

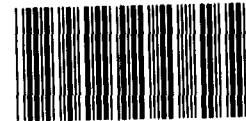
GAO

Report to the Chairman, Legislation and
National Security Subcommittee,
Committee on Government Operations,
House of Representatives

December 1992

THEATER MISSILE DEFENSE PROGRAM

Funding and Personnel Requirements Are Not Fully Defined



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**National Security and
International Affairs Division**

B-251195

December 15, 1992

The Honorable John Conyers, Jr.
Chairman, Legislation and National
Security Subcommittee
Committee on Government Operations
House of Representatives

Dear Mr. Chairman:

As you requested, we reviewed certain aspects of the Strategic Defense Initiative Organization's (SDIO) five theater missile defense systems to determine (1) SDIO's funding requirements for the planned theater missile defense capability, including the estimated cost of the various systems and (2) the Army's projected personnel requirements for operating and supporting the various theater missile defense systems. This letter presents the results of our review, and appendix I provides additional information on the status of the theater missile defense systems.

Background

In 1990, the Secretary of Defense designated SDIO as the central manager for developing and deploying a theater missile defense capability. As a part of this effort, the Army, with SDIO funding and guidance, is developing five ground-based theater missile defense systems: (1) the Theater High Altitude Area Defense (THAAD) system, (2) the Theater Missile Defense-Ground Based Radar (TMD-GBR), (3) the Extended Range Interceptor Technology (ERINT), (4) upgrades to the Patriot missile system (called "Patriot PAC-3"), and (5) the Corps Surface-to-Air missile (called "Corps SAM").

Before the Persian Gulf War, the Army had been developing upgrades to the Patriot's missile defense capability, and SDIO had its own research and development program for theater missile defense. The war highlighted the need for a capability to defend against theater ballistic missiles, and development and deployment of improved missile defenses became a high priority within the Department of Defense (DOD).

In January 1991, because of a perceived lessening of the Soviet threat and the emergence of tactical ballistic missile threats from Third World countries such as Iraq, President Bush directed SDIO to shift its objective from deterrence of a massive Soviet threat to protection from limited ballistic missile strikes originating anywhere in the world. DOD's proposed

system for implementing the President's direction is called Global Protection Against Limited Strikes (GPALS). GPALS would consist of surface-based, airborne, and spaced-based elements. The theater missile defense systems being developed would be a part of GPALS.

DOD's concept for theater missile defense includes capabilities in four functional areas: (1) an active defense component to provide the capability to destroy missiles in flight; (2) passive defense measures needed to evade detection and/or survive nearby missile impacts; (3) attack operations designed to destroy an enemy's capability after hostilities begin; and (4) battle management and command, control, and communications (BM/C3) that provides the capability to effectively control all theater missile defense operations. Space-based sensors are expected to provide early launch detection and missile tracking information and the theater missile defense system is expected to track and intercept tactical ballistic missiles with its transportable ground-based radars and interceptors.

Although SDIO is the central manager for the theater missile defense program, the military services will produce, deploy, and operate the systems making up the overall theater missile defense capability. SDIO is responsible for (1) defining the system design, (2) integrating requirements and technology, (3) developing budgets and allocating resources, (4) ensuring that it can be integrated with international defense capabilities, and (5) coordinating theater missile defense with other GPALS segments. The military services are responsible for (1) serving as combat and materiel developers, (2) providing program analysis and support, (3) developing performance and technology requirements, and (4) managing system development and operating the systems once they are deployed. The U.S. Army Strategic Defense Command is responsible for the research and development work related to ground-based theater missile defense systems.

The Joint Chiefs of Staff have an approved mission need for theater missile defense that states the military requirement in broad terms. The need includes the capability to defend against ballistic, cruise, and air-to-surface missiles. The need specifies that the BM/C3 capability should be incorporated into existing BM/C3 joint doctrine and service architectures. It also specifies that the theater missile defense system should provide "defense-in-depth," that is, a two-tier system with the capability of shooting at an incoming missile more than once, and that it is to be capable of being transported on C-130 aircraft.

Results in Brief

SDIO cannot estimate the total cost and personnel requirements because it has not fully defined the design and performance requirements for the overall required capability. For the functional element upon which it has concentrated—active defense—SDIO has not yet developed an overall program plan that defines how theater missile defense will interact within its own elements, with existing air defense capabilities, or with the other components of the GPALS system. Further, SDIO has not yet developed an overall program plan and acquisition strategy for acquiring and deploying the systems and has not fully defined certain performance requirements.

