Order Code RL32418

Navy Attack Submarine Force-Level Goal and Procurement Rate: Background and Issues for Congress

Updated July 26, 2006

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Summary

Of the 282 ships in the Navy at the end of FY2005, 54 were nuclear-powered attack submarines (SSNs). The Navy is planning to maintain in coming years a fleet of 313 ships, including 48 SSNs. The Navy is currently procuring one Virginia (SSN-774) class SSN per year. Each submarine currently costs about $2.6 billion. The FY2007-FY2011 Future Years Defense Plan (FYDP) proposes maintaining the one-per-year procurement rate through FY2011, and then increasing the rate to two per year in FY2012.

The Navy's 30-year SSN procurement plan, if implemented, would not be sufficient to maintain a force of 48 SSNs consistently over the long run. The Navy projects that the SSN force under this plan would fall below 48 boats during the 14-year period 2020-2033, reaching a minimum of 40 boats in 2028-2029. In addition, for the first time in about 50 years, there is currently no new submarine being designed, which has led to a decline in work for submarine designers and engineers.

Issues for Congress include the following: Is 48 the correct number of SSNs to meet future needs? Should the start of two-per-year Virginia-class procurement be accelerated from FY2012 to an earlier year, such as FY2009, so as to come closer to maintaining a force of 48 SSNs in the 2020s-2030s? How should the submarine design and engineering base be maintained in coming years?

FY2007 Defense Appropriations Bill (H.R. 5631). The House Appropriations Committee, in its report (H.Rept. 109-504 of June 16, 2006) on H.R. 5631, recommended approval of the request for FY2007 procurement funding for the Virginia-class program (page 141). The report recommended reducing by $68 million the $136-million request for FY2007 procurement funding to cover cost growth on Virginia-class submarines procured in prior years. The report recommended increasing the FY2007 request for Virginia-class research and development work by $20.4 million for four projects (page 241). The report recommended increasing the FY2007 request for advanced submarine system development by $15 million for four additional projects (page 239).

The Senate Appropriations Committee, in its report (S.Rept. 109-292 of July 25, 2006) on H.R. 5631, recommended approval of the Navy's request for FY2007 procurement funding for the Virginia-class program (page 114). The report recommended reducing by $5 million the $136-million request for FY2007 procurement funding to cover cost growth on Virginia-class submarines procured in prior years (Section 8083). The report recommended increasing the Navy's request for FY2007 research and development funding for the Virginia-class program by $47.2 million for four projects (page 187). The report recommended increasing the FY2007 request for advanced submarine system development by $18.5 million for four additional projects (page 185).

This report will be updated as events warrant.

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The Navy is currently procuring one Virginia (SSN-774) class SSN per year. Each submarine currently costs about $2.6 billion. The FY2007-FY2011 Future Years Defense Plan (FYDP) proposes maintaining the one-per-year procurement rate through FY2011, and then increasing the rate to two per year in FY2012.

The Navy's 30-year SSN procurement plan, if implemented, would not be sufficient to maintain a force of 48 SSNs consistently over the long run. The Navy projects that the SSN force under this plan would fall below 48 boats during the 14-year period 2020-2033, reaching a minimum of 40 boats in 2028-2029. In addition, for the first time in about 50 years, there is currently no new submarine being designed, which has led to a decline in work for submarine designers and engineers.

Issues for Congress include the following:

- Is 48 the correct number of SSNs to meet future needs?
- Should the start of two-per-year Virginia-class procurement be accelerated from FY2012 to an earlier year, such as FY2009, so as to come closer to maintaining a force of 48 SSNs in the 2020s-2030s?
- How should the submarine design and engineering base be maintained in coming years?

Congress's decisions on these issues could significantly affect future Navy capabilities, Navy funding requirements, and the submarine industrial base.

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[1] U.S. Department of the Navy, *Report to Congress on Annual Long-Range Plan for Construction of Naval Vessels for FY2007*. Washington, 2006. 8 pp. For additional discussion, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

The next section of this report provides background information on Navy submarines, the Virginia-class program, and the submarine construction industrial base. The following section addresses the above issues for Congress.

Background

Submarines in the U.S. Navy

Types of Submarines. Submarines are one of four principal categories of combat ships that traditionally have helped define the size and structure of the U.S. Navy. The other three are aircraft carriers, surface combatants (e.g., cruisers, destroyers, and frigates), and amphibious ships.[2]

Submarines are powered by either nuclear reactors or non-nuclear power sources such as diesel engines or fuel cells. All U.S. Navy submarines are nuclear-powered.[3]

Roles and Missions. U.S. Navy submarines fall into three types — nuclear-powered ballistic missile submarines (SSBNs), nuclear-powered cruise missile submarines (SSGNs), and nuclear-powered attack submarines (SSNs).[4]

SSBNs. The SSBNs' basic mission is to remain hidden at sea with their nuclear-armed submarine-launched ballistic missiles (SLBMs) and thereby deter a strategic nuclear attack on the United States. Although this mission is often associated with the Cold War-era nuclear competition between the United States and the Soviet Union, it has continued, with some modifications, in the post-Cold War

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[2] The Navy also includes mine warfare ships and a variety of auxiliary and support ships.

