

October 1994

ATTACK SUBMARINES

Alternatives for a More Affordable SSN Force Structure



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**National Security and
International Affairs Division**

B-248259

October 13, 1994

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

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

In response to your requests, we evaluated (1) the Navy's strategy for maintaining the nuclear-powered attack submarine (SSN) force structure as directed in the Department of Defense's bottom-up review and (2) alternatives available to the Navy for maintaining its SSN force structure at less cost.

As agreed with your offices, we plan no further distribution of this report until 30 days from its issue date. At that time, we will send copies to the Chairmen, Senate Committee on Governmental Affairs, House Committee on Government Operations, Senate and House Committees on Appropriations, and Senate and House Committees on Armed Services; the Director, Office of Management and Budget; and the Secretaries of Defense and the Navy. Copies will be made available to others on request.

If you or your staff have any questions on this report, please call me on (202) 512-3504. Major contributors to this report are listed in appendix V.

A handwritten signature in cursive script that reads 'Richard Davis'.

Richard Davis
Director, National Security
Analysis

Executive Summary

Purpose

Nuclear-powered attack submarines (SSNs) are the Navy's prime antisubmarine warfare asset. Today, faced with a changed world threat, a new defense posture, and constrained defense budgets, the Navy is reducing the size of its SSN fleet.

In response to requests from the Chairmen, Subcommittee on Regional Defense and Contingency Forces, Senate Committee on Armed Services, and the Legislation and National Security Subcommittee, House Committee on Government Operations, GAO reviewed (1) the Navy's strategy for maintaining the SSN force structure as directed in the Department of Defense's (DOD) bottom-up review and (2) alternatives available to the Navy for maintaining its SSN force structure at less cost.

Background

For more than four decades, U.S. national security and military strategies focused on fighting a global war with the former Soviet Union. However, after the dissolution of the Warsaw Pact and the Soviet Union, the Navy began to refocus its maritime strategy. Because of the changed threat and constrained U.S. defense budgets, the Navy plans to reduce its fleet of 87 SSNs to 55 by fiscal year 1999. The DOD's bottom-up review determined that the Navy needed to maintain a force of 45 to 55 SSNs thereafter to meet the requirements of the defense strategy, including both regional conflicts and peacetime presence operations. GAO did not independently verify or validate DOD's force level requirements.

Results in Brief

To maintain an SSN force of 45 to 55 submarines, as directed in DOD's bottom-up review, and remain within affordable budgets, the Navy plans to (1) extend the amount of time SSNs operate between major maintenance periods, (2) allow no more than three costly SSN-688 submarine refuelings per year, and (3) operate the submarines for their design service life of 30 years. At the same time, the Navy plans to acquire 31 SSNs through 2014 at an estimated procurement cost of \$48 billion.¹ This approach allows the Navy to maintain an SSN force close to the required maximum of 55 SSNs through 2020.

GAO identified several alternatives that would allow the Navy to free up money and still maintain the required minimum force structure of 45 SSNs. For example, GAO analysis shows that if the Navy were to acquire only 25 SSNs through 2014, it could save \$9 billion in procurement costs and

¹Unless stated otherwise, all cost estimates in this report are expressed in undiscounted constant fiscal year 1998 dollars. Discounted cost estimates are presented in appendix III.

maintain an SSN force close to 55 through 2013, but declining to 45 SSNs by 2020—still within the range directed by the bottom-up review. Under another alternative, the Navy could consider studying the feasibility of operating some SSN-688s beyond 30 years and defer spending an additional \$8 billion in procurement costs. A third alternative would be to defer new construction of SSNs and free up billions of dollars in the near term. While GAO and DOD do not know the magnitude of the reconstitution costs, this alternative offers the opportunity to defer near-term costs at a time when defense budgets have been reduced. Further, studies have shown that the estimated reconstitution costs to restart submarine construction in 2003 are less than the potential \$9 billion savings, suggesting that a deferral strategy is worth further study.

Principal Findings

Navy Is Increasing Submarine Operating Cycles to Achieve an Affordable SSN Force Structure

Until recently, the Navy planned to operate the SSN-688s for three 84-month cycles, perform major maintenance twice, and retire the submarines after 24 years. If the Navy had continued to follow this approach it would have faced the unaffordable procurement cost of \$68 billion to build 44 SSNs to maintain a minimum 45-SSN force through 2020. Funding at that level would have consumed about 45 percent of the Navy's shipbuilding budget, double the historical average. Also, the Navy would have had to perform costly refueling overhauls (at about \$294 million each) on as many as six SSN-688s in 1 year, which the Navy believed was unaffordable.

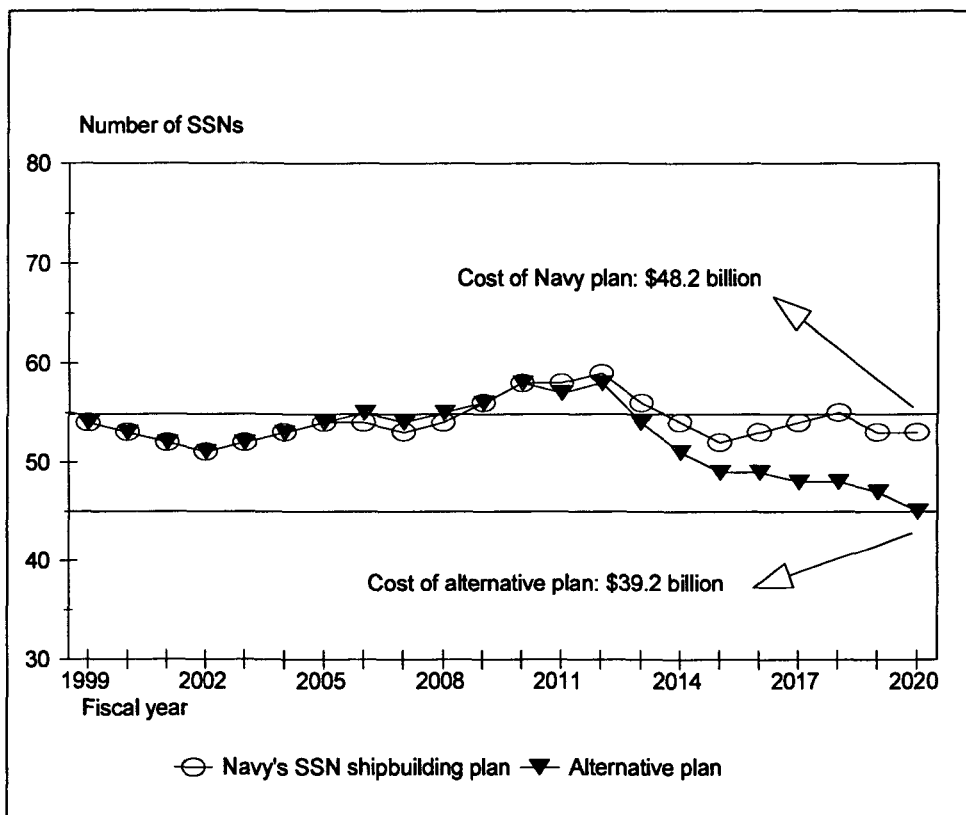
In July 1992, the Navy began to evaluate the feasibility of extending the operating cycle of SSN-688s beyond 90 months. The study is expected to be completed in November 1994. Based on preliminary analysis, the Navy has begun using an extended 120-month operating cycle for planning and scheduling purposes. The Navy also plans to operate its SSN-688 fleet for 30 years.

Navy Can Maintain Force Structure by Buying Fewer SSNs

The Navy currently plans to begin to build 31 SSNs (1 Seawolf class and a new 30-ship class of SSNs) from 1996 through 2014 at an estimated procurement cost of \$48 billion to support an SSN force level close to the maximum required force structure through 2020. GAO analysis shows that the Navy could buy six fewer submarines at a procurement cost savings of \$9 billion while sustaining SSN production. Using this alternative, the Navy

would maintain an SSN force level close to its currently planned level through 2013, declining to the minimum required force structure by 2020. The difference between the Navy's plan and this alternative plan is illustrated in figure 1.

Figure 1: Comparison of the Navy's Shipbuilding Plan and Alternative Plan



Service Life Extension of Nine Refueled SSN-688s Could Further Reduce SSN Procurements

The Navy has an opportunity to study the feasibility of extending the SSN-688's service life beyond 30 years. Because the older SSN-688s are being refueled, they will have sufficient nuclear fuel to operate for an additional 120-month operating cycle beyond the end of their 30-year design life. The Navy has previously extended the SSN-637 class submarines' service life from 20 to 30 years and is studying an extension from 30 to 40 years for the SSBN-726 (Trident) class submarines. Although not planned at this time, Navy officials stated that a similar study at the end of this decade could be the basis for extending SSN-688s' service life. If the Navy were to perform a third overhaul on the nine newest refueled SSN-688s and operated them for one more 120-month operating cycle, the submarines could operate for

42 years. This would reduce to 17 the number of SSNs the Navy needs to buy through 2014, at a procurement cost savings of \$21 billion, while maintaining an SSN force level within the range directed by the bottom-up review. GAO estimates the cost of performing the third overhauls on nine submarines to be about \$4 billion, resulting in a net savings of about \$17 billion.

Navy Could Consider Deferring Construction

To sustain the submarine shipbuilding industrial base, DOD is expected to request construction funding for new SSNs in 1996 and 1998. However, the Secretary of Defense has told Congress that there is no force structure need to build SSNs until after the turn of the century. GAO analysis shows that construction could be deferred into the next decade, freeing up billions in planned shipbuilding funds. For example, deferring construction until 2003 instead of following the Navy's plan could free up as much as \$9 billion in procurement funding. However, this acquisition strategy would require higher average annual production rates and higher annual shipbuilding budgets when SSN production resumed. While GAO and DOD do not know the magnitude of the reconstitution costs, this alternative offers the opportunity to defer near-term costs at a time when defense budgets have been reduced. Further, studies have shown that the estimated reconstitution costs to restart submarine construction in 2003 are less than the potential \$9 billion savings, suggesting that a deferral strategy is worth further study.

Matter for Congressional Consideration

GAO believes that Congress should consider these analyses of less costly alternatives as it deliberates SSN force structure and acquisition issues.

