Interview with DoD.

Scope of Threat. Apparently due to the legislative requirement that the Pentagon study architecture options for TMD systems to protect Japan, South Korea, and Taiwan, the DoD report limited its discussion to theater ballistic missiles (less than 3,500 km in range). However, the ballistic missiles available to the People's Liberation Army (PLA) cover a wider range, including ICBMs with much longer range and higher speed.[40] (See the table below.) The PRC has also worked on developing submarine-launched ballistic missiles (SLBMs) that could also pose an additional threat to Taiwan. The DoD report did not specify the PRC ballistic missiles that could threaten Taiwan except to imply that shorter-range missiles in this context have a range of less than 300 km (190 mi) and longer-range missiles have a range of about 3,000 km (1,860 mi) (p. 14). However, the DoD analysis considered some SRBMs and MRBMs (i.e., conventionally-armed CSS-5s) with ranges of 1,800 km or less.

Wide Range of Possible Threats. The PLA has at least three classes of SRBMs that could be used against Taiwan. The PRC launched the 600 km (380 mi)-range M-9 (PRC designation), or CSS-6 (U.S. designation), SRBMs into waters near Taiwan in 1995 and 1996. There are reportedly up to 50 launchers for the M-9, although the number of missiles can be much larger than the number of launchers, because launchers can be used repeatedly.[41] The M-11, or CSS-7, is an SRBM with a range of about 300 km (190 mi), sufficient to fly over the Taiwan Strait (about 100 miles wide). Like other newer PRC missiles, it can be fired from a mobile transporter-erector-launcher (TEL). However, there are questions about the status of the M-11 missile and whether a new version with a range of over 300 km will be available. The Secretary of Defense's February 1999 report on Taiwan security reported that the M-11 "has not yet entered the PLA's inventory; and an improved, longer range version may be under development."[42] The report also warned of a PRC missile build-up, saying that "within the next several years, the size of China's SRBM force is expected to grow substantially." Taiwan's Defense Ministry said in February 1999 that the PRC has more than 100 M-class missiles in storage that could target Taiwan.[43] According to news reports in early 1999, citing a classified Pentagon report, China increased its SRBM deployment on the coast across from Taiwan from 30-50 in 1995-1996 to 150-200 SRBMs (including M-9s, and possibly M-11s). Moreover, the PLA plans to increase its number of SRBMs to 650 by 2005.[44] The PLA also has M-7 (CSS-8) SRBMs that were derived from HQ-2

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[40] For details and sources, see CRS Report 97-391, *China: Ballistic and Cruise Missiles*, by (name redacted) and (name redacted). See also, U.S. Air Force, National Air Intelligence Center (NAIC), "Ballistic and Cruise Missile Threat," April 1999.

[41] NAIC.

[42] Secretary of Defense, "The Security Situation in the Taiwan Strait," Report to Congress Pursuant to the FY99 Appropriations Bill, February 1, 1999.

[43] "Citing Threat of Chinese Missiles, Taipei Calls Defense Inadequate," Reuters, February 11, 1999.

[44] Walker, Tony and Stephen Fidler, "China Builds Up Taiwan Missiles," *Financial Times*, February 10, 1999; Bill Gertz, "China Moves Missiles In Direction of Taiwan," *Washington Times*, February 11, 1999.

surface-to-air missiles. The CSS-8 has a short range of only about 180 km (90 mi), sufficient to cross the strait and hit targets in western Taiwan in about two minutes.[45]

Type	PRC Designation	U.S. Designation	Range (km)/ Warhead (kg)	Launchers*	Launch platform
SRBM	DF-15/ M-9	CSS-6	600/500	<50	mobile TEL
SRBM	DF-11/ M-11	CSS-7	300/500	?	mobile TEL
SRBM	8610/ M-7	CSS-8	180/190	?	mobile launcher
MRBM	DF-3A	CSS-2	2,800/2,150	<50	land-mobile
MRBM	DF-21	CSS-5	1,800/ ? Conventional	<50	mobile TEL
MRBM	DF-21	CSS-5	2,500/600 Nuclear	?	mobile TEL
ICBM	DF-4	CSS-3	5,500/2,200	<25	silos and land-mobile
ICBM	DF-5A	CSS-4	13,000/3,200	<25	silos

*Each launcher may launch more than one missile.

