United States General Accounting Office

GAO

Report to Congressional Requesters

June 1999

DEFENSE ACQUISITIONS

Naval Surface Fire Support Program Plans and Costs

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United States General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

B-281508

June 11, 1999

The Honorable John Warner
Chairman
The Honorable Carl Levin
Ranking Minority Member
Committee on Armed Services
United States Senate

The Honorable Floyd Spence
Chairman
The Honorable Ike Skelton
Ranking Minority Member
Committee on Armed Services
House of Representatives

This letter responds to one of four reporting requirements in section 1015 of the Strom Thurmond National Defense Authorization Act for Fiscal Year 1999. The requirements involve the status of inactive battleships and the Navy's plans, costs, and capabilities to provide naval surface fire support (NSFS).[1] Since 1994, the Navy has been engaged in a two-phase research and development program intended to address current shortfalls in its NSFS capabilities. We previously reported on the Navy's compliance with legislation directing it to retain two inactive *Iowa* class battleships and their associated logistical support infrastructure.[2] This report, addressing the second and third requirements, describes the Navy's program to modernize its NSFS capabilities and identifies the cost of the modernization. A third report, addressing the final requirement, will analyze the Navy's assessment of the costs associated with alternative methods for executing the naval surface fire-support mission, including the alternative of reactivating two battleships.

[1]NSFS is the use of guns, missiles, and electronic warfare systems on surface ships to support amphibious, maritime, or land forces.

[2]Force Structure: Navy Is Complying With Battleship Readiness Requirements (GAO/NSIAD 99-62, Apr. 12, 1999).

Results in Brief

In the first phase of the NSFS modernization program, planned for completion by 2009, the Navy plans to develop a modified 5-inch gun and associated guided munition, land-attack missiles, and mission planning system for installation on 49 of the current classes of cruisers and destroyers. However, the weapons developed during this phase are not expected to satisfy the full range of Marine Corps NSFS requirements. Development of the modified 5-inch gun is currently on schedule, but development costs have increased slightly. Development of the guided munition for this gun has been delayed by technical problems, and costs have increased. Because the most critical testing of the munition has not yet been conducted, it is too early to know whether the munition will meet performance specifications in terms of range, accuracy, and lethality. In May 1998, the Chief of Naval Operations decided to modify missiles in the Navy's inventory into a land-attack variant rather than develop a Navy variant of an Army missile. In May 1999, the Under Secretary of Defense for Acquisition and Technology approved the Navy's proposal in the near term, provided more funds were programmed to modify the Army Tactical Missile system to be fired from DDG-51 tubes. The Navy expects fleet introduction of a mission planning system in 2001 to support weapons developed during the first phase of the NSFS modernization program.

The second phase of the modernization program, beyond 2003, includes development of a longer range gun and munition and an advanced land-attack missile for the planned DD-21 class of destroyers. Weapons developed during this phase are intended to fully meet Marine Corps NSFS requirements. The Center for Naval Analyses is conducting an analysis of gun system alternatives for the DD-21, and industry teams are also developing advanced gun concepts for this class of ship. Thus far, the Chief of Naval Operations has deferred a decision on a land-attack missile for the DD-21 pending further development of competing missile systems. At the same time, the Navy is conducting technology demonstration projects intended to improve performance and reduce the costs of future munitions. Under the Navy's current plan, it will be many years before the fleet will have these weapon systems in the quantities needed to support major combat operations. The Navy plans to accept delivery of 32 DD-21s between 2008 and 2020.

In fiscal years 1994-98, the Navy spent $309 million on both phases of its modernization program. For fiscal years 1999-2005, both phases are estimated to cost a total of about $2 billion, not including the cost of the ships. The estimate also does not include the cost of (1) integrating Land

