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NAVY SHIPS: Status of SSN-21 and DDG-51 Programs

Statement of
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Before the
Subcommittee on Projection Forces and Regional
Defense
Committee on Armed Services
U.S. Senate



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Mr. Chairman and members of the Subcommittee:

I am pleased to appear before the Subcommittee today to discuss the status of the Navy's Seawolf attack submarine (SSN-21) program, its combat system (AN/BSY-2), and the Arleigh Burke class destroyers (DDG-51). This year we have issued reports to this Subcommittee on the SSN-21 and the BSY-2 and we issued a report to the Secretary of Defense on the DDG-51.

Overall, our concerns on both programs are similar. They are highly concurrent programs where major subsystems are being developed while ships are under construction. Also, several ships are being bought before the lead ships are operationally tested.

We recognize that shipbuilding may present a unique challenge because of the time it takes to develop and build a ship. Last year, the Congress enacted a provision that recognized that a number of ships could be on contract prior to completion of operational test and evaluation on the lead ship. However, with as many as 15 of a planned buy of 29 SSN-21s (over 50 percent) and 13 of a planned buy of 33 DDG-51s (nearly 40 percent) under contract before the lead ship of each class is tested, we are concerned that the Navy may be overusing the exemption. Also, independently, each program consumes a large part of the Navy's shipbuilding budget.

Chairman Nunn has questioned whether there is still a necessity for as much concurrency in weapon systems given the changing world environment. We testified (Concurrency in the Acquisition Process, statement of Frank C. Conahan, GAO/T-NSIAD-90-43, May 17, 1990) before Chairman Nunn last week and share his concern. Although concurrency can be used to expedite the development and production of weapon systems, our work has shown that after a significant expenditure of procurement dollars, several high cost concurrent systems and subsystems do not perform as intended. We believe that DOD can no longer afford to concurrently develop and procure these high cost systems without knowing early whether the desired capability can be demonstrated. We also believe that the recent changes in the national security environment mean that we can wait until we know whether systems work before we buy them.

Declining defense budgets may also greatly impact the Navy's plans for the systems we are discussing today. As you know, the Secretary of Defense is currently reviewing the SSN-21 and DDG-51 programs and his recommendations are due at the end of this month. Specifically, he is looking at what attack submarine and destroyer capabilities the United States needs; the extent to which the SSN-21 and DDG-51 programs provide these capabilities; and fiscal and acquisition considerations, including cost, schedule, and performance.

I would like to briefly summarize our reports on the SSN-21, BSY-2 and DDG-51. The reports' summaries are included as appendices to this statement.

SSN-21 SEAWOLF SUBMARINE

The SSN-21 will be larger, quieter, tactically faster and deeper diving than Los Angeles class attack submarines (SSN-688)--the last 19 of which are currently under construction. The SSN-21 will also carry more weapons than earlier classes of attack submarines.

Critical to the SSN-21 achieving its mission requirements is the successful development of the BSY-2 combat system, an advanced computer system designed to enable the submarine to detect and locate targets faster than existing submarine combat systems can, allow operators to perform multiple tasks and address multiple targets concurrently, and reduce the time between detecting a target and launching weapons. This is to be accomplished through computer-aided detection, classification and tracking, the use of a wide aperture array hull mounted sensor, and enhanced information management.

The SSN-21 and BSY-2 are being developed as separate programs, each under the direction of its own program manager and subject to its own management system. Both are highly concurrent. The BSY-2 is

to be provided as government-furnished equipment to the submarine shipbuilder.

The Navy is using two shipyards to design the SSN-21 -- the Electric Boat Division of General Dynamics and the Newport News Shipbuilding and Dry Dock Company. Newport News is responsible for the submarine's overall design under a \$343 million cost-plus-fixed-fee contract. Electric Boat is designing the engine room and its equipment under a \$212 million cost-plus-fixed-fee contract. Some research and development and detailed design efforts will continue concurrently with construction of the first SSN-21.

In January 1989, the Navy awarded Electric Boat a construction contract for the first SSN-21. Delivery is scheduled for May 1995 with an estimated cost of \$1.9 billion. The Navy expects the unit cost of the next three SSN-21s will decline and that the fifth and subsequent SSN-21s will not exceed \$1 billion each in 1985 base year dollars which would equate to \$1.3 billion in today's dollars. For fiscal year 1991, the Navy is requesting \$3.5 billion for the second and third ships, two combat systems, and long lead time items for the fiscal year 1993 program.

