

GAO

Report to the Chairman, Subcommittee  
on Defense, Committee on  
Appropriations, U.S. Senate

September 1990

# TACTICAL MISSILES

## Issues Concerning the Navy's Requirements Determination Process



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**National Security and  
International Affairs Division**

B-240050

September 12, 1990

The Honorable Daniel K. Inouye  
Chairman, Subcommittee on Defense  
Committee on Appropriations  
United States Senate

Dear Mr. Chairman:

The costs associated with developing and procuring Navy tactical missile systems exceed billions in current year dollars. In view of reduced defense spending, you expressed concern about the Navy's plan to procure large numbers of missile systems during the 1990s. In response to your request, we examined the Navy's requirements determination process, including (1) how operational requirements were developed, defined, and stated and (2) how the total number of weapons (inventory objectives) that are needed to support the requirement was established.

Initially, we examined the requirements documentation for 19 tactical missile systems. At the Chairman's suggestion, however, we limited our review to three missile systems. We selected the Standoff Land Attack Missile (SLAM), the Advanced Interdiction Weapon System (AIWS), and the Standard Missile II Block IV System (AEGIS ER) because they illustrate the types of deficiencies we found at various stages of the requirements determination process.

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**Background**

The requirements process consists of two elements: (1) the development of requirements documents, which state the acquisition strategy and can refer to generic capabilities or specific operational or performance capabilities and (2) the establishment of inventory objectives, a process of determining what to buy, when to buy it, and how many to buy. Integral to this process is the Non-Nuclear Ordnance Requirements (NNOR) process. The NNOR process establishes estimates of inventory objectives for conventional (non-nuclear) munitions. It relies on (1) military assessments and (2) computer simulations.

A number of significant issues (e.g., requirements documentation, inventory objectives, affordability, and rationale) surround the Navy's ability to acquire and support missile systems successfully.

## Results in Brief

We found that adherence to the Office of the Secretary of Defense (OSD) and Navy guidance in determining requirements for the three systems we reviewed was inconsistent. Key requirements documents were often unapproved or missing. Furthermore, the process by which inventory objectives were established was not always clear or well documented, and it was not possible to quantitatively match inventory objectives of Navy tactical missiles to military requirements.

The Navy has not consistently followed procedures for establishing requirements or setting inventory objectives for the three missile systems we reviewed. We found that

- the process for determining SLAM inventory objectives was unclear and predicated largely on assumptions and military judgments;
- the stated operational capabilities for the baseline AIWS may differ from actual capabilities, thus rendering key requirements documentation misleading; and
- a major system in development, the AEGIS ER, may proceed to production without an approved operational requirement for the system or other required documentation and formal agency approval.

## Concerns With the Non-Nuclear Ordnance Requirements Process

The Navy establishes estimates of inventory objectives for conventional munitions through the NNOR process. All requirements for naval munitions are developed through models that rely heavily on intelligence estimates, naval force doctrine, judgment, subjective information, and probability modeling. Concerns have been raised within OSD as to the reasonableness and soundness of assumptions in determining the inventory objectives for missile systems. While requirements planners and reviewers have been generally satisfied with the results of the process, the assumptions and projections entered in the NNOR model have sometimes led to inflated inventory objectives.

## Inventory Objectives of SLAM Not Supported

The SLAM, a derivative of the HARPOON antiship missile, is an advanced air-to-surface medium range missile to be used in a high-threat environment. Its flyaway unit cost has increased from \$800,000 in 1989 to over \$900,000 in 1990. Originally intended as an interim system, the Navy recently doubled the SLAM inventory objective. However, Navy requirements planners could not provide justification for this action or show support for the original inventory objective. In addition, some Navy officials have reported plans to develop a follow-on to SLAM, which will be

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more expensive than the baseline SLAM and which will be designed to meet military requirements not met in the baseline SLAM program.

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### **AIWS May Not Meet Basic Requirement or Improve Existing Capability**

The AIWS, an advanced standoff weapon to be used against low value fixed land targets, was designated to be a low cost replacement for the SLAM and a replacement for the Maverick, Walleye, Paveway, and Skipper missiles. However, the baseline AIWS missile may not provide a similar capability equal to the systems it is to replace. In addition, the baseline missile, which has a \$50,000 limit placed on its unit cost by the Secretary of the Navy, may actually cost about \$80,000. The AIWS is in the demonstration/validation phase of its acquisition program.