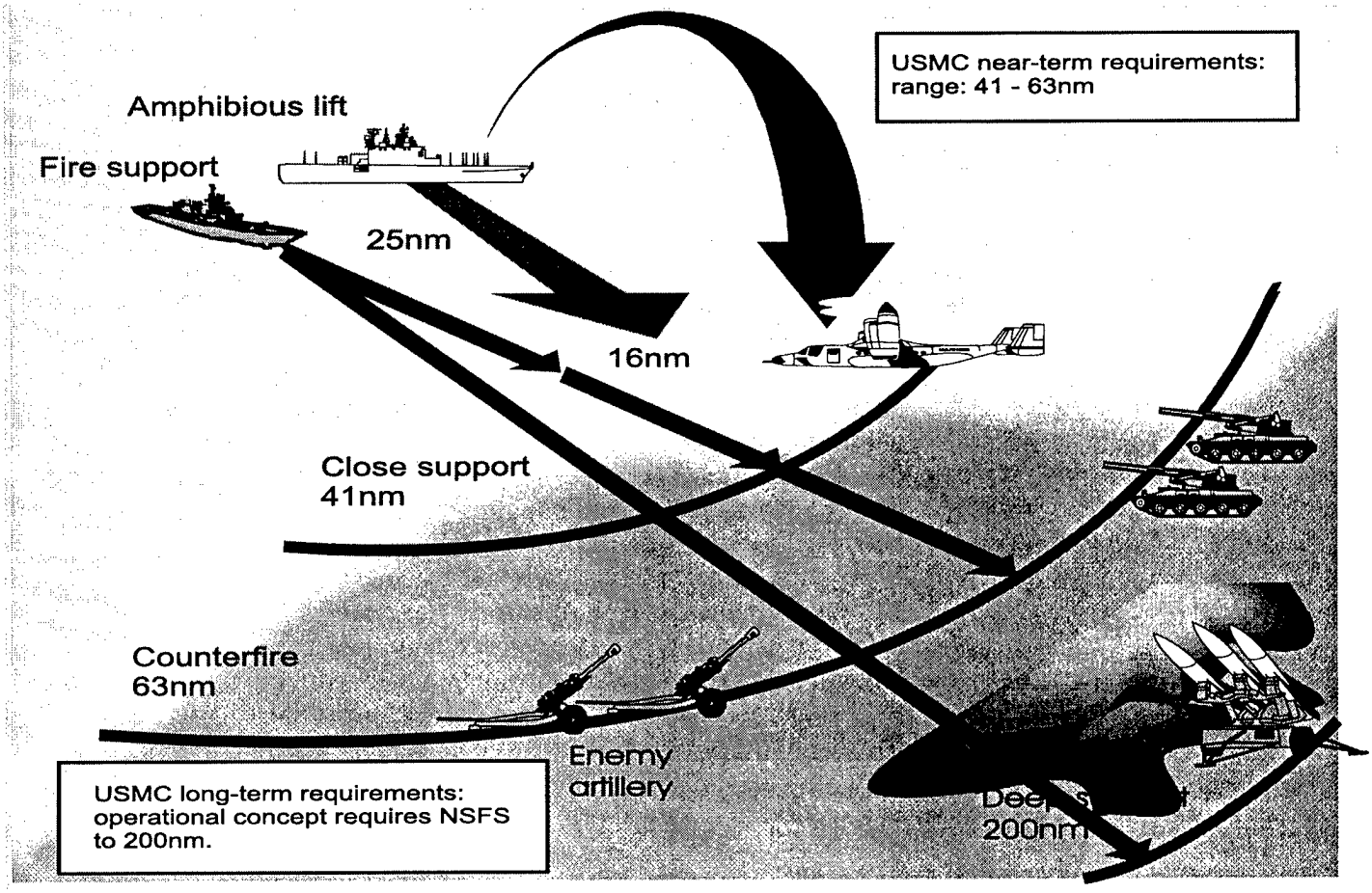
Attack Standard Missiles into the Vertical Launch System, (2) changing to the Tactical Tomahawk Weapons Control System, and (3) developing and procuring of an advanced land-attack missile for the DD-21. Total program cost estimates beyond fiscal year 2005 are not available.[3]