The BSY-2 is critical to the submarine achieving its full mission and performance capabilities. The Navy has no alternate combat system planned should the BSY-2 development be delayed. In March 1988, the Navy awarded General Electric a fixed-price incentive fee

contract worth up to \$1.84 billion to develop the BSY-2 combat system and produce the first unit for the lead submarine, with options for two more systems and related items. Full-scale engineering development is scheduled to proceed into fiscal year 1996. Total development and procurement costs for 29 planned BSY-2 combat systems are estimated to be \$7.4 billion in then-year dollars.

We continue to have several concerns that must be addressed in the SSN-21 and BSY-2 development.

Concurrency

To meet its planned delivery date of May 1995, the SSN-21 program is using a concurrent scheduling approach that has construction ongoing while design is continuing. Current plans call for as many as 15 ships, at an estimated cost of more than \$21 billion, to be on contract or under construction before the first ship is available for operational testing.

The SSN-21's construction schedule is driving the development and production schedule of its combat system. In 1988 the Navy stipulated that the delivery of the first BSY-2 was required by November 1993 to meet the scheduled delivery of the first SSN-21. However, when the Navy awarded the full-scale development contract for the combat system, it agreed to have all system hardware and

about 86 percent of its software delivered to the Navy by that date. The remaining software would be delivered in November 1994.

In our January 1990 report (Navy Acquisition: Cost, Schedule, and Performance of New Submarine Combat Systems, GAO/NSIAD-90-72, Jan. 31, 1990), we expressed our concern that this program could be high risk because development of the BSY-2 is one of the most technically challenging and complex software development efforts undertaken for a submarine. The BSY-2 combat system will require up to 800 software personnel to develop and integrate about 3.2 million lines of code -- over 2 million of which is planned to be written in the new Ada programming language. Our report also discussed some submarine redesign caused by BSY-2 changes and, more recently, we have learned that because of increased weight of the BSY-2 hardware, additional redesign may be necessary. The shipbuilder has not yet made a full assessment of this impact.

In his April 1990 report on "Concurrency in Major Acquisition Programs" the Under Secretary of Defense said that the overall risk assessment of the BSY-2 was considered low for performance and schedule and moderate for cost. However, this differs from an internal DOD assessment by the Special Assistant on software and computer technology in the Office of the Director of Defense Research and Engineering who identified several potential problems that could prevent delivery of the BSY-2 system in time to support the planned May 1995 delivery date for the SSN-21. For example,

the Special Assistant was concerned that General Electric does not have enough personnel with Ada training, and those that are trained need more expertise.

At your request, we are continuing to review the technical development of the BSY-2.

Affordability

The Navy plans to buy 29 SSN-21s by the year 2000 at an estimated cost of about \$44 billion in then-year dollars.

In April 1990, we reported (Navy Ships: Status of SSN-21 Ship Construction Program, GAO/NSIAD-90-163, April 19, 1990) our concern that fiscally constrained budgets and the cost of the SSN-21 may not allow the Navy to buy all 29 SSN-21s. The Navy's SSN construction plan is based upon several assumptions that, in our opinion, may not be achievable.

To execute the SSN construction plan within a shipbuilding budget that would, for example, grow at an annual real rate of 3 percent, the Navy would have to

- increase the percentage of shipbuilding funds allocated to SSN construction from 19 to 26 percent,
- reduce average planned SSN construction time from 65 months to about 52 months,

- receive authorization and funding for an average of about three ships per year, and
- incur no cost overruns requiring supplemental funding.

Further, during a period of zero or 3 percent negative real growth budgets, the Navy's planned SSN program could consume up to 36 percent of its shipbuilding budget.

DDG-51 ARLEIGH BURKE DESTROYER

The DDG-51 will replace retiring destroyers and will be equipped with the AEGIS combat system. The lead ship's complex design incorporates features to increase the ship's ability to survive during battle. For example, it will have a seakeeping hull, all steel construction and extensive armor around vital spaces, and a system to protect the crew from contaminated air.