Agency Comments

DOD provided comments on a draft of this report, which are included in appendix IV. Although DOD agrees with certain aspects of each of the alternatives presented by GAO in the report, none is supported by DOD.

DOD did not take issue with the smaller SSN forces that would result from accepting any of the alternatives presented in the report, and DOD agreed that procuring a smaller submarine force would cost less. However, DOD disagreed with the magnitude of cost savings or cost avoidance cited by GAO in each of the alternatives because DOD believes that the savings would be reduced by shutdown and reconstitution costs or increased unit costs by building fewer submarines. However, neither GAO nor DOD knows the

magnitude of the reconstitution costs, and DOD officials estimate the increased unit costs to be less than \$1 billion.

OSD and the Navy believe that deferral is not a preferable strategy because of (1) adverse impacts to the submarine industrial base, (2) higher annual production rates requiring high percentages of shipbuilding budgets, and (3) a resulting lesser quality SSN force. While OSD and the Navy do not agree on how many submarine industrial base vendors are critical, they both believe that all submarine-unique component vendors will lose their capabilities under the deferral strategy presented. Higher out-year production rates and costs are an outcome of a deferral strategy in which the benefits are more near term. However, even the Navy's shipbuilding plan includes a series of high production rates in the out-years. Qualitatively, the SSN force structure provided under the deferral strategy is close to meeting the Joint Chiefs' requirements.

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Abbreviations

DOD	Department of Defense
OSD	Office of the Secretary of Defense
SSBN	Nuclear-Powered Ballistic Missile Submarine
SSN	Nuclear-Powered Attack Submarine

Introduction

For more than four decades, U.S. national security and military strategies focused on fighting a global war with the former Soviet Union. During this period, an increasingly quiet and more capable Soviet submarine force drove the U.S. Navy's nuclear-powered attack submarine (SSN) force level requirement and the need for newer, quieter, and more capable SSNs. However, with the collapse of the Warsaw Pact and the December 1991 breakup of the Soviet Union, the Navy began to refocus its maritime strategy. The new strategy places greater emphasis on regional contingencies, which are considered the most likely scenarios to involve U.S. naval forces, and requires a smaller fleet. The Navy, which had already begun to reduce the size of the fleet in the late 1980s, is planning further reductions to respond to direction in the Department of Defense's (DOD) bottom-up review¹ and constrained U.S. defense budgets.

Navy Has Been Reducing SSN Force in Response to Changing Threat

In 1988, the Navy's requirement for SSNs dictated by the Navy's maritime strategy was 100 submarines. Under the 1991 base force concept, the Navy reduced the fiscal year 1995 SSN force level requirement to 80. Prior to 1993, the Navy took several measures to reduce the SSN force structure, including (1) accelerating the retirement of the SSN-637 class so that the entire class (except for two special purpose ships) would be retired by the end of the century, (2) removing five improved Los Angeles class (SSN-688I) submarines from its shipbuilding plan, and (3) truncating the Seawolf class shipbuilding program after construction of the second submarine (SSN-22). In 1992, the Deputy Secretary of Defense directed the Joint Chiefs of Staff to conduct a comprehensive examination of the submarine forces needed to meet the future threats to American interests. In April 1993, the Joint Chiefs concluded that 51 to 67 SSNs were needed to satisfy the National Military Strategy's requirements. Additionally, the Joint Chiefs required that a portion of the submarine force in 2012 have Seawolf class stealth and more capability than either the SSN-688 or SSN-688I class submarines to meet the emerging threat posed by new generation nuclear and diesel-electric submarines.

The Navy's current SSN force consists of 87 SSNs, including 54 Los Angeles class submarines (SSN-688). Two classes of SSNs are still being built—seven SSN-688Is and two Seawolf class (SSN-21). (See app. II for a description of the SSN classes and a comparison of their characteristics.)

¹Report on the Bottom-Up Review, Department of Defense (Washington, D.C., Oct. 1993).

Bottom-Up Review Directs Further SSN Force Reductions

Following the April 1993 Joint Chiefs report, the Secretary of Defense in his October 1993 bottom-up review recognized that

“the threat that drove our defense decision-making for four and a half decades—that determined our strategy and tactics, our doctrine, the size and shape of our forces, the design of our weapons and the size of our defense budgets—is gone.”

Specifically, the review determined that

- a force of 45 to 55 SSNs is needed to meet the requirements of the defense strategy, including both regional conflicts and peacetime presence operations;
- production of the third Seawolf class submarine (SSN-23) beginning in fiscal year 1995 or 1996² at Electric Boat³ would bridge the projected gap in submarine construction; and
- the Navy should develop and build a new attack submarine as a more cost-effective follow-on to the Seawolf class, with construction beginning in fiscal year 1998 or 1999 at Electric Boat.

The last two decisions were made to maintain the two shipyards that currently build all of the Navy’s nuclear-powered ships: Electric Boat and Tenneco Corporation’s Newport News Shipbuilding and Dry Dock Company (Newport News Shipbuilding), Newport News, Virginia. Newport News Shipbuilding also builds nuclear-powered aircraft carriers. These decisions were accepted in the Secretary of Defense’s Defense Planning Guidance for fiscal years 1995 through 1999.

The number of SSNs in the active fleet will primarily be dependent upon the (1) number of submarines being retired each year, (2) building rate, and (3) security environment. As a result, DOD expects the number to vary from year to year but be within the established range of 45 to 55 SSNs.

Navy Actions to Reduce SSN Force to 55

To reduce its SSN force to the maximum of 55 submarines by 1999, the Navy plans to retire 31 pre-SSN-688 class submarines and 10 of its older SSN-688s, while taking delivery of the 7 SSN-688Is and 2 Seawolf class submarines currently under construction. Retirement of the 10 SSN-688s will take place at about the midpoint of their 30-year design life, or the time a refueling overhaul would be required; therefore, each of these submarines will have as much as 14 years of their design service life

²DOD plans to request SSN-23 funds in fiscal year 1996.

³General Dynamics Corporation’s Electric Boat Division (Electric Boat), Groton, Connecticut.

remaining. The Navy believes that retiring the SSN-688s prior to their mid-life refueling is the lowest cost means of reducing the SSN force. The Navy says it will save the cost of the refueling overhaul of the 10 SSN-688s, approximately \$294 million each. After fiscal year 1999, the Navy plans to retire an additional three SSN-688s at their mid-life. These actions do not have an adverse impact on the SSN force structure in the long term because the submarines being retired early are some of the oldest of the SSN-688 class.

Objectives, Scope, and Methodology

In response to requests from the Chairmen, Subcommittee on Regional Defense and Contingency Forces, Senate Committee on Armed Services, and the Legislation and National Security Subcommittee, House Committee on Government Operations, we reviewed (1) the Navy's strategy for maintaining the SSN force structure as directed in the DOD's bottom-up review and (2) alternatives available to the Navy for maintaining its SSN force structure at less cost.

To accomplish our objectives, we obtained and analyzed information on the Navy's current SSN force levels, construction programs, and estimated future SSN force levels and budgets. We did not independently verify or validate DOD's force level requirements determined by the bottom-up review.

To determine the effects of different alternatives on the SSN force structure and on the nuclear-powered shipbuilding industrial base and the feasibility of extending the operating cycle and the operational life of SSN-688s, we met with key Navy program and technical officials. We began by analyzing the Navy's submarine shipbuilding plans of September 1993 (presented in table 3.1) and then analyzed the effects of different assumptions concerning shipbuilding profiles. In developing force structure models for comparing alternative acquisition strategies, we first modeled the existing force structure using the Navy's assumptions for (1) the starting force level (54 SSN-688s and SSN-21s in fiscal year 1999), (2) the retirement of 13 SSN-688s at their mid-life and the remaining SSN-688s at 30 years, (3) the submarine construction period for new submarines (6 years for a lead ship and 5 years for subsequent ships), and (4) the cost estimate for the SSN-23.

For new attack submarine costs, we used estimates from the September 1993 cost and operational effectiveness analysis of the baseline new attack submarine—\$2.8 billion (in constant fiscal year 1994 dollars with no

production savings)⁴ and \$1.5 billion for 29 follow-on submarines.⁵ On August 1, 1994, DOD approved Phase I design efforts for the new attack submarine program but has not released a specific acquisition plan with cost estimates. We did not verify or validate the estimates of reconstitution costs presented in chapter 4.

To aid comparison of alternatives, we also performed a present value analysis of each force structure alternative's funding profile to account for the time value of money, since each investment alternative has a different annual funding profile. This analysis showed no relative difference from the constant dollar analysis of funding used throughout the report. Appendix III contains a more detailed discussion of our present value analysis.

We observed a regional crisis demonstration and toured the USS Key West (SSN-722), the USS Finback (SSN-670), and the submarine tender USS L.Y. Spear (AS-36), which are stationed at Norfolk, Virginia. We also toured four of the Navy's six nuclear-capable public repair and maintenance shipyards. (See app. I for a listing of the organizations visited during our review.)

Our review was performed between October 1992 and June 1994 in accordance with generally accepted government auditing standards.

⁴The estimate would be \$3.1 billion in fiscal year 1998 dollars, which we used in our calculations.

⁵A fiscal year 1998 dollar estimate provided by new attack submarine program officials.