Background

Since the end of the Cold War, the Navy and the Marine Corps have been working on operational concepts for coastal combat operations that stress speed, maneuverability, and avoidance of enemy strong points to achieve military objectives. These concepts are in striking contrast to the attrition operations of past wars such as World War II, when amphibious forced entry operations required fire support from large-caliber guns on battleships and other combatants operating near enemy shores. The new war-fighting strategy assumes that amphibious assaults will be launched from at least 25 nautical miles from shore to enhance surprise and the survivability of the fleet and invading forces. According to the Marine Corps, operating at this distance from shore and the need to neutralize enemy artillery at its maximum range results in a need for NSFS from between 41 and 63 nautical miles. As illustrated in figure 1, the Marine Corps' fire support requirement under its new operational concept is up to 200 nautical miles. The Marine Corps has stated a need for both conventional unguided and precision munitions to meet its requirements. Each fire support ship should be able to deliver munition effects that equal the explosive weight and volume of fire of an artillery battery (six 155-millimeter howitzers firing high-explosive munitions).

[3]Official Navy program budget estimates are contained in the Fiscal Year 2000 President's Budget submitted to Congress in February 1999. The President's budget contains budget estimates for fiscal years 1999-2005.

Figure 1: NSFS Requirements



Source: U.S. Navy

The Navy is developing modern surface fire support weapons to address current NSFS deficiencies. The Marine Corps believes that once they are fielded, these weapons, along with the mobility enhancements provided by the Advanced Amphibious Assault Vehicle and the MV-22 tilt-rotor aircraft, will allow it to execute its new operational concept.

NSFS Modernization First Phase

During the first phase of the NSFS modernization, planned to be completed by 2009, the Navy intends to improve the capabilities of the current class of cruisers and destroyers by developing and installing (1) modified 5-inch, 62-caliber guns; (2) an extended-range guided munition for this gun;

(3) land-attack missiles; and (4) a land-attack mission planning system. The Navy plans to install 1 gun on each of 27 new Arleigh Burke class destroyers between fiscal year 2001 and 2009, and 2 guns on each of 22 Ticonderoga class cruisers selected for modernization between fiscal year 2004 and 2009. The near-term guns, munitions, and missiles will improve current NSFS capabilities, but they are neither intended nor expected to meet all of the Marine Corps' NSFS requirements for range, explosive lethality, and volume of fire.

Gun and Munition Development

Development of the modified 5-inch gun is currently on schedule, but development costs have increased slightly. Development of the guided munition for this gun has been delayed by technical problems, and costs have increased. Since the most critical testing of the munition has not yet been conducted, it is too early to know whether the munition will meet performance specifications in terms of range, accuracy, and lethality. The modified 5-inch gun and its guided munition are intended to provide increased range and accuracy compared with those of the 5-inch guns on existing surface combat ships. The guided munition's operational requirements include performance specifications for target accuracy at ranges of between 41 and 63 nautical miles, compared with the 13 nautical miles for existing unguided munitions.

The 5-inch Gun

Gun development is on schedule, though the manufacturer estimates that development costs at completion will have increased about 8 percent over the planned funding. Initial test firings of the propellant achieved the required energy levels needed to launch the guided munition, but the pressures created by ignition of the propellant caused some pitting of the test-gun barrel. According to a Navy official, the program office is working to solve this problem and believes a barrel life of 1,500 rounds can be achieved. The program office has scheduled additional gun tests in May 1999. The Navy made a low-rate initial production decision on the gun in April 1999 and initial operating capability is planned for fiscal year 2001. However, delays in delivery of the guided munition have slipped the schedule for incorporating and testing this capability from October 1999 to June 2000. Because the modified gun will be able to fire conventional 5-inch ammunition to longer ranges than the current one, it will be installed on new destroyers and modernized cruisers even if guided munition development is delayed.

Guided Munition

Technical design problems in development of the guided munition have caused schedule delays and cost increases. These problems have delayed development about 3 months. For example, during recent test firings, gun gas leakage has occurred around the projectile obturator[4] because of the increased energy generated by the new propelling charge and the mid-body placement of the obturator. This leakage may cause unacceptable wear of the gun barrel. To solve this problem, the manufacturer has been testing various obturator designs and materials.

The most critical tests to determine how well the guided munition's components work together have been delayed until the end of fiscal year 1999 by disruptions associated with the contractor's relocation from Texas to Arizona. According to Navy officials, only 20 percent of the key people who have been working on the guided munition have agreed to relocate. The guided munition's critical design review was intended to follow the successful completion of the critical tests. As a result of these delays, however, program officials expect a delay in the critical design review, previously scheduled for August 1999. They also expect up to a 1-year delay in fielding the guided munition.