SDIO projected that it would need about \$2.4 billion more funding during fiscal years 1992 through 1997 than had been approved for the theater missile defense program in DOD's fiscal year 1993 plan. SDIO officials said the fiscal year 1994 plan would include sufficient funding to implement the currently planned program. Although the Army does not know its total theater missile defense force requirements, it has estimated that it will need about 1,300 people for THAAD and has stated that no new personnel would be required if the upgraded Patriot system is selected for lower tier defense.

The National Defense Authorization Act for Fiscal Year 1993 requires the Secretary of Defense to provide a master plan covering the theater missile defense program to the Senate and House Committees on Armed Services and on Appropriations when the President submits the fiscal year 1994 budget to the Congress.

Evolving Design and Performance Requirements

SDIO is early in the process of defining the capability needed for the active defense component of the theater missile defense system. It is devoting less attention to determining requirements for other theater missile defense components, such as attack operations—destroying launchers before enemy missiles can be launched. Because SDIO does not yet have plans that describe performance requirements, operational characteristics, the various elements of the theater missile defense system, planned improvements, and the acquisition strategy, it cannot accurately estimate requirements and related costs for theater missile defense.

SDIO envisions that its involvement in the other theater missile defense components, such as attack operations, will be limited primarily to developing the overall design and providing guidance to help the services determine what is needed to provide the required capability. According to SDIO officials, the military services are working on various systems in the

area of attack operations; therefore, it does not have to devote as much attention and funding to this capability. However, if SDIO does not provide design and guidance to the services in a timely manner, the services' efforts may not provide the needed capabilities. In addition, the final design of the entire theater missile defense capability could significantly effect the funding requirements for the various elements. For example, if effective and practical attack operations or passive defense measures can be developed, the requirement for active defense could be lowered.

The Missile Defense Act of 1991 required the Secretary of Defense to submit a plan to the congressional defense committees for deployment of theater missile defense. The Secretary's June 1992 plan primarily addressed the deployment of active defense systems without defining other systems needed or who will be responsible for developing, acquiring, deploying, and operating the other components. Proceeding with the development of active defense capability without a clear understanding of the systems that will be needed for BM/CS, attack operations, and passive defense, including how those systems will interact with the active defense component, could increase the overall program cost and technical risk.

SDIO initiated an architecture (design) integration study in February 1991 to guide GPALS design and development. The objective of the study, which will continue through at least fiscal year 1993, is to define a system design that could evolve from an initial theater missile defense system to a full-GPALS system, and possibly beyond to a system capable of defeating a massive missile attack.

**Performance Requirements
Not Established**

SDIO is exploring a variety of technologies to identify the most cost-effective means of achieving the required capability. However, major performance issues of system lethality and nuclear hardening remain to be researched and refined into requirements. In addition, decisions about deploying the capability on ships or which systems to deploy in the lower tier have to be made.

**Lethality Required to Destroy a
Ballistic Missile**

To render an incoming missile harmless, the defense system must be able to intercept it at the right time to minimize collateral damage. The problem can be complicated by the size and type of an enemy missile and the type of warhead being delivered. For example, a warhead that contains chemical or biological submunitions may be more difficult to fully destroy because all of the submunitions would have to be destroyed at a sufficient range to prevent damage from them.

SDIO has not yet determined the lethality requirements or kill device for theater missile defense, but is now conducting analyses and tests to establish lethality criteria. SDIO expects to complete this work in early fiscal year 1993. The lethality required and type of kill device used on theater missile defense interceptors could significantly effect the cost of the system.

Nuclear Hardening

Shielding the theater missile defense system against nuclear effects, if required, could also significantly increase the cost of theater missile defense. During its January 1992 review of the THAAD and the TMD-GBR programs, the Defense Acquisition Board raised the issue of whether theater missile defense would have to operate in a nuclear environment. The Board directed SDIO to determine whether THAAD will need to be hardened to operate during a nuclear attack or whether it should only be designed to survive a nuclear attack.

The decision could have a significant effect on the cost of the system. For example, if the system has to operate in a nuclear environment the missile's seeker as well as other components would have to be shielded against nuclear effects. However, if it only has to survive a nuclear attack, a less costly passive defense measure may be sufficient.

Requirement of Theater Missile Defense on Ships

At the time of our review, SDIO had not decided whether theater missile defense should be deployed on ships; and if required, which system would be deployed. Such a decision could have a significant effect on the cost of the theater missile defense program.