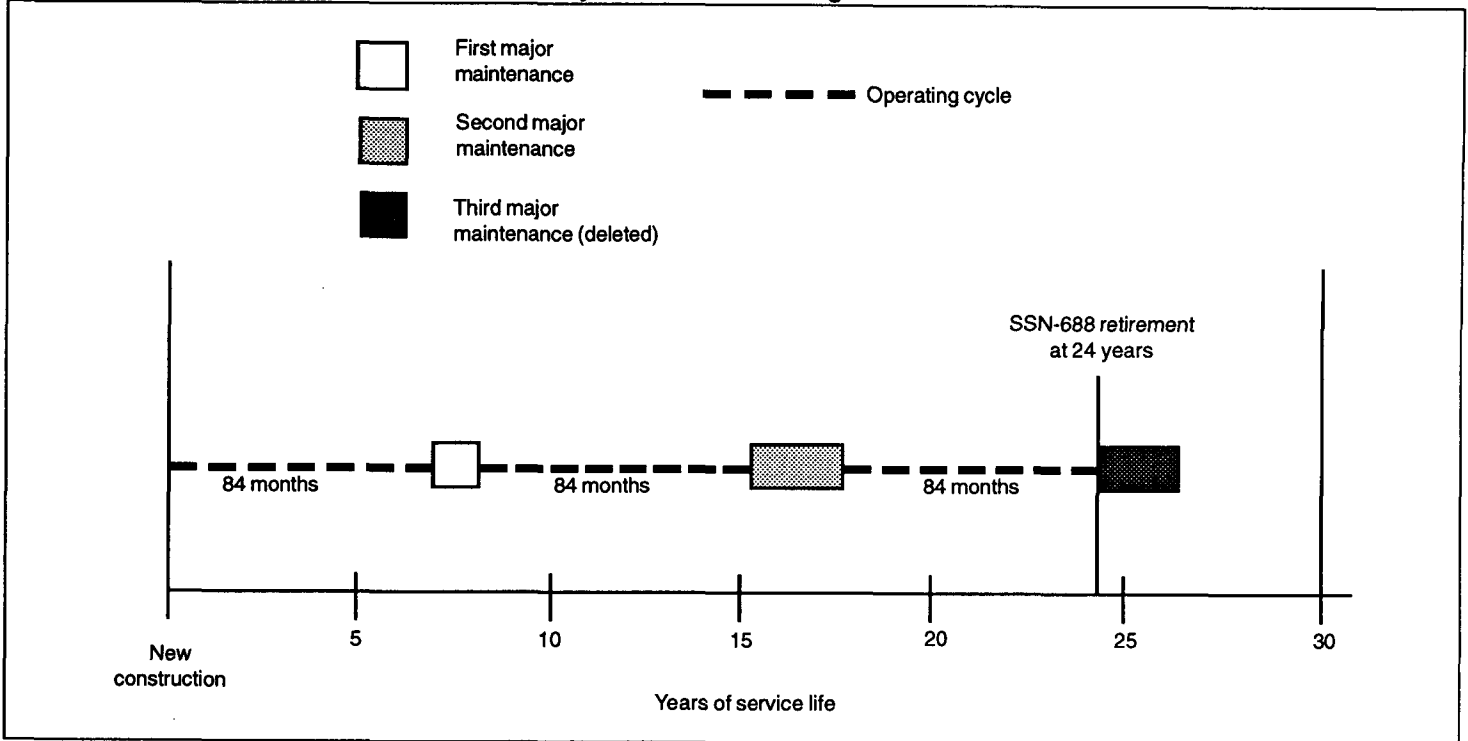
Navy Is Increasing SSN Operating Cycles to Achieve an Affordable Force Structure

The Navy's SSN-688 class submarines are designed to operate for 30 years. However, until recently, Navy submarine operating and maintenance plans would have resulted in the early retirement of most of the fleet. The Navy recognized that building submarines to replace the retired fleet would require more funds than it could afford. It therefore initiated a study to determine the feasibility of increasing the SSN-688's operating cycles. An increase in operating cycle would enable the fleet to operate for 30 years and thereby support a more affordable acquisition strategy to meet the force level requirement set by the bottom-up review. Although the study is not expected to be completed until November 1994, the Navy has recently determined that an increase in the SSN-688's operating cycle sufficient to operate for 30 years is technically feasible.

SSN-688 Maintenance Plans Required Changes

Navy regulations require that SSNs undergo major maintenance, which is fundamental to safe submarine operation, at fixed intervals. The interval between major maintenance is called an operating cycle. When SSN-688 class submarines entered the fleet in 1976, the operating cycle was 70 months with three major maintenance periods. In 1981, the operating cycle was extended to 84 months with three major maintenance periods. In 1987, the Navy eliminated the third major maintenance period and planned to retire the SSN-688s after about 24 years of service. Figure 2.1 shows the SSN-688s' operating and maintenance cycles after elimination of the third maintenance period.

Figure 2.1: SSN-688 Operating and Maintenance Cycles After 1987 Changes



Source: Our analysis of Navy data.

Because the SSN-688s would operate for only about 4 years after the third overhaul, which takes about 2 years, the Navy believed that such a short operating cycle was not worth the expense of a third overhaul.

Retiring the SSN-688 fleet at 24 years was unaffordable. Our analysis shows that the Navy would have to build 44 SSNs at an estimated procurement cost of \$68 billion to maintain a minimum force of 45 submarines through 2020. We estimate that the Navy would have to commit about 45 percent of its shipbuilding and conversion budget to support this level of SSN procurement, more than double the historical 20 percent spent for SSN construction.

Another factor influencing the Navy's need to alter its operating cycles was an unaffordable SSN maintenance burden. In February 1992 guidance for developing budgets for fiscal years 1994 and beyond, Navy officials

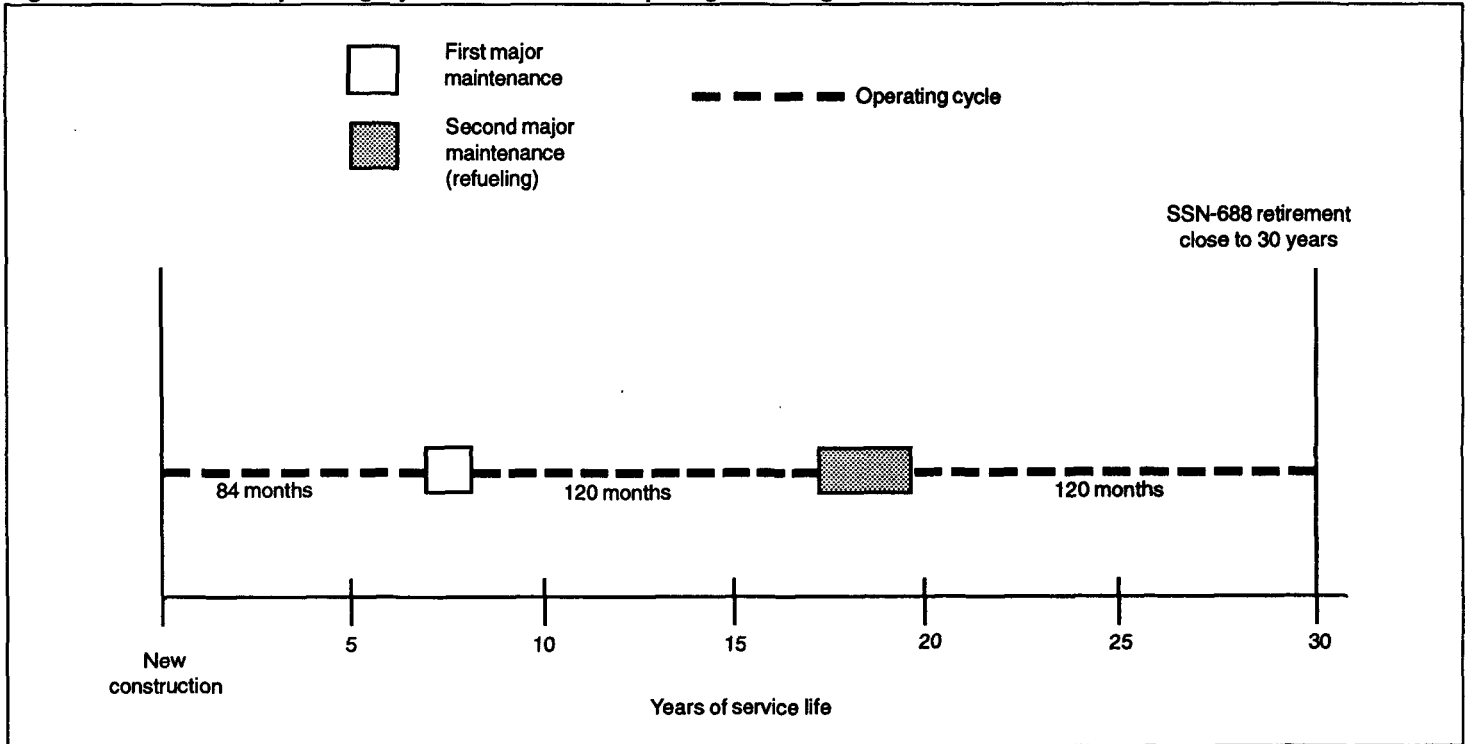
directed that no more than three submarine refuelings could be funded per year. Of the 62 SSN-688 class submarines built or under construction, the older 31 were all scheduled to receive refueling overhauls at the time of their second major maintenance period. The newer 31 SSN-688s in the class are not expected to require a refueling overhaul. Because SSN-688 class submarines were built in large numbers from year to year, the number of submarine refueling overhauls could reach as high as six in a single year. At about \$294 million per refueling, the costs could rise as high as \$1.8 billion per year.

Navy Is Studying Extension of Operating Cycle

In July 1992, the Navy began to evaluate the feasibility of extending the SSN-688 class operating cycle beyond 90 months so that it could spread refueling overhauls over a longer period of time. Much of the data for the operating cycle extension study will come from engineering evaluations of system and component condition from the first three SSN-688s in refueling overhaul and SSN-688s undergoing other maintenance. To date, the refueling overhaul of two SSN-688s is near completion, and the refueling of the third has just begun. The condition of 111 of 119 major systems on SSN-688 class submarines has been reviewed. According to Navy officials, based on preliminary analysis of the data received from the two refueling overhauls and other inspections, a 120-month operating cycle is technically feasible. The Navy expects that the extension study will be complete in November 1994. Figures 2.2 and 2.3 show that a 120-month operating cycle allows SSN-688 class submarines to operate for 30 years with only two major maintenance periods. Figure 2.2 applies to the 18 remaining SSN-688s requiring refuelings.