Partly because of design risks and delays, the Navy and the guided munition contractor are currently negotiating a restatement of contract deadlines and a cost increase over the original contract price of $75 million. In a November 1998 proposal, the contractor increased its price by $57 million. The proposal did not consider any delays resulting from the contractor's relocation. The Navy expects a revised proposal from the contractor in August 1999 that would address the relocation impact on the program schedule.

Near-Term Land-Attack Missile

The Navy's plan to add land-attack missiles to the 27 Arleigh Burke class destroyers and 22 Ticonderoga class cruisers was on hold. In May 1998, the Chief of Naval Operations decided that it would be quicker and cheaper to convert about 800 existing surface-to-air Standard Missiles to a land-attack configuration than to develop a Navy version of the Army Tactical Missile System. This decision was based on a land-attack missile assessment conducted by the Johns Hopkins University Applied Physics Laboratory.

[4]An obturator is a ring-like device that seals the projectile firmly against the gun barrel during projectile launch.

Both missiles would have a range of about 150 nautical miles—about 50 miles short of the Marine Corps' stated requirement for deep support. However, the Office of the Secretary of Defense put the Navy's decision on hold, pending additional review.

The Strom Thurmond National Defense Authorization Act for Fiscal Year 1999 conferees directed an analysis of alternatives for the Navy's land-attack missile system. In response to the congressional direction, Department of Defense (DOD) officials asked the Navy to provide additional analysis for its decision. The Navy, in turn, asked the Center for Naval Analyses to review the Johns Hopkins study's analytical basis. The Center analyzed both the land-attack version of the Standard Missile and the Navy's variant of the Army Tactical Missile System with regard to targets, target location error, weapon performance (lethality), and the cost and performance of the missiles' Global Positioning System/Inertial Navigation System (GPS/INS). In December 1998, the Center briefed the Oversight Board[5] on the results of its review. The Center concluded that: (1) finding reasonable target lists was easy but determining which targets would be best assigned to the land attack missile and which ones to guns, tactical tomahawk missiles, or aviation was not complete; (2) each missile's potential to generate a small target location error was not an issue; (3) lethality: both the land attack version of the Standard Missile and the Navy's variant of the Army Tactical Missile System were effective weapons; and (4) the GPS/INS costs were not a problem, but overall cost differences of the missiles were.

On May 11, 1999, the Under Secretary of Defense for Acquisition and Technology approved the Navy's proposal to develop the land attack Standard Missile in the near term, provided that more funds are programmed in the Navy's advanced land attack missile plan to modify the Army Tactical Missile System to be fired from DDG-51 tubes.

Naval Fires Control System Is Being Developed

The Navy is developing a Naval Fires Control System that will automate shipboard fire support management functions for the modified 5-inch gun and guided munition. The system will be used to receive targeting data, conduct planning and coordination, and execute fire missions through

[5]The Board is led by the Deputy Director, Naval Warfare, and includes representatives from the Office of the Under Secretary of Defense for Acquisition and Technology, the Office of the Secretary of Defense, Program Analysis and Evaluation, the Army, the Navy, and the Marine Corps.

interfaces to weapon control systems. To support a fiscal year 2003 initial operating capability milestone, the Navy plans to perform an operational assessment of the first phase of the fires control system in 2001. At that time, this first phase of the system is scheduled to be installed aboard 16 destroyers (DDG-81 through 96), in a stand-alone mode in the ships' Advanced Tomahawk Weapon Control Systems. The Navy plans to introduce the next phase of the fires control system as an integral part of the Tactical Tomahawk Weapon Control System and the fire control systems of the Tactical Tomahawk and Land Attack Standard Missiles. Later phases of the fires control system will support complex naval fires planning and coordination and possibly other weapon systems such as the Advanced Gun System. The Navy plans to install the new system on its new destroyers and older cruisers and make it available to amphibious and command ships.