Initially, the lead ship was scheduled for delivery in September 1989, but Bath Iron Works encountered delays in designing and constructing the lead ship. For example, it planned to use mostly computer-aided design, but it was unable to. Bath Iron Works is now making an extraordinary effort to meet a planned delivery in February 1991.

The Navy has awarded contracts for 12 follow-on ships out of a planned program of at least 33 ships estimated to cost \$27 billion.

Prior to the award of the last five ships in January 1990, we expressed our concern that much work still had to be done on the lead ship -- it was estimated at 50 percent complete -- and that 7 follow-on ships were already under construction or contract (Navy Shipbuilding: Cost and Schedule Problems on the DDG-51 AEGIS Destroyer Program, GAO/NSIAD-90-84, Jan. 17, 1990). We believed that DOD should have considered not awarding contracts for additional ships until after sea trials scheduled for this coming fall. DOD disagreed and awarded contracts for five ships.

We continue to be concerned about the concurrency in the DDG-51 program and its affordability.

Concurrency

Until Bath Iron Works completes the lead ship and it undergoes sea trials this fall, the Navy will not know if the integration of the AEGIS combat system and various systems is effective. For example, new systems such as the collective protection system and a data multiplex system are still being incorporated on the lead ship. The Navy's own assessment was that extraordinary efforts were needed to incorporate these systems to meet the ship's delivery schedule. At the same time, follow-on ships are under construction at both Bath Iron Works and Ingalls Shipbuilding. If problems develop on the lead ship, corrections may require changes

in design to follow-on ships or retrofiting. The Navy would likely be responsible for these costs.

Although DOD's Office of Developmental Test and Evaluation categorizes the DDG-51 as a highly concurrent program, the Under Secretary of Defense's recent report on concurrency did not include the DDG-51. We have been told by DOD that was an oversight.

Affordability

DOD has determined that the original fixed-price incentive contract may no longer be appropriate for developing the DDG-51 and last fall changed the cost-sharing ratios, which significantly increased DOD's costs while eliminating Bath Iron Work's projected losses under the original contract terms. In our January 1990 report we expressed our concern about the potential impact on other programs because over 50 percent of competitively awarded fixed-price incentive shipbuilding contracts were experiencing cost growth.

Lead ship design and construction costs have increased significantly since the original estimate. Before restructuring the contracts design costs were expected to more than double, from \$111 million to \$247 million, and construction costs were expected to grow by more than 60 percent, from \$157 million to \$253 million.

In April 1990 the estimated costs for design and construction were \$516 million. However, DOD believes that the total cost of the lead ship after integrating all systems, including the government-furnished AEGIS combat system, will still be under the original estimate of \$1.25 billion (in 1985 dollars) -- approximately \$1.45 billion in current dollars. The Navy's February 1991 buy of 5 ships cost about \$700 million each.

For fiscal year 1991, the Navy is requesting \$3.6 billion for another 5 ships. Like the SSN-21 program, achieving the planned DDG-51 program of five ships per year will require an increasing share of the Navy's shipbuilding program in an era of declining defense budgets. For example, at 3 percent negative real growth the DDG-51 program will consume 32 percent of the fiscal year 1991 requested shipbuilding budget.

CONCLUSIONS

In conclusion, we believe that the changing world environment may provide the opportunity to reduce concurrency in shipbuilding programs. One of the justifications for concurrency, if not the main justification, has been the urgent need to field a system to respond to the threat which several analysts now see as lessening.

At the same time, affordability issues of the SSN-21 and the DDG-51 will likely require the Navy to make important trade-off decisions.

It is our hope that the Secretary of Defense's mandated review of the attack submarine and destroyer programs will provide the high level attention programs of this importance deserve.

This concludes my prepared remarks and I would be pleased to respond to any questions.



United States
General Accounting Office
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National Security and
International Affairs Division

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April 19, 1990

The Honorable Edward M. Kennedy
Chairman, Subcommittee on Projection
Forces and Regional Defense
Committee on Armed Services
United States Senate

The Honorable John R. Kasich
House of Representatives

This report is the unclassified version of the classified report we provided you in November 1989 on the results of our review of the Navy's Seawolf Nuclear Attack Submarine (SSN-21) construction program. Our objectives were to address the program's status, the SSN-21's performance capabilities, and the Navy's ability to maintain the nuclear attack submarine (SSN) force structure.