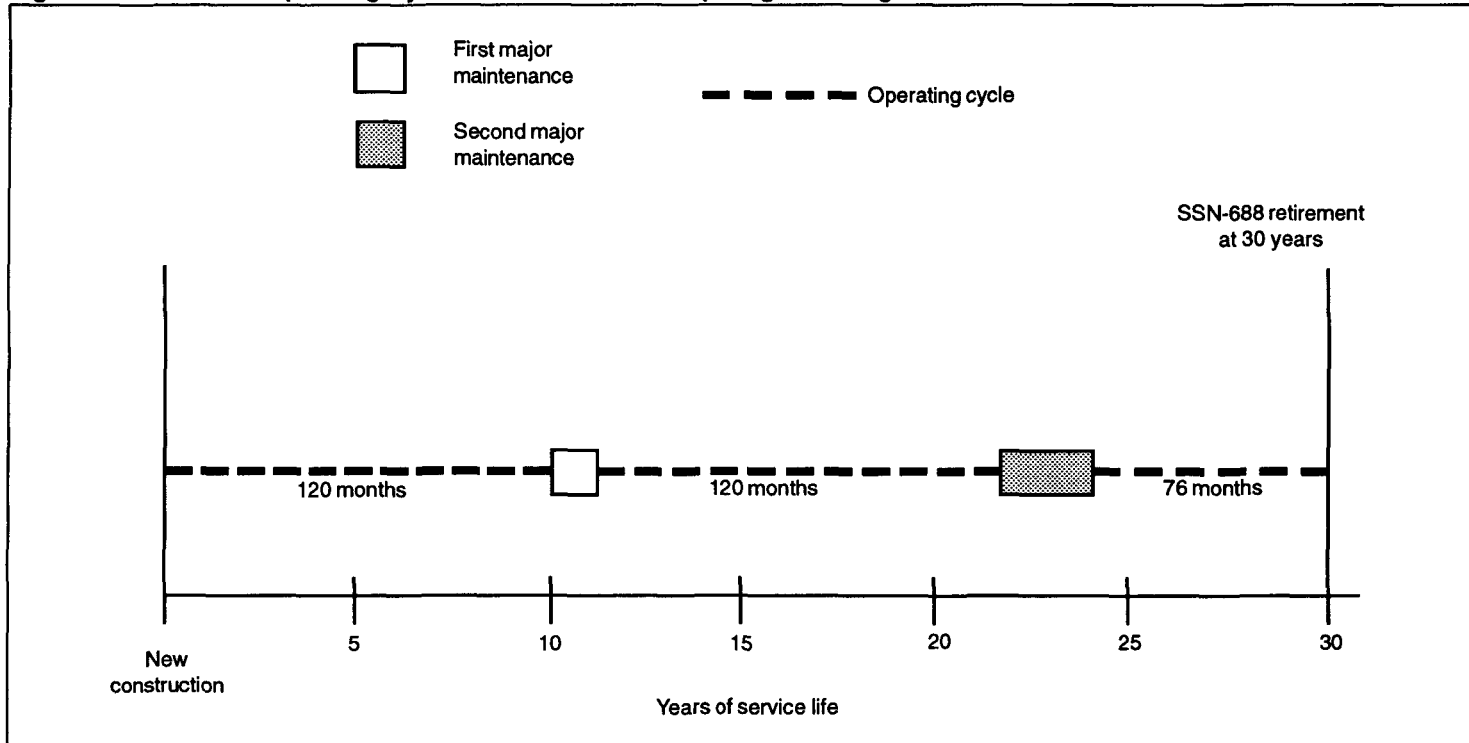
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Figure 2.2: 120-Month Operating Cycle for SSN-688s Requiring Refueling



Source: Our analysis of Navy data.

Figure 2.3: 120-Month Operating Cycle for SSN-688s Not Requiring Refueling



Source: Our analysis of Navy data.

Although the SSN-688 operating cycle study is not yet complete, the Navy has begun using a 120-month operating cycle for fleet planning and budget purposes. For example, according to Navy officials, the fiscal year 1995-99 program review assumed a 120-month operating cycle for the SSN-688s to allow the reduction of planned refueling overhauls to no more than three per year. In November 1993, the Navy used a 120-month operating cycle as the basis for the scheduling of refueling overhauls and maintenance at its shipyards through fiscal year 2003.

While the Navy has begun to implement a 120-month operating cycle for SSN-688 class submarines, Navy officials stated that significant problems with some SSN-688 components may prevent them from extending the operating cycle to 120 months without three 2- or 3-month maintenance periods to repair or replace the components. Examples of such

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components are hull castings and seawater valves, which require a drydocking and welding for repair.

Alternatives to the Navy's Shipbuilding Plan Are Less Costly and Meet DOD's Needs

Although the Navy can maintain a force level of 45 to 55 SSNs through 2020 with its current shipbuilding plan, our analysis shows that the Navy can meet its requirement by building fewer submarines. This alternative would allow the Navy to sustain SSN production and buy six fewer submarines, saving \$9 billion in procurement costs. The Navy could also consider extending the service life of 9 refueled SSN-688s and buy 14 fewer submarines than currently planned, saving an additional \$8 billion in procurement costs.

Navy SSN Shipbuilding Plan Will Support DOD's Requirement

The shipbuilding plan¹ shows that the Navy expects to begin building 31 SSNs between 1996 and 2014. In response to direction in the bottom-up review, the Navy plans to begin building the SSN-23 at Electric Boat in 1996. The Navy estimates the SSN-23 will require \$1.5 billion² more in fiscal year 1996 than the \$900 million already appropriated. A new class of attack submarines is planned to be initially built at Electric Boat beginning in 1998; the Navy plans to begin construction of 30 by 2014. The design and construction cost of the first new attack submarine is estimated at \$3.1 billion. Follow-on SSNs are expected to cost about \$1.5 billion each. Table 3.1 shows the Navy's SSN shipbuilding plan along with estimated construction costs.

¹This shipbuilding plan was the Navy's notional plan dated September 30, 1993. The plan matched the shipbuilding profile underlying the Navy's Program Review 95, which was approved by the Secretary of the Navy in September 1993.

²The estimate would be \$1.6 billion in fiscal year 1998 dollars, which we used in our calculations.

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Alternatives to the Navy's Shipbuilding Plan
Are Less Costly and Meet DOD's Needs

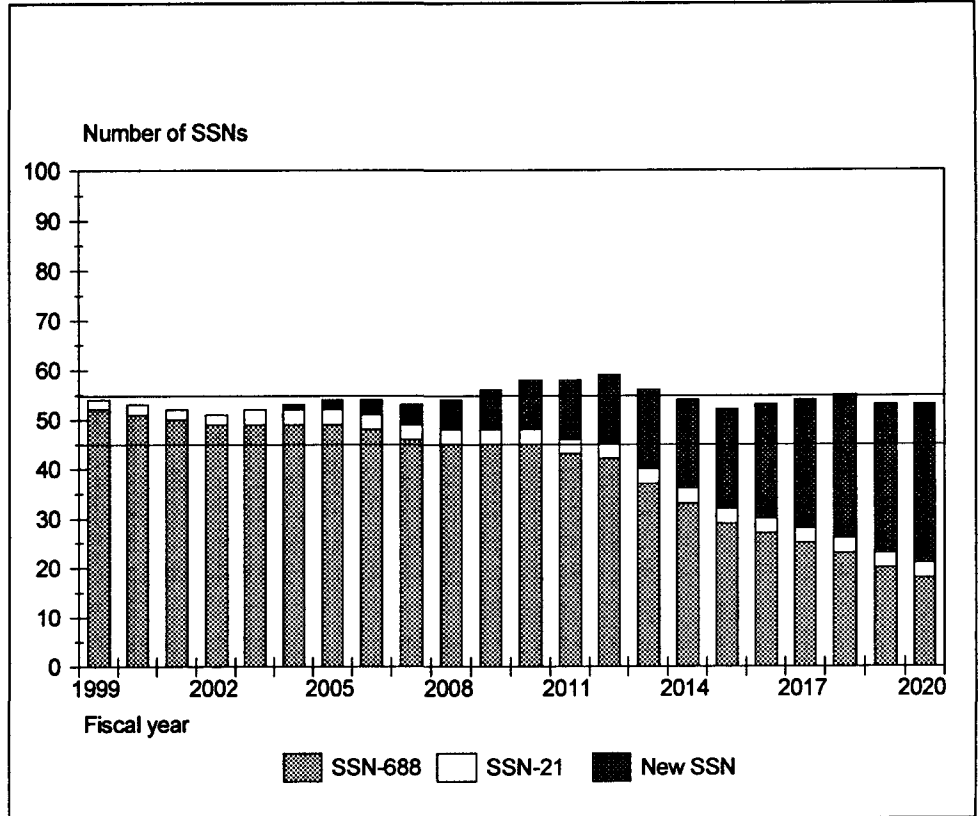
Table 3.1: Navy's SSN Shipbuilding Plan and Estimated Costs

Fiscal year 1998 dollars in billions		
Fiscal year	Quantity	Cost
1996	1	\$1.6
1997	0	0
1998	1	3.1
1999	0	0
2000	1	1.5
2001	1	1.5
2002	1	1.5
2003	2	3.0
2004	2	3.0
2005	2	3.0
2006	2	3.0
2007	2	3.0
2008	2	3.0
2009	2	3.0
2010	2	3.0
2011	3	4.5
2012	3	4.5
2013	3	4.5
2014	1	1.5
Total	31	\$48.2

Source: Our analysis of Navy data.

As shown in figure 3.1, the Navy's shipbuilding plan will support an SSN force level close to the required maximum of 55 SSNs through 2020. The Navy plans to begin construction of 3 SSNs every 2 years beginning in 2015 in order to maintain a 45-SSN force over the long term.

Figure 3.1: Effects of the Navy's SSN Shipbuilding Plan on SSN Force Levels (1999-2020)



Source: Our analysis of Navy data.

Navy Can Maintain Minimum Force Structure by Buying Fewer SSNs

The Navy's shipbuilding plan maintains an SSN force level near the maximum 55 SSNs required in DOD's bottom-up review through 2020. Our analysis shows that the Navy would need to fund only 25 SSNs through 2014 and save about \$9 billion in procurement costs. Using this alternative, the Navy would maintain an SSN force level close to the maximum 55 SSNs required in DOD's bottom-up review through 2013 before declining to 45 SSNs in 2020, continue low-rate SSN construction, and never require funds for more than 2 SSNs per year. Beyond 2014, this alternative would require managed procurements of no more than three SSNs per year. Table 3.2 shows this alternative plan and the estimated costs.