NSFS Second Phase

Because the first phase of the NSFS modernization program will not fully meet Marine Corps requirements for range, lethality, and volume of fire, the Navy intends to develop, in a second phase after 2003, a larger caliber advanced gun system and a new land-attack missile for the DD-21. Weapons developed during this phase are intended to fully meet NSFS requirements. The Navy has funded the advanced gun program and has undertaken studies of the gun design. However, the missile program remains unfunded, and the Navy has not made key decisions on its design or type. The Navy will also assess various Office of Naval Research (ONR) projects demonstrating maturing and emerging technologies to improve the performance of and reduce the costs of future fire support systems.

Advanced Gun Alternatives for the DD-21 Are Under Study

A new larger caliber gun for the DD-21 is being developed as the Advanced Gun System (AGS). To ensure early design integration, the DD-21 program office has been given responsibility for AGS development.[6] However, House and Senate committees have raised concerns about the extent to which the Navy has considered different gun alternatives. In response to these concerns, the Navy contracted with the Center for Naval Analyses to conduct an analysis of alternative gun systems for the DD-21. The analysis

[6]House Committee on National Security report (105-532, at 180) and Senate Committee on Armed Services report (105-189, at 167-168).

is to consider guns of various calibers and designs and the Multiple Launch Rocket System.[7] The Center plans to brief the Navy on its results in June 1999 and to issue a final report in August 1999. At the same time, two DD-21 industry teams are developing concepts for the AGS. The teams expect to reach a decision on whether to adopt a vertical or deck-mounted gun design by June 1999. The Navy will select the final characteristics, based on the results of the Center's analysis and on industry efforts, both of which are scheduled for completion at the end of fiscal year 1999.

Advanced Land-Attack Missile Plans Deferred

When the Chief of Naval Operations decided to proceed with development and procurement of the Land Attack Standard Missile, he explicitly deferred a decision on a next generation land-attack missile for the DD-21 pending further development of competing missile systems. According to a Navy official, the Navy presently has no program activity or funding associated with an advanced land-attack missile.

ONR Projects Explore NFSF Enhancing Technologies

Over the next few years, the Navy plans to assess various ONR demonstration projects intended to reduce costs and enhance weapon performance of NFSF development programs. The projects will explore both maturing and emerging technologies that may enhance fire support capabilities in both the first and second phases of the NSFS modernization.

The goals of the first project, called Air and Surface Launched Weapons Technology/Naval Surface Fire Support, are to increase gun-launched projectile and missile ranges, decrease the response time required to reach the target, increase the weapon's accuracy against moving targets, and increase the weapon's lethality. The three goals are scheduled to be achieved in 2005, 2010, and 2015.

The second project, called Air Systems and Advanced Technology/Weapons Advanced Technology, is expected to demonstrate emerging technologies in weapon system components/subcomponents that may improve the performance of existing and future surface weapon systems. A portion of the project will demonstrate improved mission planning and execution times of missiles for land-attack missions.

[7]The two major designs are a deck-mounted gun and a vertical gun.

The next project is the "competent munitions" advanced technology demonstration[8] that aims to combine miniaturized (microelectromechanical system) inertial measuring units with the Global Positioning System and with an inertial navigation system to guide and control a gun-launched projectile such as the one designed for the 5-inch gun. The goal is to produce a low-cost, highly accurate guidance and control unit that can be used in various munitions by the Army, the Navy, and the Marine Corps. Final flight tests are scheduled to be complete by the end of fiscal year 1999.

The last project is the "best buy" advanced technology demonstration that aims to demonstrate technologies critical to developing a projectile with a range of 100 nautical miles and twice the payload of the guided munition currently being developed for the modified 5-inch gun. This project plans to demonstrate a projectile, made of composite materials rather than steel, that can hold a variety of other payloads using guided munition subsystems and components. The demonstration is scheduled for fiscal year 2000.