There are also at least two classes of Chinese MRBMs that could be used against Taiwan. The older DF-3A (CSS-2) MRBMs, with up to 50 launchers, have a range of approximately 2,800 km (1,700 mi). The newer, solid-fuel DF-21 (CSS-5) MRBMs, armed with conventional warheads, travel about 1,800 km (1,100 mi), with up to 50 launchers deployed.[46] Another version of the CSS-5, with a 2,500 km range, is believed to be armed with a lighter nuclear warhead, but the DoD report did not consider this nonconventional missile to be targeted at Taiwan. These longer-range, faster MRBMs would have been a greater challenge for the Taiwan TMD system and may have required a more robust architecture.

While the DoD report did not discuss the threats from Chinese ICBMs, there are also at least two classes of Chinese ICBMs that potentially could threaten Taiwan, although they are believed to be deployed for strategic nuclear deterrence. The DF-4 (CSS-3) ICBM has a limited range of about 5,500 km (3,400 mi), and the DF-5A (CSS-4) has a range of about 13,000 km (8,000 mi). While these ranges are longer than needed to reach Taiwan, they can be changed depending on the amount of fuel,

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[45] Stokes, Mark A., "China's Strategic Modernization: Implications for U.S. National Security," Paper for the Project for the New American Century, April 23, 1999.

[46] NAIC.

the weight of the warhead, and the trajectory, including potentially a very high flight path (lofted trajectory).

In addition, the PRC has been developing more modern ICBMs, including the DF-31 that was test-launched on August 2, 1999, and SLBMs, including the JL-1 with a range of about 1,700 km (1,000 mi). Twelve JL-1s are intended to be deployed on the PLA's one XIA class nuclear-powered ballistic missile submarine (SSBN), but the missile apparently has not yet been successfully deployed.[47] A follow-on JL-2 SLBM is also reportedly under development for deployment on planned 094 SSBNs.

The trajectories and speed of the PRC's ballistic missiles would affect defenses against them. The DoD report provided some details on these questions. It said that the SRBMs and MRBMs threatening Taiwan have apogees "outside the atmosphere" and that "the medium range missile also has a re-entry speed likely to preclude a high probability of intercept by lower-tier systems."[48] However, according to another part of the DoD report and DoD sources, if China deployed and fired ballistic missiles with shorter ranges (less than 300 km), these missiles could "remain inside the atmosphere for the entire trajectory" and fly beneath the coverage of exo-atmospheric, upper-tier TMD systems (such as NTW).[49] Depressed trajectories of ballistic missiles could reduce the effectiveness of, or possibly defeat, certain TMD systems considered.

Apparently assuming a conventional role for China's theater ballistic missiles that threaten Taiwan, the DoD report did not discuss the warheads that may be delivered by PRC ballistic missiles, which could carry conventional warheads or WMD. While they may carry various types of conventional warheads, the M-11 and M-9 SRBMs as well as the MRBMs are nuclear-capable. Some in Taiwan fear that the PRC has not ruled out the use of WMD, including nuclear weapons, against Taiwan.[50] While previously serving as Chief of General Staff, Taiwan's Defense Minister Tang Fei reported to the legislature on the Chinese threat, including modernization of nuclear weapons and ballistic missiles.[51] On July 15, 1999, the PRC government issued a report to refute the findings of the House Select Committee on China (Cox Committee), and the PRC's statement included the first official acknowledgment that it has the neutron bomb.[52] Neutron bombs kill large numbers

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[47] NAIC.

[48] The report may be referring to both CSS-2 and CSS-5 MRBMs as having re-entry speeds that are too fast for lower-tier missile defense systems.

[49] The endo-atmospheric flight of a 300 km-range SRBM was also indicated by a briefing by the Ballistic Missile Defense Organization (BMDO) of the Department of Defense, March 18, 1999.

[50] Liao, Hung-hsiung, "Should Taiwan Develop Strategic Nuclear Weapons?" Ch'uan-ch'iu Fang-wei Tsa-chi, March 15, 1999, in FBIS.

[51] Lai, Victor, "Top Military Leader Reports on Taiwan Defense Situation," Central News Agency, September 30, 1998, in FBIS.