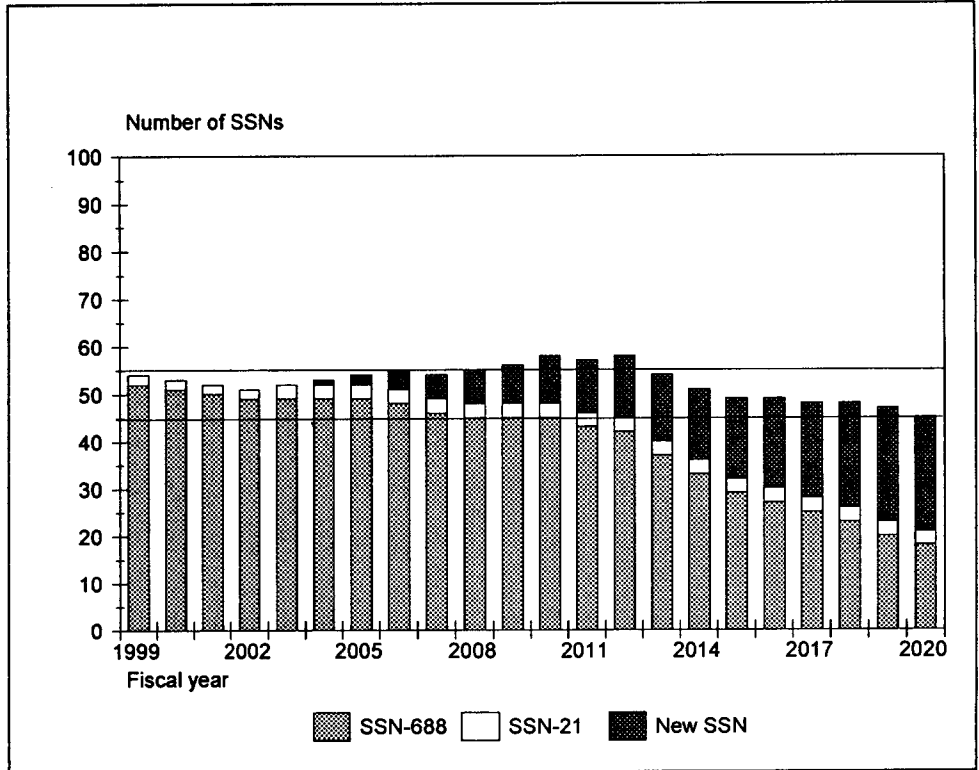
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Table 3.2: Alternative SSN Shipbuilding Plan and Estimated Costs

Fiscal year 1998 dollars in billions		
Fiscal year	Quantity	Cost
1996	1	\$1.6
1997	0	0
1998	1	3.1
1999	0	0
2000	1	1.5
2001	2	3.0
2002	1	1.5
2003	2	3.0
2004	1	1.5
2005	2	3.0
2006	1	1.5
2007	2	3.0
2008	1	1.5
2009	1	1.5
2010	2	3.0
2011	2	3.0
2012	1	1.5
2013	2	3.0
2014	2	3.0
Total	25	\$39.2

Figure 3.2 shows SSN force level projections based on this alternative SSN shipbuilding plan.

Figure 3.2: SSN Force Level Projections Through 2020 if the Navy Buys 25 SSNs Through 2014 (1999-2020)



Refueling Older SSN-688s Offers Opportunity to Reduce Procurements

The Navy could extend the SSN-688's service life beyond 30 years. The first half of the SSN-688 fleet is scheduled to be refueled at about the midpoint of the submarine's design life. The new nuclear cores to be installed are of the same design as those installed in the second half of the SSN-688 class. With these new nuclear cores, the early SSN-688 class submarines will have sufficient fuel to operate for an additional 120-month operating cycle at the end of their 30-year design life. Furthermore, officials from both SSN shipbuilders stated that SSN-688 class submarines could operate for much longer than 30 years; one of the shipbuilders stated that 10 to 20 years of additional service would not be unreasonable.

Past Navy actions indicate that extending a submarine's service life may be feasible. After a 5-year study was completed on the SSN-637 class submarine—the predecessor of the SSN-688 class—the design life was extended from 20 years to 30 years, with a possible extension to 33 years on a case-by-case basis.³ According to Navy officials, a similar study could be the basis for extending the SSN-688's service life. Technical information

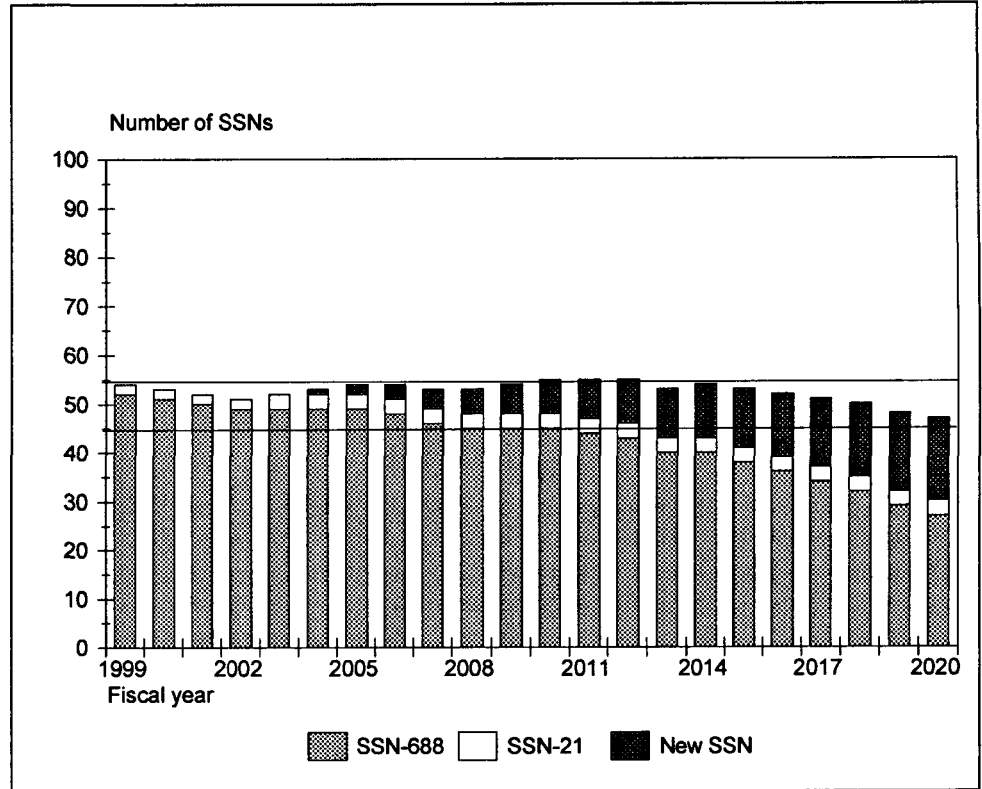
³Budget decisions in 1989 led the Navy to accelerate the retirement of the SSN-637 class so that most will be retired by 27 years of service.

from the SSN-688s' midpoint overhauls could be used in an assessment of the feasibility of a service life extension. In addition, both SSN shipbuilders agree that conducting various destructive and nondestructive metallurgical tests on retiring submarines would be useful for determining the validity of the submarines' operational life prediction models and their actual conditions. Navy officials said, however, that (1) it would be premature to begin a study before 1998 at the earliest, when the SSN-688s near the end of their design life, and (2) the Navy plans no such study for the SSN-688 class. The Navy has begun to study an extension from 30 to 40 years of the service life of its Nuclear-Powered Ballistic Missile Submarine (SSBN)-726 Ohio class (Trident) submarine, which entered the fleet 5 years later than the SSN-688.

If the SSN-688's service life could be extended and the Navy chose to operate the submarines longer than 30 years, substantial procurement savings would be possible through 2014. The 18 SSN-688 class submarines that will be refueled at their mid-life could make good candidates for a service life extension because they could operate for nearly 30 years after the refueling. We analyzed the effect on the force structure of extending the service life of the 18 refueled SSN-688s, assuming that the refueled SSN-688s would operate for one additional operating cycle. After these submarines serve for 30 years, they could undergo a 2-year overhaul and serve for one more 10-year operating cycle, for a total service life of 42 years. We found that extending the service life of the newer 9 refueled SSN-688s was a more cost-effective alternative than extending the service life of all 18 refueled SSN-688s.

We estimated that the cost for the additional overhaul of SSN-688 class submarines would be about \$406 million. If the service life of the 9 SSN-688s was extended to 42 years, SSN procurements from 1996 through 2014 could be reduced from 31 to 17. At \$1.5 billion per submarine, the Navy could save about \$21 billion in procurement costs. However, the cost of extending the service life of the nine SSN-688 class submarines would be about \$3.7 billion, reducing the overall savings to about \$17.3 billion. Also, after 2020, submarine procurements would have to be increased to 2 or 3 per year to maintain the minimum 45-SSN force level. Figure 3.3 shows the effects on the force structure of operating nine of the refueled SSN-688s for an additional 120-month operating cycle.

Figure 3.3: Effects on SSN Force Levels of Extending the Service Life of Nine Refueled SSN-688s (1999-2020)



DOD Comments and Our Evaluation

DOD agreed that buying fewer submarines would cost less, but indicated that lower procurement rates would increase unit costs. The alternative plan presented satisfies the bottom-up review's minimum 45-SSN force level, providing a less costly alternative during times of reduced defense budgets. DOD officials said that procurement savings could be reduced by as much as \$1 billion due to the higher unit costs caused by building 25 SSNs versus the 31 planned by the Navy. If service life extension proves feasible, it also provides an opportunity to buy fewer submarines later in the program, although unit costs again may be higher. The two alternatives presented both satisfy DOD's industrial base concerns by continuing low-rate production and defer higher SSN production rates (three per year) until after 2014. The Navy's plan will require this higher production rate beginning in 2011.

DOD commented that we did not adequately address the current and future threat. However, like the Navy's shipbuilding plan, the alternative plans in this chapter meet the Joint Chiefs' requirement for more capable submarines by 2012.

Alternative Acquisition Strategy Available to Navy

The confluence of reductions in the SSN force structure and the extension of the SSN-688's service life affords the Navy an opportunity to choose an alternative SSN acquisition strategy. The Navy could defer SSN construction until early in the next century and build the submarines in larger numbers when production resumes. Using this strategy, the Navy could free up billions of dollars in near-term shipbuilding funds required for planned SSN construction. However, some uncertain reconstitution costs would reduce the \$9 billion savings that the Navy could achieve by building 25 submarines versus 31 as the Navy plans (as discussed in ch. 3). Depending on the assumptions used regarding closing, maintaining, and restarting shipbuilder facilities; hiring and retraining personnel; and shipbuilder workloads, reconstitution costs could range from less than \$1 billion to as much as \$6 billion.