Results in Brief

The Navy is using two shipyards to design the SSN-21 and is proceeding with its ship construction plans. During the research and development phase, the program experienced some cost increases and a revised delivery schedule. Indications are that further cost increases and schedule adjustments are possible, and it is unclear whether overall performance goals will be met since the lead submarine will not be available for testing until 1995. The SSN-21's shipbuilding plan is designed to achieve the Navy's 100 SSN force goal. However, fiscal constraints and ship cost may prevent the Navy from achieving its SSN force goals.

Background

The 100 nuclear attack submarine force is a keystone of the Navy's maritime strategy and the new SSN-21 is to be one of the principal components of that force. The Navy sees no alternative to the SSN-21 in providing the quantum improvements needed in submarine warfighting capability. According to the Navy, the SSN-21 is needed because of Soviet deployments of more capable and quieter SSNs and because space and weight limitations prevent further performance improvements to the Los Angeles class nuclear attack submarine (SSN-688). Designed to be quieter, deeper diving, and tactically faster, the SSN-21 also will carry more weapons than the SSN-688s being built today. In addition, a new combat system (AN BSY-2) is expected to provide the SSN-21 with a greater capability to detect, classify, localize, and launch weapons against enemy targets. (See app. 1.)

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The SSN-21 construction program is a major Navy initiative. Between fiscal years 1989 and 2000, the Navy plans to award contracts for 29 SSN-21s, including combat systems, at an estimated cost of \$36 billion. The SSN-21 program is completing its detail design phase, and in January 1989 the Navy awarded the Electric Boat Division of General Dynamics Corporation a construction contract for the first ship. Some research and development and detail design effort will continue concurrently with construction of the lead submarine. Construction of the first ship began in October 1989 and delivery is scheduled for May 1995. In terms of 1985 base year dollars, the first SSN-21 is estimated to cost \$1.6 billion and the Navy expects the unit cost of the next three SSN-21s will decline to the point that the fifth and the 24 following SSN-21s will not exceed \$1.0 billion each.

Program Status

The SSN-21 shipbuilding program has experienced cost increases over estimates and a 6-month schedule adjustment. Newport News Shipbuilding—the lead shipyard for submarine design—has reported increased costs under its cost-plus-fixed-fee design contract that has an authorized cost of \$343 million. Not yet included in the authorized cost is \$5 million for submarine redesign caused by changes in the configuration of the combat system Electric Boat, which is designing the engine room and its equipment also under a cost-plus-fixed-fee contract with an authorized cost of \$212 million, shows a cost increase in its cost report. The Navy contended that the cost increase figure was invalid because the contractor's budgeted costs, against which actual costs were compared, were incomplete. The amount of the individual cost increases is considered to be proprietary by the contractors. According to the Navy, it agreed to a 6-month schedule adjustment for constructing the first SSN-21 to secure a lower price.

The AN/BSY-2 combat system development program could further exacerbate the SSN-21 program's cost and schedule problems. Managed separately from the SSN-21 program, the AN/BSY-2 is critical to the submarine achieving its full mission and performance capabilities. The combat system's development schedule is set by the ship's construction schedule, and the Navy has no alternate system planned should the AN/BSY-2 development be delayed. In October 1988 Newport News Shipbuilding indicated to the Navy that, on the basis of its assessment, it believed the AN/BSY-2 development program was 12 to 16 months behind that needed for the lead submarine delivery schedule. The Navy has since extended delivery of the lead submarine 6 months, to May 1995.

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As of March 1989, design of the combat system was about 3 months behind schedule and two important Navy design reviews had been delayed about 5 months. In addition, the Department of Defense (DOD) has identified problems in developing two combat system components. Further combat system changes could have a major impact on completed SSN-21 design, with an adverse effect on program cost and schedule.

Until the first SSN-21 is built and fully tested, the Navy will not know the exact extent to which the SSN-21 will achieve its performance goals. Except for the two components, component and system development test results appear satisfactory.

A more detailed discussion of the SSN-21 program and the AN/BSY-2 combat system is provided in appendix II.

Operational Testing

Section 2366 of title 10 of the United States Code provided that major defense acquisition programs may not proceed beyond low rate production until operational testing and evaluation is completed. The acquisition schedule for the SSN-21 program provides that contracts for 14 submarines are to be awarded before the first ship is available for operational testing. The Navy plans to begin construction of the second and third SSN-21s more than 4 years before the lead ship is ready for operational testing.