[52] People's Republic of China, Information Office of the State Council, "Facts Speak Louder (continued...)

of people with radiation without destroying buildings and equipment. Some analysts considered this announcement to be a threat meant to intimidate Taiwan, since the timing of the report came soon after Taiwan President Lee Teng-hui angered Beijing on July 9, 1999, by saying that cross-strait relations are "special state-to-state ties."[53] As noted above, a PRC MRBM with a nuclear warhead would have a longer range and higher velocity than one with a heavy high explosive warhead. Although it would present a greater challenge to a TMD system and a greater risk to Taiwan, the nuclear-tipped MRBM was not considered in the DoD report.

In addition, as a signatory to the Chemical Weapons Convention, China has acknowledged that it has chemical weapon facilities and stockpiles.[54] On May 21, 1997, the Clinton Administration imposed sanctions confirming that Chinese entities had contributed to chemical weapon proliferation in Iran.[55] As for biological weapons, the U.S. Arms Control and Disarmament Agency reported in 1998 that "there are strong indications that China probably maintains its offensive program."[56]

Also, the DoD report did not specify what types of conventional warheads, penetration aids, and countermeasures are likely to be associated with Chinese missiles that may threaten Taiwan. Indeed, in September 1999, the Intelligence Community publicly confirmed that China has developed "numerous countermeasures" and likely is willing to sell the technology to other countries.[57] The effectiveness of missile defenses may be degraded by decoys, chaff, submunitions, multiple-simultaneous launchings, modified trajectories, or electronic countermeasures. The use of multiple warheads could have a similar effect by requiring the defense to acquire, track, and engage more weapons at one time.[58]

Potential Capabilities and Limitations of TMD Systems

Taiwan's Considerations. Taiwan has a number of options should it decide to seek missile defenses beyond the Modified Air Defense System (MADS), a Patriot

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[52] (...continued)
Than Words and Lies Will Collapse by Themselves — Further Refutation of the Cox Report," July 15, 1999.

[53] Faison, Seth, "Is China Waving a Bomb at Taiwan?," *New York Times*, July 16, 1999.

[54] Lippman, Thomas, "Poison Gas Treaty Process Reveals Previously Unknown Production Sites," *Washington Post*, September 28, 1997.

[55] See CRS Issue Brief 92056, *Chinese Proliferation of Weapons of Mass Destruction: Current Policy Issues*, by (name redacted).

[56] U.S. Arms Control and Disarmament Agency, "Adherence to and Compliance With Arms Control Agreements," 1997 Annual Report.

[57] National Intelligence Council, "Foreign Missile Developments and the Ballistic Missile Threat to the United States Through 2015," September 1999.

[58] The DoD report states, "there was insufficient time to examine the effects of suppression of TBMD systems by a potential aggressor, robustness against maximum aggressor raid sizes, or countermeasures which could be employed on theater ballistic missiles (TBMs)." (p. 4)

system, acquired in 1997 to protect Taipei. Taiwan may consider several factors in selecting a system to counter the PRC's possible use of SRBMs as well as longer range ballistic missiles. The possibility that the missiles could carry non-conventional as well as conventional warheads may require greater emphasis on the interception of missiles over the PRC or over the sea, farther from Taiwan. A Chinese attack with lofted ICBMs, depressed MRBMs, or shorter range missiles may be able to defeat the TBMDs discussed. It is not clear how effective a sea-based upper tier system would be if Taiwan were attacked with SLBMs launched from a submarine east, north, or south of the island.

DoD Report's Options. The DoD report noted that either the land-based or the sea-based lower tier system could adequately defend "most of Taiwan's critical assets," but neither system could provide "any defense" against longer range theater ballistic missiles. Thus, the report said that "to address the full range of threats [SRBMs and MRBMs], three land- and sea-based upper tier options were explored." The DoD report found that one land-based upper tier system, with an additional THAAD-like radar, could cover the "entire island of Taiwan" and could intercept both missiles flying inside the atmosphere (endo-atmosphere) and outside (exo-atmosphere). Alternatively, one sea-based upper-tier system, like NTW, with only one ship position, could cover "all of Taiwan." A sea-based option could be the NTW SM-3 Block I Missile (with Aegis Spy-1 radar) or the NTW Block II system.[59]