New Attack Submarines Are Not Needed Until the Next Decade

In February 1994, the Secretary of Defense testified that DOD has no force structure need to build new submarines until after the turn of the century. New SSN construction can be deferred because the Navy can maintain the minimum force structure with its current fleet until 2012; that is, the force level would not fall below the minimum required 45-SSN level until 2012. Deferring new construction can free up billions of dollars in planned construction costs in the near term. As an illustration of the potential for deferring SSN construction, we analyzed an alternative in which construction is deferred until 2003. We assumed that construction of the submarines would take 5 years, which is how long the Navy estimates new attack submarine construction will take. However, we lengthened construction time for the first two SSNs to 7 and 6 years, respectively, to account for the additional time needed to build the first submarine of a class and any extra effort required to restart production after a hiatus. We believe that using 7 and 6 years is reasonable because a recently issued RAND report¹ noted that 6 years was required to deliver the first submarine after restarting submarine production at Newport News Shipbuilding, assuming construction of the funded aircraft carrier, CVN-76. Although SSN unit costs would vary based on the number of SSNs bought, we used the same procurement costs as the Navy's current estimates for the new attack submarine program because OSD and the Navy did not provide alternative unit costs. Table 4.1 shows the production rate and cost of the deferral scenario.

¹The U.S. Submarine Production Base: An Analysis of Cost, Schedule, and Risk for Selected Force Structures, RAND (Santa Monica, CA., 1994).

Table 4.1: Deferred SSN Shipbuilding Plan and Estimated Costs

Fiscal year 1998 dollars in billions		
Fiscal year	Quantity	Cost
1996-2002	0	0
2003	1	\$3.1
2004	0	0
2005	1	1.5
2006	1	1.5
2007	2	3.0
2008	2	3.0
2009	3	4.5
2010	3	4.5
2011	3	4.5
2012	3	4.5
2013	3	4.5
2014	3	4.5
Total	25	\$39.1

Compared to the Navy's September 1993 SSN shipbuilding plan, this alternative would save about \$9 billion in procurement costs through 2014. Also, this alternative defers as much as \$9 billion in planned SSN construction funding from 1996 to 2002. However, savings would be offset by reconstitution costs.

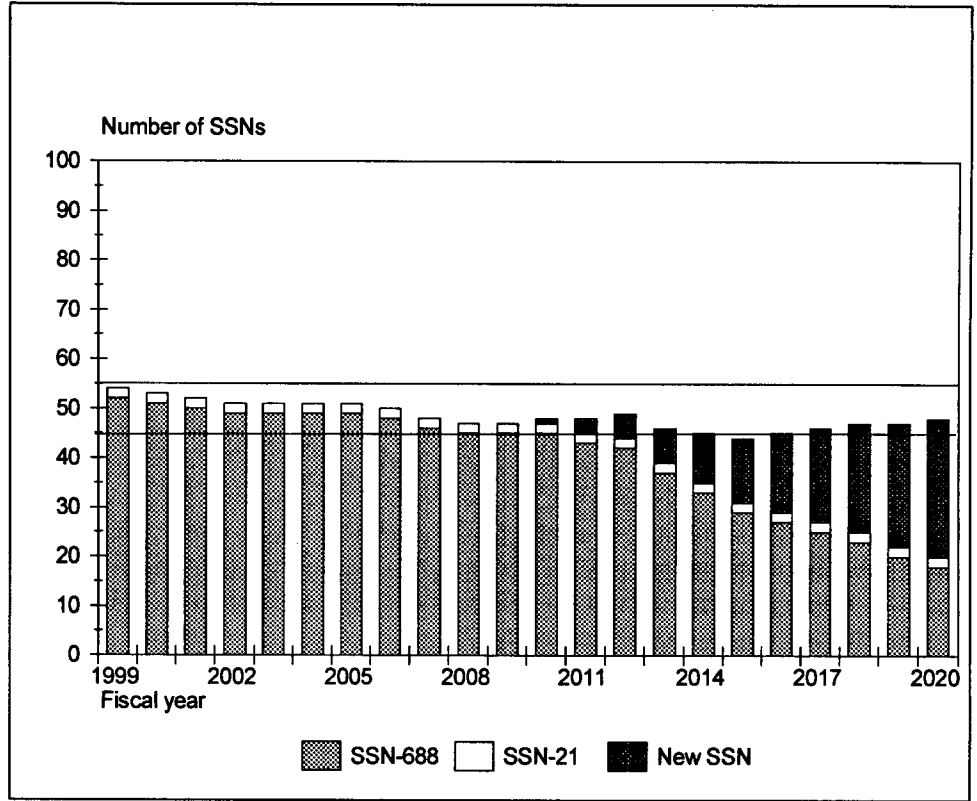
The 1994 RAND report, which evaluated the U.S. submarine production base, shows that reconstitution costs are highly dependent on assumptions regarding closing, maintaining, and restarting shipbuilder facilities; hiring and retraining personnel; and shipbuilder workloads. According to the report, shipbuilder facilities and personnel reconstitution costs are estimated at \$800 million to \$2.7 billion.² The \$800 million estimate is based on the Navy beginning to build CVN-76 at Newport News Shipbuilding in 1995 and then restarting submarine production in 2003. The \$2.7 billion represents RAND's estimate to restart submarine production at Electric Boat in 2003. Further, Navy officials cited a Navy industrial base study estimate of \$4 billion to \$6 billion for reconstitution costs, including vendor costs.

Even with a deferral of SSN construction and a reduction in the number of submarines built, the Navy can still support its required SSN force

²The RAND report used fiscal year 1992 dollars.

structure. Figure 4.1 shows the force structure implications of deferring SSN construction to 2003 and building at the rate shown.

Figure 4.1: SSN Force Structure Under a Deferred Acquisition Scenario (1999-2020)



Deferring SSN construction has budgetary risks. If construction is deferred until 2003, the average annual production rate would increase from about 1.5 SSNs to about 3 SSNs. These higher production rates would force the Navy to sustain higher annual shipbuilding budgets than it currently plans once SSN construction resumed.

SSN Construction to Continue for Industrial Base Reasons

DOD decided to build the SSN-23 in 1996 and commence with new SSN construction in 1998 at Electric Boat to support the nuclear shipbuilding industrial base. The United States has two nuclear shipbuilders: Electric Boat, which builds submarines and Newport News Shipbuilding, which builds aircraft carriers and submarines. In the bottom-up review, DOD

considered consolidating nuclear shipbuilding at Newport News Shipbuilding. This would have eliminated the need to build the SSN-23 before the commencement of new SSN construction. Newport News Shipbuilding could shut down construction of nuclear submarines and still preserve the capability to resume production in the future because much of the shipbuilder's skilled workforce would continue building nuclear-powered aircraft carriers. An official from the shipbuilder reported that aircraft carrier production would account for 69 to 92 percent of the specialized job areas and skills needed for submarine construction. These percentages would increase from 95 percent to 100 percent if the shipbuilder also overhauled and refueled SSNs.¹ According to the bottom-up review, consolidating construction at Newport News would save the Navy about \$1.2 billion after accounting for about \$625 million of shutdown/reconstitution costs during the future years defense program period.

DOD determined that the Navy needs to retain both nuclear shipbuilders for industrial base and national security reasons. To support DOD's decision, Electric Boat will continue to build nuclear-powered submarines, while Newport News Shipbuilding will build nuclear-powered aircraft carriers. This decision is based on DOD's belief that given the uncertain world situation, it is too risky to have only one provider for both nuclear-powered aircraft carriers and submarines. Unless DOD changes its policy to retain the two shipbuilders, the alternative of deferring SSN construction may not be feasible.

Our analysis shows that either shipbuilder can meet the Navy's SSN shipbuilding requirements. Both nuclear-capable shipbuilders have the capacity to build at least three Seawolf-size submarines per year and can build a larger number of smaller submarines. The new attack submarine class is planned to be at least 20 percent smaller than the Seawolf class. Under either the Navy's shipbuilding plan or a deferred construction acquisition strategy, either shipbuilder could meet the Navy's SSN construction needs.

Effect of Construction Deferral on Critical Industrial Vendors Is Unclear

The Navy has stated that if no submarine is built before the start of the new class of attack submarines in 1998, several critical submarine vendors will be lost. However, OSD and the Navy lack uniform criteria for

¹Currently, naval shipyards at Puget Sound, Washington; Mare Island, California; Pearl Harbor, Hawaii; Portsmouth, New Hampshire; Norfolk, Virginia; and Charleston, South Carolina, overhaul and refuel SSNs.

determining what constitutes a critical vendor, and the Navy may not be considering the availability of alternate suppliers.

According to OSD, a vendor is critical if no alternate sources or substitutes are available or can reasonably be developed and still meet long-term defense needs. The Navy, however, considers some vendors critical even when alternate sources are available. For example, although OSD has identified 8 critical suppliers of nuclear and nonnuclear submarine components, the Naval Sea Systems Command has identified 49 critical vendors of nonnuclear components alone, and the Seawolf program office has identified 63 critical nonnuclear vendors.

Evidence shows that the Navy has not fully considered alternative sources to the vendors it considers critical. For example, of the products produced by 49 vendors considered critical by the Naval Sea Systems Command, if no more than two Seawolf class submarines are built, a majority are available from multiple vendors or from single-source vendors for which alternate suppliers exist. Furthermore, the Navy could create new or expand existing relationships with the SSN shipbuilders and government-owned laboratories to compensate for the loss of commercial industrial skills. For example, in the past the SSN shipbuilders have been forced to produce submarine components that vendors stopped producing. When Newport News Shipbuilding lost its sole-source manufacturer of torpedo tubes, it began producing torpedo tubes. Newport News Shipbuilding officials stated that they can now produce the tubes faster and at less cost than the vendor could. The Navy could also rely on government laboratories like the Department of Energy's Y-12 facility at the Oak Ridge National Laboratory and the Kansas City Plant, both of which already produce components for Navy submarine-related programs. For example, the Y-12 facility is responsible for machining and assembling the SSN-21 propulsor.