In approving the mission need statement for theater missile defense, the Joint Chiefs of Staff stated that the system should include requirements of all services. During its January 1992 review of the THAAD and the TMD-GBR programs, the Defense Acquisition Board also instructed SDIO to review the requirement for THAAD on Navy ships. The National Defense Authorization Act for Fiscal Year 1993 specified that not less than \$90 million should be made available for the exploration of promising concepts for naval theater missile defense. According to an SDIO official, SDIO and the Navy have now negotiated a major program to put a theater missile defense capability on ships.

According to SDIO, deploying the capability on ships offers the potential advantage of having a capability in a theater faster than having to transport the systems from the United States or some other location. If evaluations show that a capability is required, decisions will have to be made on a

system to meet the requirement. Some of the options include deploying THAAD or a variant, upgrading the Navy's standard missile, or developing a new system.

Lower Tier System

SDIO has decided that active theater defense will require two tiers of defense systems, but it has not yet selected the lower tier system—another factor that could effect total costs. The Army is currently developing major upgrades to the Patriot to improve its range and altitude capability against tactical ballistic missiles, and SDIO is developing ERINT, which will have similar capability. Sixteen ERINT missiles can be deployed on 1 Patriot launcher, rather than 4 Patriot missiles; therefore, ERINT can potentially provide more fire power than the Patriot. Both the upgrades to the Patriot missile system and ERINT are currently in flight test programs, and SDIO plans to decide in late fiscal year 1993 whether to proceed with development of the Patriot upgrades, ERINT, or a combination of the two systems.

Projected Funding Needs

DOD's fiscal year 1993 Future Years Defense Program plan includes about \$10.2 billion for fiscal years 1992-1997 for SDIO's theater missile defense program.¹ However, SDIO estimates that it will need at least \$12.6 billion to fund the planned program, or about \$2.4 billion more than included in the approved 6-year funding plan. According to SDIO officials, the plan was to basically fund the Army's approved theater missile defense program. However, they said that after the funding plan had been approved, they added programs from other services that could contribute to theater missile defense, such as placing a theater missile defense capability on ships. These additional programs created a funding shortfall in the 6-year plan. According to the SDIO officials, the fiscal year 1994 plan will include sufficient funding to implement the currently planned program.

SDIO's theater missile defense budget picture is further complicated by the cost of supporting the development of the Arrow and Arrow Continuation Experiments (ACES) program, a joint U.S.-Israeli program to develop a missile defense interceptor to protect Israel against ballistic missile attack. SDIO estimates the total U.S. cost for the Arrow and ACES development program at about \$390 million.² According to SDIO officials, although SDIO

¹The Future Years Defense Program plan represents the DOD's 6-year plan of estimated expenditures and anticipated appropriation needs. Legislation requires that the annual submission of a Future Years Defense Program plan be consistent with the President's annual budget submission.

²The \$390 million figure includes \$158 million for the Arrow (80 percent of the estimated development costs) and \$232 million for the ACES (72 percent of the estimated development costs).

does not have any plans to procure the system, it is continuing to participate in the Arrow and ACES program because it supports development of U.S. systems from a technology standpoint and provides a potential backup in the event THAAD cannot be developed successfully.

Personnel Requirements

Deployment of active theater missile defense systems will likely increase the requirement for Army personnel in the air defense area. However, the total personnel requirements for operating and supporting the theater missile defense systems once they are deployed are unknown. The Army's most recent analysis of its personnel requirements, completed in 1991, showed shortages in the air defense area without theater missile defense requirements.

Although the Army does not know its total theater missile defense force requirements, it has estimated its personnel requirements for some systems. For example, the Army has estimated that about 1,300 people will be required for THAAD and has stated that no new personnel will be required if the upgraded Patriot system is selected for lower tier defense.

The Army is conducting an updated analysis that considers all force requirements, including those for theater missile defense. The analysis is based on the authorized end strength for the Army and includes an assessment of requirements for both operational and support personnel. Once the analysis is completed in early 1993, Army officials plan to decide how available personnel will be allocated to various areas. For example, if the analysis shows a shortage of personnel in the air defense area, decisions have to be made about whether personnel will be assigned from other areas or whether those requirements will remain unfulfilled.