However, while the DoD report found that either one land-based or one sea-based upper-tier option is sufficient to defend Taiwan, it did not compare their respective advantages or disadvantages. Both sea-based upper tier systems are exo-atmospheric and would not intercept SRBMs or MRBMs on trajectories that remain inside the atmosphere. While THAAD is expected to have the capability to defend against ballistic missiles flying inside the atmosphere as low as 40 km, NTW has a minimum intercept altitude of about 100 km (p. 11). On the other hand, the NTW system could intercept some incoming missiles (possibly with non-conventional warheads) in their ascent, mid-course, and descent phases outside the atmosphere,[60] potentially farther away from Taiwan. The DoD report also did not discuss the effectiveness and vulnerability of various possible locations of the one ship position needed for a sea-based, upper-tier option (i.e., in the Taiwan Strait or east of Taiwan).

Alternative Options. Thus, Taiwan may need to further enhance defenses against the PRC's missiles with a combination of both an upper tier system and another system to defend against low altitude missiles and to provide "layered defenses" (or "defense-in-depth"). Rather than the DoD report's options of a single system similar to THAAD, NTW Block I, or NTW Block II, Taiwan's defense may well require a set of alternative options (with one or more units of each system):

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[59] The DoD report states the upper tier systems could protect all of Taiwan, although it also says the upper tier systems could not defend the upper portions of South Korea. NTW could not defend the upper 250 km of South Korea, although it can reportedly defend all of Taiwan which is only 175 km from mainland China. (Pp. 10 and 14)

[60] BMDO interview.

1. Land-based Lower Tier (PAC-3) and Sea-based Exo Upper Tier (NTW Block I or Block II), or

2. Sea-based Lower Tier (NAD) and Sea-based Exo Upper Tier (NTW Block I or Block II), or

3. Land-based Lower Tier (PAC-3) and Land-based Endo-Exo Upper Tier (THAAD), or

4. Sea-based Lower Tier (NAD) and Land-based Endo-Exo Upper Tier (THAAD).

Limits to Missile Defense. Nonetheless, in the context of military considerations discussed within the scope of the DoD report, there are limitations to Taiwan's pursuit of the above missile defense options.

First, while the upper-tier missile defense systems provide better protection for Taiwan against Chinese MRBMs or high altitude SRBMs, they are not expected to reach initial operational capability until after 2007. On the other hand, the lower-tier systems are expected to be operational sooner (PAC-3 in FY 2001 and NAD in FY 2003).

Second, with the PRC's reported build-up of its missile force and its range of options (from limited to large-scale missile firings), there may be concern that Taiwan could face a large-scale missile threat from many directions that could strain its missile defenses. Furthermore, a ballistic missile could cross the Taiwan Strait in only minutes, making it very difficult for decision-makers to react and missile defenses to intercept. For example, a ballistic missile with a range of 600 km, such as the M-9, would travel at a maximum velocity of 2.4 km/second, crossing the Strait in a few minutes. In spring 1999, Assistant Secretary of Defense Franklin Kramer provided an idea of the capability of Taiwan's MADS (a system in the PAC-3 family) to defend against many incoming missiles. He told the Senate Foreign Relations Committee that,

> The PLA is expected to deploy substantial numbers of ballistic missiles which could overcome a limited theater missile defense architecture. Assuming two interceptors are dedicated against each incoming missile and a 100 percent probability of kill, a Patriot-derived MADS battalion theoretically could halt a near simultaneous barrage of 48 SRBMs directed against targets within the battalion's area of coverage. A 100 percent probability of kill, however, is not likely. Larger SRBM salvos could ensure at least some ballistic missiles reach their targets.[61]

Third, apparently because the legislative requirement called for architecture requirements against limited ballistic missile attacks only, the DoD report did not discuss the threat of PRC cruise missiles. The upper-tier missile defense systems discussed in the DoD report as more effective options for Taiwan would not defend

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[61] U.S. Senate. Committee on Foreign Relations. Hearing on U.S.-Taiwan Relations: The 20th Anniversary of the Taiwan Relations Act. March 25, 1999.