Full NSFS Capability Is Years Away

Table 1 shows that the delivery schedules for the modified 5-inch gun and projectile, the Land Attack Standard Missile, and the Advanced Gun System span a number of years. According to its schedules, the Navy will have accepted for delivery all of the 5-inch guns and Land Attack Standard Missiles and some of the AGS and advanced land-attack missiles between fiscal year 2010-2015. If it is able to obtain all the planned NSFS weapons that perform as required, between fiscal year 2010-2015, the Navy will have 71 5-inch guns with guided munition capability and an expected NSFS range of 63 nautical miles on 49 ships between fiscal year 2010-2015. In addition, the Navy will have accepted delivery of Land Attack Standard Missiles (about 20 per ship) with a range of 150 nautical miles aboard these same ships. The Navy will fall short of meeting the full NSFS range goal of 200 nautical miles until it fields the advanced land-attack missile in the DD-21 destroyer. But it expects to have fielded 22 DD-21 destroyers equipped with AGS and advanced land-attack missiles by 2015. According to one Navy official, this level of capability on cruisers and destroyers will enable the Navy to have three to four NSFS-capable ships deployed at all times to support operations ashore.

[8]A narrowly-focused technology demonstration to identify key technologies ready for transition and demonstrate their performance parameters.

Table 1: Schedule of Fire Support Systems Deliveries

System delivery	Weapon system range	First delivery (fiscal year)	Last delivery (fiscal year)	Quantity
5"/62 caliber gun, forward fit on Arleigh Burke class destroyers[a]	41-63 nautical miles	2001	2009	27 ships, 27 barrels
5"/62 caliber gun, retrofit on Ticonderoga class cruisers[b]	41-63 nautical miles	2004	2009	22 ships, 44 barrels
Naval Fires Control System	Not applicable	2001	2009+	All ships with 5"/62 caliber guns
Land Attack Standard Missile	150 nautical miles	2003	[c]	800
Advanced Gun System	100 nautical miles	2008	2020	32 ships, 64 barrels
Advanced Land-Attack Missile	200 nautical miles	[c]	[c]	[c]

[a]Destroyer hull numbers 81 through 107.

[b]Cruiser hull numbers 52 through 73.

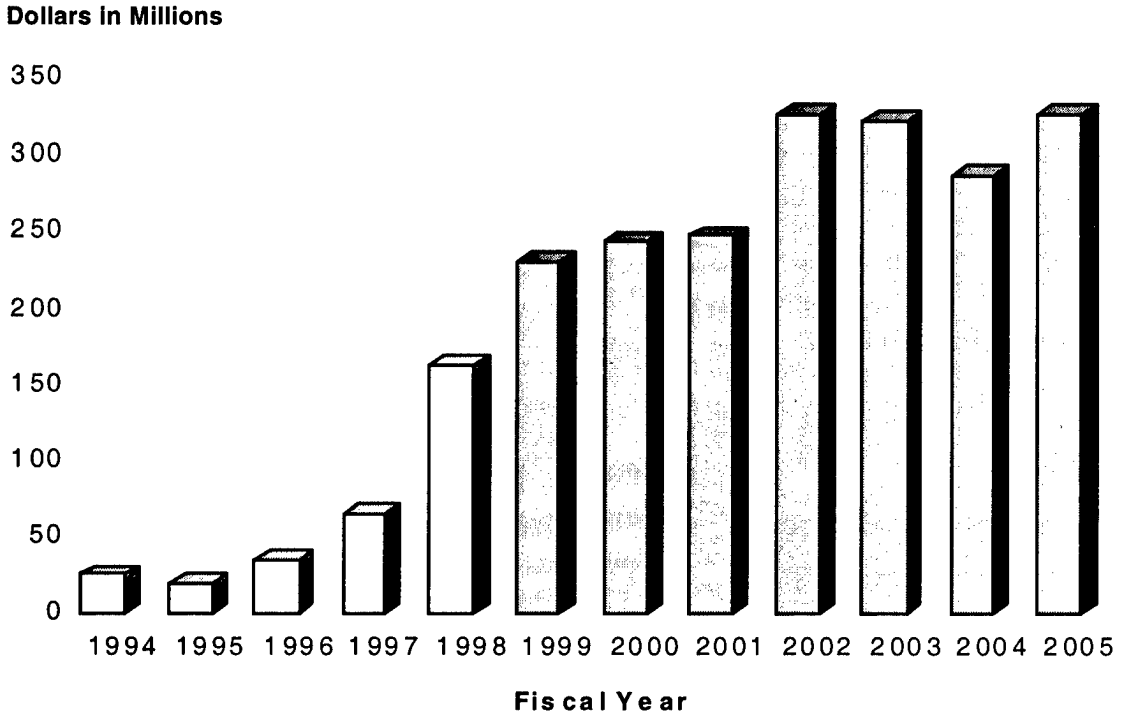
[c]To be determined.