In an opinion dated February 27, 1989, we concluded that the SSN-21 program could not proceed beyond low-rate initial production on the basis of "early operational assessments" that did not constitute operational testing.¹

The Navy believed that waiting for operational testing of the first SSN-21 before contracting for more submarines would delay the program 5 or 6 years and entail a large cost increase. The Navy, therefore, had no plans to change its acquisition schedule. However, in its comments on a draft of our November 1989 report, DOD indicated that actions were underway to seek legislative relief from the current requirement. Subsequent to our November report, the Congress resolved this issue in the Navy's favor.

¹GAO letter to the Chairman, Legislation and National Security Subcommittee, House Committee on Government Operations, B-222886, Feb. 27, 1989.

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SSN-21 Affordability

The Navy believes the SSN-21 will allow it to maintain far-term submarine superiority into the next century. Yet, fiscally constrained budgets may not allow the Navy to buy all of the SSN-21s it needs to achieve and maintain its 100 SSN force. To achieve its SSN force goal and execute its SSN-21 shipbuilding program, the Navy, according to our analysis, with sustained annual shipbuilding and conversion budget growth of 3 percent above inflation, will need to increase the SSN's share of the shipbuilding and conversion budget from 19 to 26 percent. Further, during a period of zero or negative real growth budgets, the Navy's planned SSN program could consume up to 36 percent of its total shipbuilding and conversion budget, which may affect Navy total force structure decisions. (See app. III.)

The Navy could achieve its SSN force level goals by building a mix of SSNs. This might entail acquiring fewer SSN-21s and more of the less costly SSN-688s. However, the Navy does not consider this a viable alternative to the SSN-21 program. According to Navy officials, if SSN-21 affordability becomes an issue they would rather reduce the SSN force level.

Conclusions

Without aggressive funding, the Navy will probably have difficulty achieving its SSN force goal and executing its SSN-21 program. SSN-21 affordability issues will likely require the Navy to make total force, as well as SSN force, trade-off decisions. The Navy also may experience difficulties in achieving its current SSN-21 construction plan because the AN BSY-2's development, which is critical to the SSN-21 construction program, may not be completed when the first submarine is delivered. The SSN-21 will not be operationally tested until after construction of the second and third ships has started; therefore, the Navy will not precisely know whether the SSN-21 will provide the warfighting capabilities needed.

Recommendations

In our November 1989 report, we recommended that the Secretary of Defense direct the Secretary of the Navy to either (1) ensure that the SSN-21 and its combat system undergo operational testing and evaluation before proceeding past low-rate initial production, as required in the law, or (2) seek legislative relief that would change the law to either exempt shipbuilding in general or the SSN-21 program specifically.

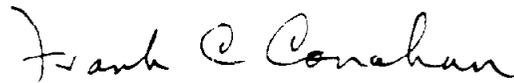
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Agency Comments and Our Evaluation

DOD generally agreed with our report and with the facts as presented. In some cases it disagreed as to how those facts were characterized and provided an update to the Navy's SSN force structure data. Where appropriate, we modified the report to reflect DOD's position.

DOD agreed with our recommendation that the Navy either seek legislative relief or comply with the law. It indicated that actions were underway to seek legislative relief from the current requirement. In November 1989, Public Law 101-189 was enacted, which allows shipbuilding programs to proceed prior to the completion of operational testing of the first ship.

This report was prepared under the direction of Martin M Ferber, Director, Navy Issues, who may be reached on (202) 275-6504 if you or your staff have any questions. Other major contributors are listed in appendix IV.



Frank C. Conahan
Assistant Comptroller General

Executive Summary

Purpose

To meet new Soviet threats and ensure continued U.S. submarine superiority, the U.S. Navy has initiated development of two new advanced combat systems. These systems—the AN/BSY-1 and the AN/BSY-2—are to be installed in improved Los Angeles (SSN-688) and new Seawolf (SSN-21) class nuclear attack submarines, respectively. The life-cycle costs for the two systems have been estimated at over \$26 billion

The Chairman, Subcommittee on Projection Forces and Regional Defense, Senate Committee on Armed Services, requested that GAO examine the status of the Navy's submarine combat system development programs. Specifically, GAO determined whether these two combat systems will meet cost, schedule, and performance goals and whether the combat system being developed for SSN-21s can avoid developmental problems experienced with the SSN-688 combat system.