Congressional Requirement for a Theater Missile Defense Plan

The National Defense Authorization Act for Fiscal Year 1993 established a Theater Missile Defense Initiative, which includes the theater missile defense program. This act requires the Secretary of Defense to provide an updated master plan for the Theater Missile Defense Initiative to the Senate and House Committees on Armed Services and on Appropriations when the President submits the fiscal year 1994 budget to the Congress. The plan is to include (1) a detailed consideration of plans for theater and tactical missile defense doctrine, training, tactics, and force structure and (2) a detailed acquisition strategy that includes the acquisition and life-cycle costs through the year 2005 for the programs, projects, and activities associated with the Theater Missile Defense Initiative.

Scope and Methodology

We obtained information on cost estimates and personnel requirements by reviewing various documentation related to the overall plans for theater missile defense, including SDIO's Plan for Deployment of Theater and National Ballistic Missile Defenses and the Army's Integrated Theater Missile Defense Plan. We also reviewed SDIO's planned funding for fiscal years 1993-1998 and material presented to the Defense Acquisition Board in support of the demonstration and validation phase of the THAAD and the TMD-GBR programs. In addition, we obtained information on the Army's process for determining personnel requirements and examined the results of the Army's latest analysis, which was completed in 1991.

We performed most of our review at SDIO, Washington, D.C.; and the U.S. Army Strategic Defense Command, Huntsville, Alabama. We also performed limited work at the U.S. Army Air Defense School, Fort Bliss, Texas, and the U.S. Army Concepts Analysis Agency, Bethesda, Maryland.

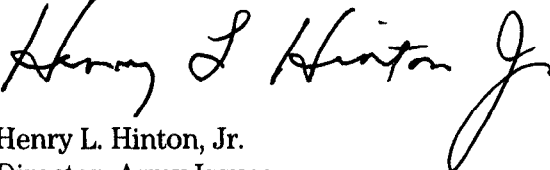
We conducted our review from December 1991 to November 1992 in accordance with generally accepted government auditing standards.

As requested, we did not obtain fully coordinated DOD comments on this report. However, we discussed the results of our review with officials from SDIO and the U.S. Army Strategic Defense Command and have incorporated their comments where appropriate.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from its issue date. At that time, we will send copies to the Chairmen of the Senate and House Committees on Armed Services and on Appropriations and the Senate Committee on Governmental Affairs; the Secretaries of Defense and the Army; the Director of SDIO; and the Director of the Office of Management and Budget. Copies will also be made available to others on request.

Please call me at (202) 275-4141 if you or your staff have any questions concerning this report. Other major contributors to this report are listed in appendix II.

Sincerely yours,



Henry L. Hinton, Jr.
Director, Army Issues

Status of Theater Missile Defense Systems

The five ground-based theater missile defense systems being developed by the Army with the Strategic Defense Initiative Organization (SDIO) funding—(1) the Theater High Altitude Area Defense (THAAD) system, (2) the Theater Missile Defense-Ground Based Radar (TMD-GBR), (3) the Extended Range Interceptor Technology (ERINT), (4) upgrades to the Patriot missile (Patriot PAC-3), and (5) the Corps Surface-to-Air missile (Corps SAM)—are in various stages of acquisition. SDIO estimates the funding requirements for these systems at \$7.24 billion for fiscal years 1993-1998. Table I.1 provides SDIO's milestones and projected funding requirements for the various systems.

Table I.1: Milestones and Projected Funding for Theater Missile Defense Systems

Dollars in millions					
	THAAD	TMD-GBR	ERINT	Patriot PAC-3	Corps SAM
Milestone schedule					
0 (Concept studies approval)	Jan. 1992	Jan. 1992	^a	Aug. 1965	Aug. 1990
I (Concept demonstration approval)	Jan. 1992	Jan. 1992	^a	May 1967	July 1993
II (Development approval)	First quarter, FY 1997	First quarter, FY 1997	^a	Feb. 1972	First quarter, FY 1998
III (Production approval)	FY 2002	FY 2002	^a	Apr. 1982	First quarter, FY 2002
IV (Major modifications approval)	Milestones have not been established	Milestones have not been established	^a	Fourth quarter, FY 1993	Milestones have not been established
Projected funding needs					
Fiscal years 1993-1998	\$2,772.0	\$1,194.5		\$2,528.1	\$745.9

Source: This data was provided by SDIO on November 4, 1992.

^aERINT is considered to be a technology demonstration program. Therefore, it does not have established milestones as defined in the Department of Defense's (DOD) acquisition regulations.