DOD Comments and Our Evaluation

DOD nonconcur with the deferral strategy presented in this chapter because it believes that deferring construction would (1) cause SSN unit costs to rise, (2) result in the loss of the submarine shipbuilding industrial base, and (3) require billions of dollars to reconstitute the industrial base. DOD believes that low-rate submarine production is the preferable option for sustaining the submarine industrial base.

OSD and Navy officials disagreed with using the same SSN construction cost estimates for a strategy that defers construction to 2003 because the cost

estimates were developed for a 30-SSN buy starting in 1998. Our estimate that the Navy could save as much as \$9 billion by building 25 SSNs, versus the 31 SSNs the Navy plans to build, is based on notional cost estimates from the best information available; OSD and the Navy did not provide alternative cost estimates. We agree that the actual costs for the new attack submarine could be affected by design and construction learning curves, variation in overhead expenses, the wide variation of material costs, and construction inefficiencies caused by fluctuations in the construction workforce. Because of these factors, cost estimates become less certain over time. However, regardless of the unit cost, the alternatives presented in this report require building fewer submarines and should require less total funding than the Navy's current plans.

DOD commented that the deferral strategy does not adequately address the threat. However, this strategy meets the Joint Chiefs' requirement for more capable submarines in 2014, only 2 years later than required.

DOD believes that a construction deferral and subsequent reconstitution of the submarine industrial base would create an enormous management challenge and increase program risk. DOD commented that funds saved by deferring SSN construction would need to be spent during the deferral period to reconstitute the industrial base. Our report clearly states that deferring SSN construction to 2003 could defer the spending of as much as \$9 billion in costs between 1996 and 2002. While we and DOD do not know the magnitude of the reconstitution costs, this alternative does offer the opportunity to defer near-term costs, which may be appealing during a period of reduced defense budgets. Further, the 1994 RAND report shows that the estimated reconstitution costs to restart submarine construction in 2003 are less than the potential \$9 billion savings, suggesting that a deferral strategy is an alternative warranting further study.

In its comments, DOD acknowledged that OSD and the Navy had not thoroughly explored the expansion of current manufacturing relationships to sustain the industrial base, but argued that such a restructuring would have a large cost (although not estimated by DOD) that would offset near-term cost avoidance. However, expanding current manufacturing relationships might reduce the adverse effects on the submarine industrial base during a deferral and might reduce the time and funding required when reconstitution begins.

Organizations GAO Visited

The following is a list of the U.S. government organizations and private companies contacted during our review.

Department of Defense

Office of the Secretary of Defense, Washington, D.C.

- Assistant Secretary of Defense for Program Analysis and Evaluation, General Purpose Forces, Naval Force Division

Office of the Chairman, Joint Chiefs of Staff, Washington, D.C.

- Force Structure, Resource, and Assessment Directorate

Defense Intelligence Agency, Washington, D.C.

Advanced Research Projects Agency, Arlington, Virginia

Department of the Navy

Office of the Assistant Secretary of the Navy (Research, Development and Acquisition), Washington, D.C.

- Program Executive Officer, Submarine Programs

Office of the Chief of Naval Operations, Washington, D.C.

- Assistant Deputy Chief of Naval Operations for Undersea Warfare, Attack Submarine Division

Commander in Chief, U.S. Atlantic Fleet, Norfolk, Virginia

- Commander, Submarine Forces Atlantic
- Commanders, Submarine Squadrons 6 and 8, Naval Submarine Forces, U.S. Atlantic Fleet, Norfolk, Virginia
- Chief of Staff, Submarine Squadron 4, Naval Submarine Forces, U.S. Atlantic Fleet, Charleston, South Carolina
- Commanding Officer, USS Albany (SSN-753), U.S. Atlantic Fleet, Norfolk, Virginia
- Director, Special Surveillance and Commander, Task Force 84 Operations, U.S. Atlantic Fleet, Norfolk, Virginia

Naval Sea Systems Command, Washington, D.C.

- Deputy Commander for Nuclear Propulsion
- Deputy Commander for Submarines
 - Submarine Safety and Quality Assurance Division
 - Program Manager, SSN-688 Ship Acquisition Program Office, Arlington, Virginia
 - Submarine Maintenance Engineering, Planning and Procurement Activity, Portsmouth, New Hampshire
- Deputy Commander for Industrial and Facility Management
 - Industrial Planning Division
 - Puget Sound Naval Shipyard, Bremerton, Washington
 - Portsmouth Naval Shipyard, Kittery, Maine
 - Mare Island Naval Shipyard, Vallejo, California
 - Charleston Naval Shipyard, Charleston, South Carolina

Office of Naval Intelligence, Suitland, Maryland

Department of Energy

Office of Technology Utilization, Washington, D.C.

Y-12 Plant, Oak Ridge, Tennessee

Kansas City Plant, Kansas City, Missouri

Other Organizations and Companies

Babcock and Wilcox, Nuclear Equipment Division, Barberton, Ohio

Electric Boat Division, General Dynamics Corporation, Groton, Connecticut

Marine Mechanical Corporation, Cleveland, Ohio

Newport News Shipbuilding and Dry Dock Company, Tenneco Corporation, Newport News, Virginia

Westinghouse Electro-Mechanical Division, Cheswick, Pennsylvania

Congressional Research Service, Washington, D.C.

U.S. SSN Characteristics

Submarine Characteristics

The Navy claims that a submarine's unique combination of stealth, endurance, and agility gives it a critical advantage over other weapons. A submarine's stealth is derived from its ability to submerge and become essentially invisible and undetectable. Nuclear propulsion allows submarines to remain submerged 24 hours a day. Nuclear propulsion also gives a submarine endurance because the ship's nuclear fuel lasts for many years of operation. The endurance of a nuclear-powered submarine is limited only by the crew's food supply and weapons expenditures. Endurance provides submarines the advantages of continuity and independence. The Navy defines submarine agility as the ability to proceed quickly where needed, often before other forces, and respond to a broad range of situations. A submarine's agility results from (1) nuclear propulsion, which allows unlimited high speed operation; (2) multiple mission capability; and (3) ship- and shore-based command, control, and communications systems.

Current U.S. SSN Programs

In fiscal year 1994, the U.S. Navy operated 87 SSNs: 54 SSN-688 Los Angeles class submarines and 33 SSNs of older classes. The Navy is currently building two classes of SSNs: the SSN-688 Los Angeles class and SSN-21 Seawolf class.

Los Angeles Class (SSN-688)

The SSN-688 class, introduced into the fleet in 1976, will be the mainstay of the Navy's SSN force well into the next century. By 1996, 62 SSN-688s will have been built to make up the entire class. While all SSN-688 submarines are capable of firing the Tomahawk cruise missile, the last 31 submarines were equipped with vertical launch tubes for these missiles. Older class submarines launch cruise missiles through their torpedo tubes. The final 23 SSNs of the SSN-688 class are improved versions of the original SSN-688 design (SSN-688Is). Among the changes to the SSN-688 class are improved sound quieting and an improved sonar. Also, replacement of the sail-mounted control planes with control planes attached to the bow allows SSN-688Is to surface through arctic ice. The last SSN-688s cost the Navy approximately \$800 million in then-year dollars. The Navy has estimated that SSN-688 procurement could be restarted and two submarines built for approximately \$2.4 billion in current dollars.

Seawolf Class (SSN-21)

Two Seawolf class submarines are now being built, with the first to be delivered in 1996 and the second to be delivered in 1998. The Seawolf is designed to be substantially quieter than the SSN-688 class and have better

sonar and combat systems. According to the Navy, the Seawolf will have three times as much capability as the SSN-688. When the program began, the Navy justified construction of the Seawolf largely on the need to counter the improved Soviet submarines that were expected to appear in the future.¹ While two Seawolf class submarines are under construction, the bottom-up review directed building a third Seawolf to sustain the submarine shipbuilding industrial base during the gap between the end of SSN-22 construction and the beginning of the new attack submarine construction program. The SSN-21 was funded in fiscal year 1989 at a cost of \$1.9 billion, while the SSN-22 was funded in fiscal year 1991 at a cost of \$1.8 billion. The Navy currently estimates the SSN-23 will cost \$1.5 billion more in fiscal year 1996 dollars than the \$900 million already appropriated.

New Attack Submarine

In early 1991, the Navy began to plan for a new attack submarine to replace the truncated Seawolf program. This program has previously been known as the Centurion. Although no final decision has been made about which new attack submarine design will be built, the Navy expects it to be as quiet as the Seawolf but smaller, generally less capable, and less costly. In August 1992, the Under Secretary of Defense for Acquisition approved concept definition studies for the new attack submarine. A cost and operational effectiveness analysis, which analyzes the comparative cost-effectiveness of new attack submarine alternatives, was completed in September 1993. As a result of the Defense Acquisition Board's review on January 12, 1994, the Navy studied a number of alternative SSN building programs and their impact on the industrial base. On August 1, 1994, the Defense Acquisition Board met to review an initial acquisition strategy for the new attack submarine (Milestone I) and approved Phase I design efforts focused on construction of a lead ship in fiscal year 1998. The cost and operational effectiveness analysis estimated that the first new attack submarine would likely cost \$3.1 billion and follow-on submarines would cost \$1.5 billion.²

¹Initially, the Navy planned to procure 29 Seawolf class submarines; after the 1991 major warship review, that number was reduced to 12. After three Seawolfs had been authorized, the Bush administration proposed that the number be further reduced to 1; however, Congress funded the second Seawolf (SSN-22).

²The analysis presented the cost estimates in constant fiscal year 1994 dollars: \$2.8 billion for the lead ship and \$1.5 billion for 29 follow-on ships.

Present Value Analysis

Investment alternatives normally involve incurring different costs at different times. For two or more alternatives to be compared on an equal economic basis, taking into account the time value of money, the costs of each alternative at its “present value” must be considered. We did an analysis to determine the present value of funding required by different SSN shipbuilding alternatives. Discounting, which reduces a stream of future funding requirements to a single amount (a present value), attaches greater weight to more current costs and less weight to future costs. By using present value techniques, we converted future dollar funding into their value in 1994. A present value analysis makes each alternative’s funding comparable despite the differing funding profiles for each alternative.