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### **AEGIS ER Acquisition Proceeding Without Formal Approval**

The AEGIS ER, a surface-to-air missile, is designed to provide fleet air defense for surface ships by countering high altitude missiles. The Navy has not developed or approved an operational requirement for the system. While there were initial indications that the Navy might proceed into production without operational testing, Navy officials said such tests will be conducted. If not, it could lead to a commitment of significant production funds before technical and operational problems are identified and resolved.

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The requirements determination process is described in greater detail in appendix I, including a discussion of the three systems identified as illustrative of deficiencies in the requirements process. Our objectives, scope, and methodology are presented in appendix II.

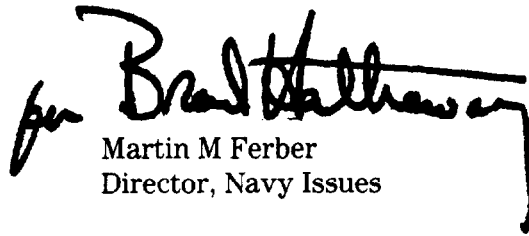
As discussed with your staff, we did not obtain official agency comments. However, we discussed our findings with responsible agency officials and included their comments where appropriate.

Unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time, we will send copies of this report to the Chairmen, House Committees on Appropriations and on Government Operations and Senate Committee on Governmental Affairs, and the Secretaries of Defense and the Navy. Copies will be made available to other interested parties on request.

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Please contact me at (202) 275-6504 if you or your staff have any questions concerning this report. Major contributors to this report are listed in appendix III.

Sincerely yours,



Martin M Ferber  
Director, Navy Issues

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# Contents

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Letter		1
Appendix I		8
Deficiencies in the	The Requirements Planning Process	8
Requirements	The NNOR Process	9
Determination Process	The Three Tactical Missile Systems Reviewed	10
Appendix II		13
Objectives, Scope, and		
Methodology		
Appendix III		14
Major Contributors to		
This Report		

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## Abbreviations

AEGIS ER	AEGIS Extended Range Missile
AIWS	Advanced Interdiction Weapon System
GAO	General Accounting Office
NNOR	Non-Nuclear Ordnance Requirements
OSD	Office of the Secretary of Defense
SLAM	Standoff Land Attack Missile





# Deficiencies in the Requirements Determination Process

The Navy's requirements process provides the foundation and structure for planning, developing, evaluating, and fielding weapon systems to respond to the threat within reasonable time frames and at a reasonable cost. The degree of formality, extent of documentation, and level of decision authority vary with the dollar value of a program.

The management of major weapon system programs is normally divided into phases to provide effective oversight during development and procurement.<sup>1</sup> These phases include concept demonstration/validation, full-scale engineering development, limited production, and full-rate production. Department of Defense approval is normally required at key decision points, or milestones, before these programs can proceed from one phase to the next.

## The Requirements Planning Process

The term "requirements" has several meanings. In the broadest sense, it can be applied to generic capabilities or it can be applied to specific operational or performance characteristics. It also applies to contract specifications that dictate how a weapon system will be built, tested, and inspected. For the purpose of this review, requirements refers to the military capability.

When dealing with state-of-the-art technology, no process, however sound and well staffed, can anticipate all future uncertainties in fielding a weapon system that has yet to be developed, let alone put into active service. Incorrect estimates and assumptions that occur during the requirements planning process can become magnified later in the form of program instability, production delays, or excess costs.

Department of Defense and Navy guidance provide the structure and procedures for managing and funding weapon system programs. The following principal documents are required.

- Tentative Operational Requirements statement identifies deficiencies in meeting the threat in the current mission and outlines, in general terms, key capabilities desired.
- Development Options Paper outlines alternative means of solving deficiencies in meeting the threat.
- Operational Requirement contains the statement of capabilities required.

<sup>1</sup>Programs that are expected to exceed \$200 million in research, development, test, and evaluation or \$1 billion in procurement funds are classified as major weapon system programs.