Total Program Cost Estimates Are Incomplete

Figure 2 shows the cost of developing a modern NSFS capability from fiscal year 1994 to 2005, not including the cost of the ships. The Navy spent $309 million between 1994 and 1998 and plans to spend at least another $2 billion between fiscal year 1999 and 2005.[9] However, this amount also does not include significant additional costs for (1) integration of the Land Attack Standard Missile into the Vertical Launch System, (2) fire control modifications to the Tomahawk Tactical Weapons Control System, and (3) development and procurement of an advanced land-attack missile for the DD-21. Costs projected beyond 2005 for most of the NSFS programs are incomplete or not available.

[9]According to the most recent Future Years Defense Plan, submitted to Congress in February 1999 with the Fiscal Year 2000 DOD budget request.

Figure 2: NSFS Programs Costs



Note: Fiscal years 1999-2005 are estimates.

Source: Congressional Budget Documents.

Agency Comments and Our Evaluation

In written comments, DOD concurred with a draft of this report (see app. I). DOD also provided technical clarifications that we incorporated as appropriate.

Scope and Methodology

To assess the Navy's plans to modernize its surface fire support capabilities and describe the cost of these efforts, we interviewed officials and obtained and reviewed documentation from the Office of the Secretary of Defense, the Chief of Naval Operations, the Commandant of the Marine Corps, the Marine Corps Combat Developments Command, the Naval Sea

Systems Command and subordinate activities, the Center for Naval Analyses, the Office of Naval Research, and the Johns Hopkins University Applied Physics Laboratory.

We viewed firing demonstrations of the modified 5-inch gun and received briefings on the guided munition, the automated munition handling system, and the Naval Fires Control System software at the Naval Surface Warfare Center, Dahlgren, Virginia.

We conducted our review from July 1998 through April 1999 in accordance with generally accepted government auditing standards.

We are sending copies of this report to Senator Ted Stevens, Chairman and Senator Robert C. Byrd, Ranking Minority Member, Senate Committee on Appropriations; Representative C. W. Bill Young, Chairman and Representative David R. Obey, Ranking Minority Member, House Committee on Appropriations. We are also sending copies of this report to the Honorable William Cohen, Secretary of Defense; the Honorable William J. Lynn, Under Secretary of Defense (Comptroller); the Honorable Jacob Lew, Director, Office of Management and Budget; the Honorable Louis Caldera, Secretary of the Army; the Honorable Richard Danzig, Secretary of the Navy; and General Charles C. Krulak, Commandant of the Marine Corps. Copies will be made available to others upon request.

Please contact me at (202) 512-4841 if you or your staff have any questions concerning this report. Major contributors to this report are listed in appendix II.

James F. Wiggins
Associate Director
Defense Acquisition Issues

Contents

Abbreviations

AGS	Advanced Gun System
DOD	Department of Defense
GPS/INS	Global Positioning System/Inertial Navigation System
NSFS	naval surface fire support
ONR	Office of Naval Research

Comments From the Secretary of Defense

OFFICE OF THE UNDER SECRETARY OF DEFENSE

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ACQUISITION AND TECHNOLOGY

30 APR 1999

Mr. James F. Wiggins
Associate Director, Defense Acquisition Issues
National Security and International
Affairs Division
U.S. General Accounting Office
Washington, DC 20548

Dear Mr. Wiggins:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report "Defense Acquisitions: Naval Surface Fire Support: Program Plans and Cost" dated April 1, 1999 (GAO Code 707396/OSD Case 1779).

The Department has reviewed the report and concurs without further comment. Suggested technical changes were provided separately.

The Department appreciates the opportunity to comment on the draft report.

Sincerely,

George R. Schneiter
Director
Strategic and Tactical Systems

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