Although present value analysis is a generally accepted practice, selecting an appropriate discount rate has been the subject of much controversy. For federal government investment analysis and decision-making, arguments have been presented for discount rates ranging from the cost of borrowing by the Treasury to the rate of return that can be earned in the private sector. Since the Treasury meets most government funding requirements, we maintained that its estimated cost to borrow was a reasonable basis for the discount rate used in present value analysis. Accordingly, for our analysis, we used the average yield on outstanding marketable Treasury obligations that had remaining maturities similar to the time period involved in our analysis. We subtracted a 20-year average of the projected gross domestic product deflator from the average yield on outstanding marketable Treasury obligations and applied the resulting real discount rate to the 1994 constant dollar funding values. Table III.1 shows our present value analysis.

Table III.1: Constant Dollar and Present Value Analysis of Funding Profiles for SSN Shipbuilding Alternatives for Fiscal Years 1996-2014

Dollars in billions		
SSN shipbuilding alternative	Funding (constant 1998 dollars)	Present value of funding
Navy plan (31 SSNs) ^a	\$48.2	\$24.8
Alternative plan (25 SSNs) ^b	39.2	20.9
Deferred plan (25 SSNs) ^c	39.1	17.5

^aThe Navy plan’s funding profile is presented in table 3.1.

^bThe alternative plan’s funding profile is presented in table 3.2.

^cThe deferred plan’s funding profile is presented in table 4.1.

Under the alternative plan, the stream of funding requirements begins almost right away (1996), with the program's reduced buy of 25 SSNs spread out fairly evenly over the 1996-2014 time interval. Under the deferred plan, the stream of funding requirements does not begin until 2003; the bulk of the 25 SSNs would be bought toward the end of the 1996-2014 time interval. Also, estimated reconstitution costs, which range from \$800 million to \$6 billion, would raise the deferred plan's total funding and its present value.

Comments From the Department of Defense



ACQUISITION AND TECHNOLOGY

OFFICE OF THE UNDER SECRETARY OF DEFENSE

3000 DEFENSE PENTAGON
WASHINGTON DC 20301-3000



19 AUG 1994

Mr. Frank C. Conahan
Assistant Comptroller General
National Security and International
Affairs Division
United States General Accounting Office
Washington, D. C. 20548

Dear Mr. Conahan:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report "ATTACK SUBMARINES: Alternatives for a More Affordable SSN Force Structure," dated July 27, 1994 (GAO Code 394493), OSD Case 9746. The DoD nonconcurs with the report.

The draft GAO report presents several alternative shipbuilding profiles. Those profiles include (1) building a reduced number of nuclear-powered attack submarines (SSNs), (2) extending the service life of selected SSN-688 submarines, and (3) deferring all submarine production until FY 2003. Although the DoD agrees with certain aspects of the alternatives, none is supported by the DoD.

See p. 22.

With regard to the first GAO alternative, the final GAO force structure level is six submarines less than the Navy plan. The draft report compares a Navy force size of 51 with a GAO force level of 45. The DoD agrees that procuring a smaller submarine force will cost less. A more meaningful analysis, however, would be a comparison of costs for different acquisition profiles of an equal force size. In that comparison, the most affordable acquisition profile for attaining a given SSN force level could be ascertained. The DoD also does not agree with the cost savings presented by the GAO for the smaller force size because the GAO analysis does not take into account the change in per-ship cost associated with lowering procurement rates in a lean production environment.

See pp. 26, 31, and 32.

With regard to the second option, the DoD agrees that if it is determined that the 688 class service life can be significantly extended, then future SSN procurement requirements may be able to be reduced. However, that is a technical decision and the analysis required to support the decision will not be available until several years after an initial procurement decision on the New Attack Submarine (NSSN) is required. The DoD and GAO agree on this point. However, the DoD nonconcurs with the cost savings presented by the GAO because again, the GAO

See p. 24.

See pp. 26, 31, and 32.



Appendix IV
Comments From the Department of Defense

analysis does not take into account the increased costs associated with lower procurement rates.

The DoD also nonconcurs with regard to the GAO option of deferring all SSN production until FY 2003. The GAO concludes that billions of dollars of near term cost avoidance could be realized by deferring altogether, attack submarine construction over the next decade. That opinion however, is not supported by various DoD studies, which concluded that low rate submarine production is the preferable option for sustaining the submarine industrial base.

In formulating a plan for maintaining SSN force levels as affordably as possible, several interdependent variables must be studied and optimized. Those variables include: (1) the submarine industrial base, both production and design, (2) overall program costs based on realistic annual budgetary estimates, and (3) the number and quality of ships needed to meet the potential threat into the next decade. A discussion of each variable in relation to the GAO draft report follows.

First, the preservation of the submarine industrial base, including both the design/engineering and production bases, is pivotal in any discussion of affordably maintaining the SSN force structure. The submarine design and engineering base includes scientists at Federally funded centers, technologists at laboratories, shipbuilders, and vendors, and design and engineering talent both in industry and in the Government. Because those technologies are so highly specialized, the industrial base is heavily dependent on continuity of submarine design and construction work.

There are two basic approaches which could be used to preserve an industrial base able to build submarines. The first would be to fund a recapitalization effort through sustained low rate submarine production. That approach would enable vendors and shipbuilders to make the capitol investment necessary to down-size and make cost effective low-rate production possible. That is the approach favored by the DoD.

The second approach would involve a wholesale shutdown of the industrial base, a period of no production, and then a restart of the design and production bases. This is one of the options referred to in the GAO draft report. The complete shutdown/startup approach would involve an enormous management challenge and would result in substantially increased program risk. No industrial base reconstitution of that magnitude and complexity has successfully been accomplished. Depending on the assumptions made, the shutdown/restart approach, if it were possible, could result in some near term cost avoidance, but would inevitably be much costlier in the long run. The GAO draft report does not address the costs associated with the shutdown and startup effort. The vendor base has been removed from the GAO analysis based on "lack of agreement" (between the OSD and

See pp. 27-32.

See p. 32.

See p. 6.

the Navy) over what constitutes a critical vendor. While vendor characterization is a subject of some discussion, both the Navy and the OSD agree that all submarine-unique component vendors will lose their submarine component design and production capabilities given the six year gap in submarine awards proposed in the GAO draft report. The near term costs which would be associated with the shutdown/startup proposal form the very basis of the financial arguments for choosing the low rate production alternative. Since shutdown and startup costs and risks are not included in the GAO analysis, no meaningful comparison between the two alternatives is possible.

See p. 6.

Another difficulty with the deferral of all attack submarine production until FY 2003 would be that unreasonably high production rates that would be required, once SSN construction were resumed, in order to maintain the SSN force level. Even under the current Navy plan, a production rate of three submarines per year will be required for more than five consecutive years (between FY 2010 and FY 2020) in order to maintain a 45 SSN force level. That represents an unprecedented percentage of total Navy ship construction funding devoted to submarine construction. By deferring another four or five submarines until FY 2003, an already difficult situation would be made much worse. Although the GAO draft report mentions that higher production rates would be required under the shutdown/restart option, it fails to evaluate the impact that action would have on the production plan. Planning for such unreasonably high out-year production rates would threaten the ability to maintain a 45 SSN force level.

See pp. 31-32.

Concerning the issue of program costs, the GAO suggests that "savings" of \$9 billion are possible by deferring SSN construction. Actually, the figures cited represent "near term cost avoidance," rather than "cost savings" as stated in the draft report. Clearly, any deferral plan which builds the same number of ships will be costlier in the long run than the DoD plan. In addition, the near term cost avoidance figures cited by the GAO draft report did not account for the substantial expenses of shutdown and reconstitution or the increased cost of production which would result from reduced building profiles or production delays.

See p. 32.

The shutdown/reconstitute approach was studied by the Navy in 1992, and more recently by the Rand Corporation. The Navy study concluded that at least \$4 to \$6 billion would be required to shutdown and start up the industrial base. The RAND Corporation study determined that the cost avoidance of deferring production would be comparatively small, and advocated a minimum gap strategy. Even if near term costs of an industrial base shutdown could be shown to be somewhat less than those associated with steady low rate submarine production, the low rate production option would still be preferable because submarines would be produced while sustaining the industrial base. In contrast, the industrial base shutdown/restart option would

**Appendix IV
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(1) produce no new submarines between FY 1996 and FY 2003, (2) result in comparable short term cost, (3) cause a substantial increase in overall program cost and (4) involve greatly increased program risk.

The draft report suggests reallocation of work and expansion of current manufacturing relationships to sustain the industrial base. The GAO provides no cost analysis to support that suggestion. The restructuring would have a large cost, yet no allowance is made for potential offset of the \$9 billion in near term cost avoidance proposed by the GAO.

All three of the GAO draft report alternative shipbuilding options fail to assume realistic costs. For example, the draft report suggests that a lead ship NSSN can be constructed for the current nominal projected lead ship design and construction cost of \$2.8 billion following a shipbuilding hiatus of 6 to 7 years. Historical data shows that radically altered shipbuilding rates in lean production environments have a dramatic effect on program costs. Nonetheless, the options cited in the GAO draft report fail to take into account inflation effects, the design and construction learning curves and loss of learning effects, variation in overhead expenses as the shipyards deal with changing backlog and periods of no new orders, the wide variation of material costs over the construction of the class of ships, and construction inefficiencies caused by ramping up or down of the construction workforce. In summary, the overly simplified cost evaluations presented for each of the shipbuilding alternatives in the GAO draft report are misleading and inaccurate.

With regard to the threat variable, the draft report does not adequately address the current and future threat in determining force structure alternatives. New generation nuclear and diesel-electric submarines pose a significant challenge to SSN-688/688I class submarines. To counter that emerging threat, a portion of the submarine force must include submarines with more capability and SEAWOLF level of stealth. The "Submarine Force for the Future Plan" prepared by the Joint Chiefs of Staff in 1993 and accepted by the Navy, specifies a force structure of SEAWOLF or NSSN-type submarines to meet the threat. Some of the alternatives proposed in the GAO draft report do not satisfy the need identified by the Joint Staff.

To counter the threat, the New Attack Submarine (NSSN) program, with lead ship authorization in FY 1998, was approved by the Defense Acquisition Executive following a Milestone I Defense Acquisition Board meeting on August 1, 1994. Further, the NSSN program is fully funded by the President's FY 1995 Budget. The DoD has sent a strong signal of commitment to the FY 1998 start of the NSSN program and to the low rate production option of sustaining the submarine industrial base.

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The DoD appreciates the opportunity to comment on the GAO draft report.

Sincerely,



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