against the PRC's land-, air-, or ship-launched cruise missiles. The lower-tier PAC-3 system and MADS could provide some defense against cruise missiles.[62] In February 1999, Taiwan's Defense Minister Tang Fei warned that the PRC is stressing the development of cruise missiles and has acquired Russian cruise missile technology after 1996. Moreover, he reportedly said that the threat to Taiwan from cruise missiles will eventually pose a greater threat than that of ballistic missiles.[63] The Secretary of Defense's report on Taiwan security also confirmed that China is developing land-attack cruise missiles (LACMs), with a "relatively high development priority" and an "aggressive effort to acquire foreign cruise missile technology and subsystems, particularly from Russia." That DoD report on Taiwan security predicted that the PRC's first LACM to be produced will probably be air-launched and could be operational early in the 21st century. Moreover, the PRC is improving its C-801 and C-802 anti-ship cruise missiles (ASCMs). The report warned that the PLA Navy could "saturate the Taiwan Navy with barrages of ASCMs." The PLA is planning to acquire Russian SS-N-22/Sunburn ASCMs deployed on two Sovremenny-class destroyers. China is also expected to deploy submerged-launch cruise missiles on its submarines, according to the Defense Secretary.[64] The warheads on the PRC's cruise missiles may be conventional or carry WMD.

Fourth, the five missile defense options for Taiwan discussed in the DoD report on missile defense in East Asia address only one aspect of missile defense. According to DoD, TMD is comprised of four operational pillars: active defense, passive defense, attack operations, and C4I (essential for any of the other pillars).[65] As pointed out in the Defense Secretary's report on Taiwan security, "exclusive reliance on active missile defenses and associated BM/C^3I [battle management/command, control, communications, intelligence], however, will not sufficiently offset the overwhelming advantage in offensive missiles which Beijing is projected to possess in 2005."[66] Taiwan's defense planners may prefer to develop aspects of missile defense other than the active defense options discussed in the DoD report on TMD. For example, there is reportedly growing support in Taiwan for the development and deployment of ballistic missiles to deter Chinese missile attacks by targeting the PRC's major cities, such as Beijing and Shanghai, for retaliation.[67] Similarly, the DoD report did not discuss other possible missile defense options such as the Airborne Laser and Space-Based Laser (boost-phase intercept systems) that could destroy the enemy missiles near their launch sites and associated structures.

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[62] BMDO.

[63] Wu, Sofia, "Tang Fei Says PRC Cruise Missiles to Post Threat by 2005," Taiwan Central News Agency, February 9, 1999.

[64] Secretary of Defense, "The Security Situation in the Taiwan Strait," Report to Congress Pursuant to the FY99 Appropriations Bill, February 1, 1999.

[65] DoD, "Doctrine for Joint Theater Missile Defense," Joint Pub 3-01.5, Feb. 22, 1996.

[66] Secretary of Defense, "The Security Situation in the Taiwan Strait," Report to Congress Pursuant to the FY99 Appropriations Bill, February 1, 1999.

[67] Opall-Rome, Barbara, "Support Mounts In Taiwan For Ballistic Missiles," Defense News, April 26, 1999.

Fifth, Taiwan may conclude that its pursuit of missile defense options (through indigenous development, U.S. arms sales, or co-development) may be an inefficient and expensive use of limited defense resources. For example, the unspecified ship-position required in a sea-based upper-tier system could be provided by the U.S. Navy, and not necessarily the Taiwan Navy. There may also be other options to lessen cross-strait tensions, including dialogue and confidence-building measures, provided Beijing is willing to pursue meaningful exchanges.