Background

In 1980 the Navy began developing an advanced combat system for improved SSN-688s authorized in fiscal year 1989 and beyond. Originally, it planned a single-phased program. However, in October 1983 the Secretary of Defense accelerated the program and approved a three-phased plan to apply to SSN-688s authorized, starting in fiscal year 1983—a 6-year acceleration

Because of ambitious program objectives and schedules, cost, schedule, and technical problems surfaced causing the Navy to restructure the program into two separate development efforts—AN/BSY-1 for use on improved SSN-688s and AN/BSY-2 for SSN-21s. These combat systems are designed to improve data processing and management capabilities. With the use of new and more capable computers, new data displays, and additional software, certain tasks, such as searching for, detecting, and tracking targets, will be more automated. System operators can thus perform multiple tasks, address multiple targets concurrently, and process tactical data faster and more accurately than they can with prior systems. Collectively, these capabilities are designed to reduce the response time between initially detecting a target and launching a weapon.

Results in Brief

The Navy's submarine combat system development programs are experiencing problems. AN/BSY-1 program problems raise questions as to when the improved SSN-688s will be fully mission capable. Because of continued ambitious development objectives and schedules for the combat system development program, the Navy allowed insufficient time in

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the development schedule to resolve technical problems. As a result, the AN/BSY-1 systems will provide the SSN-688s improved performance capabilities in the acoustics and weapons launch areas, but the systems will be less capable in other areas. Also, the capabilities will be delivered later and cost more than originally planned under the earlier program.

The Navy has taken steps to reduce risks in the AN/BSY-2 program. However, it appears that potential problems in the AN/BSY-2 are similar to those experienced in developing prior submarine advanced combat systems, including the AN/BSY-1. In order to meet the SSN-21's construction schedule, the Navy also has established ambitious objectives and schedules for the AN/BSY-2 development program. As a result, the first combat system will not have full capabilities when delivered to the shipbuilder. In addition, combat system development problems could adversely affect the planned cost, schedule, and performance of the first SSN-21.

 Principal Findings

The Navy continues to establish ambitious program objectives and schedules in its development of complex submarine combat systems. As a result, the Navy must accept less than fully capable combat systems in order to meet the shipbuilders' schedule.

 AN/BSY-1 Has Experienced Problems

The estimated life-cycle costs for the AN/BSY-1 have increased from \$5.4 billion to \$12.1 billion for 19 and 24 systems, respectively. The first four systems will not have full AN/BSY-1 offensive capabilities and will be upgraded during the submarines' post shakedown availability period. Therefore, these submarines will not be able to perform a full range of missions. In addition, the AN/BSY-1 will provide less capabilities than originally planned under the original submarine advanced combat system program.

AN/BSY-1 design changes were the major cause of several improved SSN-688s under construction being modified. These changes also resulted in one shipyard being awarded almost \$82 million for changes to five submarines and another requesting a \$150 million contract adjustment for modifications for nine submarines. The first nine AN/BSY-1-equipped submarines will be delivered an average 17 months late to the Navy.

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AN/BSY-2 Will Not Have Full Capabilities When Delivered

Like the improved SSN-688 program, the need to meet the SSN-21 ship construction schedule also is affecting the AN/BSY-2 development program. As a result, the prime contractor does not have sufficient time to deliver the first combat system with full capabilities to the Navy. Remaining capabilities are scheduled to be delivered to the Navy in November 1994.

AN/BSY-2 Development Problems Could Adversely Delay Further System Delivery

As of November 1989, AN/BSY-2 development was about 3 months behind the program's current schedule and further delays are expected. Delays have resulted in deferring two Navy critical system design reviews and some critical item testing. Until the Navy completes these reviews, the prime contractor is unable to begin developing most hardware and writing most system software code.

Recommendations

GAO is not making recommendations in this report.

Agency Comments

The Department of Defense (DOD) generally agreed with GAO's report and with the facts as presented on the AN/BSY-1 but only partially concurred with GAO's findings on the AN/BSY-2. In those cases where it partially agreed with the report, DOD provided further elaboration. (See app II.)