- Decision Coordinating Paper identifies program options based on initial studies of design concepts, alternative acquisition strategies, planned operational capabilities, and cost estimates.
- Test and Evaluation Master Plan contains performance parameters defined in the Decision Coordinating Paper, outlines the plan for testing and evaluating systems, and reflects changes and updates in capabilities as systems proceed through development.

These documents provide background for milestone decisions associated with research and development and production of weapon systems. They outline the weapon system's purpose; the new system's uniqueness as compared to existing systems; the evaluation of risks, funding, and scheduling aspects; the acquisition strategy; and the test and evaluation strategies.

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## The NNOR Process

Integral to the acquisition strategy is an assessment of how many weapons will be bought. In the Navy, calculation of inventory objectives for most types of tactical missiles is done through the NNOR model.

The NNOR model plays a key role in determining inventory requirements for most tactical missiles in the Navy. The numbers generated by this model, after a review by high ranking Navy officials, are used as a basis for the Navy's Program Objectives Memorandum submission to OSD.

Factors that affect inventory requirements and that are entered into the NNOR model are revised estimates on the threat, platform availability, adjustments in the probability of kill percentages, and revisions in false target ratios. Different allocations of targets to a missile, trade-offs between systems, needed upgrades in weapon systems, and program termination are also factors.

The Office of the Assistant Secretary of Defense for Production and Logistics tasked the Rand Corporation to review the Navy's procedures for estimating conventional munitions. The study, published in April 1989, identified several deficiencies in the NNOR model.<sup>2</sup> For example, the model assumes the complete independence of every U.S. ship and airplane, which is in contrast to evolving strategies and warfare tactics. In addition, cost trade-off values among comparable munitions are not considered as the model assumes no budget constraints.

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<sup>2</sup>A Rand Note: Conventional Munitions Requirements Estimation in the Navy.

Another deficiency, according to Rand analysts, is that an analysis of the validity and soundness of assumptions is not performed to determine which are the key variables that affect requirements. Several variables inflate inventory objectives, including the assumption of the need to destroy 100 percent of the threat to win the war, excessive categorization of targets (more than one type of weapon assigned to a target), and false targets treated like real targets. The NNOR model does not account for maldistribution of weapons or, in some cases, loss of munitions (i.e., such as when supply ships are sunk). OSD and Navy requirements planners generally concurred with the Rand findings.

Thus, it is difficult to measure the adequacy or soundness of inventory objectives generated by the model. Navy planners and OSD program evaluators familiar with requirements planning have reported that they have occasionally rejected NNOR-generated inventory objectives for being too inflated or not supportable. However, generally they have been satisfied with the results of the process.

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## The Three Tactical Missile Systems Reviewed

During our review of the three missile systems, we found that the Navy did not always follow its own or OSD guidance and procedures for establishing requirements or setting inventory objectives. For example, (1) the Navy did not go through prescribed procedures for determining inventory objectives for SLAM, (2) the baseline A1WS will not provide an enhanced capability over systems it is designed to replace, and (3) the AEGIS ER may go forward in development and/or production without formal approval of required documentation.

The following systems illustrate deficiencies we found in various stages of the requirements determination process.

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## Status of SLAM Is Uncertain

The SLAM is a land attack variation of the HARPOON missile. The total unit cost of SLAM is about \$1.121 million; the missile flyaway unit cost is about \$910,000 in current year dollars. With its high cost, the SLAM was originally considered an interim solution in meeting the low inventory of air-launched modular standoff weapons available for a multiservice role.

The acquisition strategy of SLAM has not been well defined. Even though it was originally scheduled for only limited production, Navy officials said that the inventory objectives had recently doubled. Furthermore,

Navy officials disagree as to the future of SLAM. While one official indicated the SLAM program will not be expanded, other officials indicated that the requirement for SLAM may be even greater than currently stated and that a follow-on and costly enhancements are being considered.

Navy requirements planners who execute the NNOR model reported that they could not support or justify how the Navy established the initial inventory objective, nor were they provided a rationale for doubling the inventory objective that was outside of the routine NNOR modeling process.

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### **Proposed AIWS May Not Be an Improvement**

The AIWS is an advanced air-to-surface, standoff missile designed to provide close air support, battlefield interdiction, and destruction of low value ground targets in a high-threat environment. It was initially viewed as a low cost alternative to SLAM, which costs \$910,000 per unit, and a replacement for the Walleye, Skipper II, Laser Maverick, and Paveway Guided Bomb. However, its estimated unit cost has already exceeded the \$50,000 limit the Secretary of the Navy placed upon it. In fact, the currently projected baseline AIWS unit cost may rise to over \$80,000. In addition, a proposed planned product improvement may cost over \$170,000 per unit.