Political Considerations and U.S. Options

Arguments Against. While beyond the scope of the DoD report on TMD options, there are political and security considerations concerning the possible transfer of U.S. missile defense systems to Taiwan. Foremost, the PRC favors the "one China" policy and objects to increases in U.S. arms sales to Taiwan, especially those perceived to increase Taiwan's potential offensive capability. The PRC strenuously opposes U.S. TMD transfers to Taiwan as spurring its movement towards independence by reestablishing close U.S. defense cooperation with Taiwan akin to an alliance – a relationship that some say is more important for Taiwan's defense than simply acquiring weapon systems. The PRC also argues that missile defenses in Asia would be destabilizing and would prompt the PRC to engage in an arms race by responding with additional deployments of missiles. Some U.S. policymakers are concerned about the negative impact on U.S.-PRC relations that would obstruct the pursuit of important U.S. interests that require PRC cooperation, including improved cross-strait relations, stability in Korea, weapon nonproliferation, and expanded U.S. exports to China. Some are concerned about provoking the PRC with narrow military solutions that derail efforts to improve cross-Strait relations which ultimately provide Taiwan with lasting security. Finally, U.S.-Taiwan missile defense cooperation could complicate critical U.S.-Japan cooperation in missile defense by aggravating Chinese concerns about a U.S.-led coalition to contain China and any possible Japanese links to Taiwan's missile defense systems.

Arguments in Favor. Those in the United States and Taiwan who support the potential deployment of missile defense systems in Taiwan point out that the PRC already has been building up its offensive missile force in a destabilizing manner. Facing such a real and growing threat, Taiwan needs to respond with TMD systems as one way to improve its defenses against potential PRC intimidation and attacks. Some are confident that the TMD systems proposed would significantly mitigate the PRC missile threat. Along with missile defense systems, deepened military cooperation with the United States would help to enhance Taiwan's military hardware as well as military thinking and training (software). Improved early warning systems could improve stability in a potentially volatile situation and avoid miscalculations. Taiwan's acquisition of active defense systems may be preferable to its possible pursuit of offensive missile systems for deterrence or even warfighting. Some say that Taiwan's defense is ultimately its responsibility, and its pursuit of TMD systems is one way to shore up defenses. The Taiwan Relations Act (TRA) (P.L. 96-8) requires that "the United States will make available to Taiwan such defense articles and defense services in such quantity as may be necessary to enable Taiwan to maintain a sufficient self-defense capability" (sec. 3(a)). In the summer of 1999, Deputy Assistant Secretary of Defense Kurt Campbell testified to the Senate Foreign Relations Committee that the TRA has been "the most successful piece of

legislative leadership in foreign policy in recent history."[68] In 1999, moreover, some in Congress introduced the Taiwan Security Enhancement Act (S. 693, Helms; H.R. 1838, DeLay), specifically authorizing the President to sell TMD-related systems and other items to Taiwan. (The International Relations Committee later amended the House version, removing specific references to particular systems. The Administration and others in Congress oppose the bill as unnecessary and counterproductive, since it could jeopardize the current situation of maintaining strong but unofficial ties to Taipei while pursuing engagement with Beijing.)

U.S. Options. Thus, U.S. policy has a broad range of options. The United States could focus on development and deployment of TMD systems in Asia that could cover Taiwan — without transfers of TMD systems or technology to Taiwan. Such development and deployment may or may not involve allies, such as Japan. Alternatively, the United States could sell one missile defense system or a combination of TMD systems to Taiwan without technology transfers. On the other hand, U.S. sales may include sharing related technology with Taiwan in co-development and co-production. Finally, U.S. policy may examine the possible development of other missile defense options in Taiwan in addition to the active defense options discussed in the DoD report.

U.S. Considerations in Cooperative Missile Defense Programs

Beyond the architecture requirements for establishing and operating missile defenses for East Asia, there are numerous security, political, and economic issues policy-makers might consider. A thorough discussion of these considerations was beyond the scope of the DoD report. The topics will only be mentioned here to indicate the complexity of the issue and possible implications of entering or establishing a joint missile defense system.

- Associated with the acquisition of missile defense systems by Japan, South Korea, or Taiwan would be improved protection of U.S. troops and facilities abroad, and possibly a reduced call for U.S. units to provide missile defense.

- Plans to establish a missile defense system could provoke hostilities as North Korea or China saw its offensive military capability eroding.

- If the allies were able to establish a very effective defense, it might tend to dissuade North Korea and China from expanding their missile forces because they would be of little use. However, a marginally effective missile defense could encourage those countries to increase their missile inventories and improve their missiles' ability to penetrate defenses. Some analysts think North Korea and

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[68] Testimony before the Senate Foreign Relations Committee, Aug. 4, 1999.

China are determined to modernize their missile forces regardless of allied defenses and that some level of arms race will continue in the region.