DOD agreed that AN/BSY-1 combat system design changes were a major contributor to submarine delivery delays and cost increases but added that other design changes also contributed to the submarines' delays and cost increases. Regarding the AN/BSY-2, DOD stated that the slippage of the preliminary design review and the critical design review had no impact on the scheduled delivery of the system to the Navy. Although DOD agreed that some critical item tests have been delayed, it stated that many have been satisfactorily completed. Also, DOD agreed slowness in subcontract definitization increased program risks but added that no subcontractor design effort is being delayed.

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Purpose

The Navy currently plans to acquire at least 33 Arleigh Burke (DDG-51 class) guided missile destroyers at a total cost of about \$27 billion. The ships will replace retiring battle-force destroyers and will be equipped with the AEGIS combat system. Originally, the Department of Defense (DOD) estimated the total cost of the lead ship at about \$1.25 billion (in 1985 dollars) after design, construction, and outfitting with the AEGIS combat system.

The lead ship's complex design incorporates features to increase its ability to survive during battle. For example, it will have a seakeeping hull, which increases stability by reducing vertical motion; all-steel construction and extensive armor around vital spaces; and a collective protection system to protect the crew from contaminated air.

Because of the program's importance to the Navy mission and its significant costs, GAO assessed the status of the program.

Background

In April 1985, the Navy awarded Bath Iron Works a fixed-price incentive contract for the lead ship of the DDG-51 class destroyers. Bath Iron Works was responsible for designing the ship, which included integrating the AEGIS combat system and other government-furnished equipment. The contract called for ship construction to begin in May 1987, with delivery of the ship to the Navy in September 1989.

The Navy has awarded construction contracts for seven additional, or follow ships. The Navy awarded the contract for the second ship (DDG-52) in May 1987 to Ingalls Shipbuilding and the contract for the third ship (DDG-53) in September 1987 to Bath Iron Works. Contracts for five additional ships (DDGs 54 through 58) were awarded in December 1988—three to Bath Iron Works and two to Ingalls Shipbuilding.

Results in Brief

Bath Iron Works has encountered problems in designing and constructing the lead ship. As a result of these problems and Navy changes in the contract requirements, costs have increased substantially over the original contract estimate. Design and other problems contributed to two revisions to the ship's delivery schedule. The revisions, in January 1987 and February 1988, delayed the expected delivery by 17 months. Bath Iron Works is now accelerating construction to meet the planned delivery in February 1991.

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While Bath Iron Works estimates that more than 50 percent of the lead ship is complete, the major part of outfitting the ship still has to be done. The combat system and certain other technical components have to be installed and integrated within the ship. Often in the development of new systems, it is these activities and the subsequent testing of the complete system that surface problems that could affect follow ships' schedule and cost. Therefore, GAO believes that DOD should ensure that sufficient information exists on program development and affordability before the award of contracts for follow ships beyond the seven awarded to date.

Principal Findings

Design Delays

Bath Iron Works planned to prepare production drawings using computer-aided design, but major problems arose. The computer equipment did not have adequate data storage capacity needed to design a complex warship. Design delays were also due to Navy changes in ship requirements, late government-furnished design data for the reduction gear, and difficulties with several developmental systems. As of November 1989, Bath Iron Works and Navy representatives believed that design problems had been resolved and production drawings were essentially complete. GAO believes that the installation and integration of the ship systems, which still has to be done, could surface additional design or performance problems.

Construction Problems

Design and other problems contributed to two revisions to the ship's scheduled delivery, totaling 17 months. The last revision to the delivery schedule was made in February 1988. The ship, originally scheduled to be completed in September 1989, is currently scheduled for delivery in February 1991. Bath Iron Works is accelerating construction to meet this date.

Bath Iron Works had not been able to perform as much construction in the fabrication buildings as planned because of delays in preparing production drawings. Therefore, more construction has been required in the production yard, which is more time-consuming and costly.

Bath Iron Works launched the lead ship in September 1989. According to Bath Iron Works representatives, the ship was more than 50 percent

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complete in October 1989. However, to complete the ship requires incorporating and integrating the AEGIS combat system and demonstrating that other systems, such as the collective protection system, work as designed.