A rationale for developing a new weapon system, among other justifications, is to provide a similar capability at a lower cost over existing weapon systems. We found, and Navy officials acknowledge, that the baseline AIWS missile, currently in demonstration/validation, may fail to provide a capability equal to systems it is to replace. OSD documents show a pre-planned product improvement of this missile, proposed for future development upon completion of the baseline production program, may actually serve as the replacement missile. The AIWS proposed pre-planned product improvement would provide enhanced range and targeting capability. The requirements documentation did not clearly distinguish the capabilities of the baseline and the improved AIWS. Navy officials stated that it has been their intent to follow a two-pronged approach to AIWS development, and they acknowledged that the requirements documentation can be misinterpreted.

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### **AEGIS ER Is Lacking Critical Documentation**

The AEGIS ER, also known as the Standard Missile II Block IV, is a surface-to-air missile that will replace the Standard Missile II Block II on AEGIS cruisers and destroyers equipped with the MK-41 vertical launch

system. The missile, which is in development, is being designed to provide fleet air defense for surface ships by countering high altitude missiles.

The Navy has awarded contracts worth over \$231 million to Raytheon and General Dynamics, codevelopers of the AEGIS ER missile, but it has not determined the total procurement costs for the AEGIS ER. Development costs exceed \$360 million in current year dollars.

Navy program sponsors report that the AEGIS ER is an upgrade, not a new development effort. General Dynamics disagrees, however, indicating that the missile is over 60 percent new and, in many ways, is a major development effort. According to Navy guidance, an operational requirement must be developed and approved to support new research and development programs. This is particularly true for such major acquisition programs as AEGIS ER. However, the Navy has not developed or approved an operational requirement for the system.

The Navy has not approved the Decision Coordinating Paper or the Test and Evaluation Master Plan, yet the Navy has decided to purchase 300 AEGIS ER missiles in the early 1990s through a pilot production program. The Decision Coordinating Paper would provide a description of the weapon system's concept and an assessment of technological risks. Master plans are required for all major defense acquisition programs. Furthermore, test and evaluation of system capabilities cannot begin until the master plan is approved.

We were initially told that the Navy might forego a series of operational tests normally conducted in a realistic operational environment that would demonstrate the combat effectiveness and suitability of the AEGIS ER and resolve technical uncertainties and problems at the conclusion of the pilot production phase before entering full-rate production. However, Navy officials recently indicated that they plan to conduct operational tests and evaluation before entering into the full-rate production phase.

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# Objectives, Scope, and Methodology

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The Chairman, Subcommittee on Defense, Senate Committee on Appropriations, asked us to examine the procedures the Navy followed in matching inventory objectives to military requirements for tactical missiles. Our objectives were to review how operational requirements were developed, defined, and stated and how the total number of weapons needed to support the requirement was established.

Initially, we examined the requirements documentation for 19 tactical missile systems. At the Chairman's suggestion that we narrow our review, we selected three systems—the SLAM, the AIWS, and the AEGIS ER.

To examine the procedures used in the requirements determination process, we met with officials at the Offices of Research and Engineering; Weapons Systems Assessment; Program Analysis and Evaluation, Production and Logistics; Tactical Warfare Programs; and Joint Technical Coordinating Group/Munitions Effectiveness in the Office of the Secretary of Defense. We also met with Navy officials from Ordnance Material Management, Aviation Plans and Requirements, Weapons Analysis Branch (Tactical Air Surface and Electronic Warfare Development Branch), Commander in Chief, Headquarters Atlantic Fleet Ordnance; program managers from Naval Air Systems Command and Naval Sea Systems Command; and the former Commander in Chief, Headquarters Atlantic Fleet, and Sixth Fleet commander. We also held discussions with issue area experts from the Rand Corporation, Brookings Institute, Center for Strategic and International Studies, and the Analytical Sciences Corporation.

We conducted our review from May 1989 to May 1990 in accordance with generally accepted government auditing standards.

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# Major Contributors to This Report

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