- Cooperation in missile defense is seen as a sign of close security and political relations between the United States and its three partners. Many see these close relations as contributing to stability and peace in the region, but China and North Korea perceive them as hegemonic, threatening, and destabilizing. American analysts disagree on the net political-military effects of East Asian missile defenses, depending in part on the technical characteristics and capabilities of the systems to be considered.

- Expending political capital and large sums of money on various missile defense options may occur at the expense of other political or military solutions that some analysts see as more effective.

- Cooperative missile defense provides an opportunity for Japan, South Korea, and Taiwan to share technology and lucrative defense contracts while sharing the economic burden of defending the region. It has often been difficult for the United States to manage a joint research and development program that is acceptable to all the businesses and governments of participating countries.

- The transfer of cutting-edge missile defense technology to Japan, South Korea, or Taiwan could have far-reaching implications for their military and industrial capabilities that may or may not be in the best interest of the United States, and could also violate U.S. obligations under the ABM Treaty and the Missile Technology Control Regime.

U.S. Options for Missile Defense in East Asia

The United States could pursue regional missile defense cooperation by sharing any of a dozen systems, or any combination of them, with Japan, South Korea, or Taiwan, or could deploy U.S. TMD systems in East Asia without their participation. The DoD report discussed several of these missile defense options in terms of the architecture requirements. The options considered by DoD are shaded in the table below. Hypothetically, several other systems, including those associated with NMD, might be shared with East Asia, although transfers may be constrained by the ABM treaty or the Missile Technology Control Regime. Those options not considered in the DoD report are not shaded in the table. Summarizing preceding discussions above, the U.S. systems that might be shared include:

CLASS	SYSTEM	TARGET
Lower Tier		
Land-Based	Patriot PAC-3	SRBMs in Terminal Phase, Cruise Missiles
	MEADS	SRBMs in Terminal Phase, Cruise Missiles
Sea-Based	NAD	SRBMs in Terminal Phase, Cruise Missiles
Upper Tier		
Land-Based	THAAD (Upper-Endo-Atmosphere, Exo-Atmosphere)	SRBMs, MRBMs, IRBMs with an Apogee of 40+ km (25 mi.) in Midcourse and Terminal Phase
Sea-Based	NTW, Block I or II (Exo-Atmosphere)	SRBMs, MRBMs, IRBMs with altitude of 100+ km in Ascent, Midcourse, or Exo-Descent Phase
Boost Phase Intercept		
Air-Based	Airborne Laser	Any Ballistic Missile within several hundred km of aircraft
Space-Based	Space-based Laser	Any Ballistic Missile within view of satellite
Air-Based	Unmanned Aerial Vehicle with Interceptor	Any Ballistic Missile within range (tens of km?)

CLASS	SYSTEM	TARGET
NMD		
Land-Based	Similar to initial or augmented systems planned for U.S.	ICBMs +
Sea-Based	Augmented NTW (Endo-Atmosphere)	MRBMs, IRBMs, and ICBMs at high altitude
Space-Based	Similar to U.S. research program	ICBMs +
Radar/Sensors/Electronics		
Land-Based Sea-Based Space-Based Battle Management/C^3	Equipment associated with each U.S. system	

Providing missile defense for Japan, Korea, and Taiwan may take any of several forms. The United States could interact with one, two, or all three of them in the following ways:

- Unilaterally develop, produce, and deploy missile defense units with U.S. troops, providing some missile defense for East Asia,
- Deploy some additional U.S. MD protection for allied and friendly forces or cities,
- Provide allies and friends early warning of missile attacks (from space-, sea-, air-, or land-based sensors),
- Sell U.S. MD systems to allies and friends,
- Sell components, materials, and technology to help allies and friends develop MD, or to help them enhance units previously transferred,
- Co-develop and co-produce U.S. MD with allies and friends,
- Integrate U.S. and Asian MD systems for regional coverage,
- Integrate allies and friends or geographic areas into U.S. NMD,
- Sell, co-produce, or co-develop NMD with allies and friends.

As Congress considers the TMD architecture options discussed in the DoD report, additional information on the capabilities of potentially hostile missile forces, the specific capabilities of U.S. missile defense systems, and the advantages and disadvantages of sharing missile defense systems through various mechanisms, may be of interest.

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