 Cost Issues

According to the June 1989 cost performance report, the total cost for Bath Iron Works to design and construct the ship was estimated at about \$500 million (in May 1984 dollars). Design costs were expected to more than double, from the original contract estimate of \$111 million to about \$247 million. Construction costs were expected to grow more than 60 percent, from \$157 million to about \$253 million. In September 1989, representatives of Bath Iron Works said that their estimate at completion had increased to \$505 million and that costs could increase further. DOD believes that the total cost, after integrating the combat system, will still be under the original estimate of \$1.25 billion (in 1985 dollars).

In September 1989, Bath Iron Works and the Navy modified the lead ship contract to resolve outstanding contractual issues. The issues were varied and included many technical matters. The modification provided for restructuring compensation to Bath Iron Works and, on the basis of information supplied by Bath Iron Works to the Navy, could increase Navy compensation as much as \$71.7 million. Projected losses of about \$41.5 million on design and construction would be eliminated.

GAO has reported that over 50 percent of competitively awarded fixed-price incentive shipbuilding contracts were experiencing overruns. Therefore, GAO was concerned that the contract modification for changing the lead ship contract terms could establish an inappropriate precedent. During the audit, GAO discussed this with Navy officials who said they expected the total cost of the ship to be under the original estimate and current shipbuilding appropriations were appropriate to cover the additional costs. DOD, in commenting on this report, stated that the restructuring will not set a precedent for future pricing of changes to Navy shipbuilding contracts because this instance presented a unique set of circumstances. GAO remains concerned about the modification in view of the high incidence of overruns on other fixed-price contracts.

 Rescheduling of the First Two Follow Ships

In January 1989, the Navy modified the DDG-52 contract to provide for better helicopter support capabilities, which rescheduled the delivery date by 8 months. Also, the Navy has approved a proposal by Bath Iron Works to reschedule the DDG-53 construction schedule. The 7-month

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rescheduling will allow Bath Iron Works to more efficiently schedule its work on other ships it is building for the government. These ships will be delivered earlier than expected.

 Other Follow Ships

Contracts for seven follow ships, including the DDG-52 and DDG-53, have been awarded and will be under construction before the lead ship is completed. A major program milestone—approval for full-rate production — is scheduled for July 1990. Before then, contracts for five more follow ships could be awarded. Moreover, contracts for another five ships could be awarded before the scheduled February 1991 delivery of the lead ship. Thus, as many as 17 follow ships could be under construction or awarded before the lead ship has finished testing and has been delivered.

Although the Navy and Bath Iron Works believe the potential for lead ship problems is minimal, much work needs to be done to complete the ship. Unanticipated lead ship problems may increase costs and delay deliveries for many follow ships. Because of the technical advances being made in the destroyer program and because the lead ship is still only about 50 percent complete, putting a large number of ships in construction or under contract seems to be a risky procurement strategy. Before contracting for additional ships, the Secretary of Defense should review the status of the destroyer program. This is especially important in light of current deliberations on force structure and budget reductions.

 Recommendations

GAO recommends that the Secretary of Defense ensure sufficient information exists to justify the award of contracts for follow ships beyond the seven now under contract.

 Agency and Contractor Comments

DOD commented that the probability of a major problem affecting follow ships is minimal and did not concur in our recommendation in the report draft. DOD said that it had complied with existing federal statute regarding the adequacy and the evaluation of tests necessary to proceed beyond limited production. It stated that the adequacy and results of testing would continue to be evaluated and would be an important factor in the deliberation and decision to award contracts for additional follow ships.

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GAO maintains the thrust of its recommendation because the program risks are significant; however, GAO reworded the recommendation to emphasize the need for high-level assurance on the overall program development and affordability. If DOD is not able to provide the assurances, it should delay contract award for additional follow ships.

Bath Iron Works commented that the report did not assess the validity of the Navy's acquisition process—most importantly, the fixed-price incentive type of contract. Bath Iron Works commented that it has become widely recognized that the use of a fixed-priced contract is not workable or compatible with the developmental nature of a highly complex warship.

GAO did not review the appropriateness of a fixed-price incentive contract for the DDG-51 acquisition. However, in commenting on this report, DOD did not agree with Bath Iron Works that, at the time of contract award, a fixed-price incentive contract was inappropriate. DOD said the contract terms at the time of award were appropriate to balance the risk between the Navy and Bath Iron Works. It also said that while Bath Iron Works' bid was aggressive, it was not unreasonably low.