THAAD

The THAAD is being designed as a transportable ground-based theater missile defense system capable of intercepting ballistic missiles fired at U.S. defended territories worldwide. THAAD is to intercept missiles at high altitudes and provide a large area defense. The missile requires development of a ground-based radar to acquire and track primarily tactical ballistic missile targets. THAAD is expected to destroy the targets by colliding with them ("hit to kill") rather than using an explosive warhead

like the Patriot. A THAAD system would include missiles, launchers, a ground-based radar, battle management and command, control, and communications (BM/C3) units, and ground support equipment.

SDIO has planned a 10-year development program for THAAD that is estimated to cost about \$3 billion. In January 1992, DOD approved the THAAD demonstration and validation program. The Army awarded the demonstration and validation contract in September 1992. It plans to begin engineering and manufacturing development in first quarter, fiscal year 1997; and it anticipates beginning production in fiscal year 2002.

The Army is developing THAAD concurrently with the TMD-GBR system, which will be used to provide acquisition and tracking data to the missile. DOD estimates the total life-cycle cost for THAAD to be about \$8.4 billion.

TMD-GBR

TMD-GBR is to be a ground-based sensor to provide target search, track, and discrimination capabilities for U.S. theater missile defense interceptors. The radar will be air transportable, and it is being developed as part of a family of radars that will use common components to reduce overall program cost. The theater and strategic versions of the radar are being developed concurrently; however, the theater version will be delivered first.

DOD approved the start of the demonstration and validation phase in January 1992, and the Army awarded the contract in September 1992. The Army plans to begin engineering and manufacturing development in first quarter, fiscal year 1997; and it anticipates beginning production in fiscal year 2002. SDIO currently estimates life-cycle cost of the theater version to be about \$4.2 billion, including \$626 million for demonstration and validation and \$579 million for engineering and manufacturing development.

ERINT

The ERINT system is a lower tier weapon candidate that could replace or complement the Patriot antitactical missile system by providing increased firepower and lethality. It is being flight tested. The ERINT missile is to be fired from Patriot launchers to engage ballistic missiles and is expected to destroy targets by colliding with them, instead of using an explosive warhead. Designated Patriot launchers will be capable of firing up to 16 ERINT missiles—four times the number of Patriot missiles that can be fired from a single launcher. ERINT can be deployed in conjunction with Patriot

fire units, and since the missile—like the Patriot—will be considered a lower tier asset, its primary mission would be to destroy those missiles that are not destroyed by the upper tier defense system. It will also have capability against aircraft.

The first ERINT flight test occurred in June 1992, and the flight test program is scheduled to be completed in the fourth quarter of fiscal year 1993. After flight tests are completed, DOD will decide whether ERINT should enter the engineering and manufacturing development phase. Firm production and fielding decision milestones have not been established, and DOD has not prepared a life-cycle cost estimate for the program. The Army currently estimates that the total ERINT research and development will cost about \$295 million through fiscal year 1993.

Patriot Upgrades

The Patriot PAC-3 is designed to improve the missile to its maximum performance level. The program is intended to improve missile velocity, range, and accuracy and systems mobility through phased upgrades to the missile, launcher, and radar. Most missile improvements are to be accomplished by developing a multimode seeker with the capability to acquire targets using both millimeter wave and infrared technology. Other developments are to improve radar signal transmission and reduce the weight of the launcher and other support equipment.

SDIO plans to conduct performance tests to determine the extent to which the Patriot system should be upgraded and to decide in fourth quarter, fiscal year 1993, whether to proceed with engineering and manufacturing development of the Patriot PAC-3. As yet, a firm production decision for the multimode missile has not been scheduled, but a Patriot project cost analysis official anticipates a decision in fiscal year 1994. The Army estimates the Patriot PAC-3 conversion will cost about \$822 million to develop and \$2.1 billion to produce and field.

Corps SAM

The Corps SAM system is to be an air transportable, rapidly deployable, highly mobile air defense system capable of destroying both aircraft and tactical missiles. DOD is considering the program as a lower tier theater missile defense candidate, but the program can also support some strategic defense applications.

Corps SAM is in early development. It entered the concept definition phase in August 1990, and the Army awarded study contracts for concept

definition in July 1992. The Army will use the results of these concept definition studies, along with results of a parallel independent government concept evaluation, to define Corps SAM program requirements, and initiate a demonstration and validation program, which is scheduled to begin in July 1993.

Engineering and manufacturing development is tentatively scheduled for first quarter, fiscal year 1998, and production for first quarter, fiscal year 2002. These milestones will be firmly established after DOD decides the concept that best meets the Army's requirements. DOD does not plan to approve a program cost estimate until a concept is selected and a demonstration and validation milestone decision is made.

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