[3] An exception for the U.S. Navy is the non-combat auxiliary submarine Dolphin (AGSS-555), a small submarine that the Navy uses for research and development work. As a non-combat research asset, the Dolphin is not included in counts of the total number of submarines (or battle force ships of all kinds) in the Navy. Until the 1950s, the U.S. Navy included many non-nuclear-powered combat submarines. Following the advent of nuclear power in the mid-1950s, construction of new non-nuclear-powered combat submarines ended and the total number of non-nuclear-powered combat submarines in Navy service began to decline. The Navy's last in-service non-nuclear-powered combat submarine was retired in 1990. Most military submarines around the world are non-nuclear-powered. Five countries — the United States, the United Kingdom (UK), France, Russia, and China — operate nuclear-powered submarines. The United States and the UK operate all-nuclear submarine fleets, while the other three countries operate both nuclear- and non-nuclear-powered submarines. A submarine's use of nuclear or non-nuclear power as its energy source is not necessarily an indication of whether it is armed with nuclear weapons. A nuclear-powered submarine can lack nuclear weapons, and a non-nuclear-powered submarine can be armed with nuclear weapons.

[4] In the designations SSBN, SSGN, and SSN, SS stands for submarine, N stands for nuclear-powered, B stands for ballistic missile, and G stands for guided missile (such as a cruise missile).

era.[5] As of the end of FY2005, the Navy included 14 Ohio (SSBN-726) class SSBNs, which are commonly called Trident submarines because they carry Trident SLBMs. Each Trident SSBN can carry 24 Trident SLBMs.

SSGNs. The Navy's SSGNs, which are a new addition to the fleet,[6] are former Trident SSBNs that are being converted (i.e., modified) to carry Tomahawk cruise missiles and special operations forces (SOF) rather than SLBMs. A total of four SSGNs are planned; the first was completed in January 2006, and the fourth is scheduled to be completed by September 2007. Upon reentering service as SSGNs, the ships are scheduled to remain in operation for about 20 years.[7]

Although the SSGNs differ somewhat from SSNs in terms of mission orientation (with the SSGNs being strongly oriented toward Tomahawk strikes and SOF support, while the SSNs are more general-purpose in orientation), SSGNs are sometimes included in counts of the projected total number of Navy attack submarines.

SSNs. The SSNs — the focus of this report — are general-purpose submarines that perform a variety of peacetime and wartime missions, including the following:

- covert intelligence, surveillance, and reconnaissance (ISR), much of it done for national-level (as opposed to purely Navy) purposes;
- covert insertion and recovery of SOF;
- covert strikes against land targets with the Tomahawk cruise missiles;
- covert offensive and defensive mine warfare;
- anti-submarine warfare (ASW); and
- anti-surface ship warfare.

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[5] For a discussion of U.S. strategic nuclear weapons policy and force structure, see CRS Report RL31623, *U.S. Nuclear Weapons: Changes in Policy and Force Structure*, by Amy F. Woolf.

[6] The Navy in the late 1950s and early 1960s built and operated two non-nuclear-powered cruise missile submarines (or SSGs — the Grayback [SSG-574] and the Growler [SSG-577]) and one nuclear-powered cruise missile submarine (the Halibut [SSGN-587]). The submarines could each carry two Regulus II strategic nuclear cruise missiles. In the mid-1960s, following the deployment of the Navy's initial SSBNs, the Regulus cruise missile was removed from service and the Grayback, Growler, and Halibut were converted into attack and auxiliary transport submarines.

[7] Each SSGN as converted will retain its 24 large (7-foot-diameter, 44-foot-long) SLBM launch tubes. In one possible configuration, 22 of these tubes would be used to carry a total of 154 Tomahawks (7 Tomahawks per tube) while the remaining two would be used as lockout chambers for an embarked force of 66 SOF personnel. In the future, the 24 tubes could be used to carry large numbers of other payloads, such as unmanned vehicles. The SSGNs as converted will also retain their four original 21-inch-diameter torpedo tubes and their internal torpedo magazines. In discussing the SSGNs, Navy officials often express a desire to take maximum advantage of the very large payload volume on each SSGN by developing new unmanned vehicles or other advanced payloads. For more on the Navy's SSGN conversion program, see CRS Report RS21007, *Navy Trident Submarine Conversion (SSGN) Program: Background and Issues for Congress*, by Ronald O'Rourke.

During the Cold War, ASW against the Soviet submarine force was the primary stated mission of U.S. SSNs, although covert ISR and covert SOF insertion/recovery operations were important on a day-to-day basis as well.[8] In the post-Cold War era, although maintaining a capability for conducting anti-submarine warfare against the Russian submarine force remains a mission, the Navy has placed increased emphasis on missions that contribute to U.S. military operations in littoral (near-shore) areas against regional adversaries other than Russia.

Attack Submarine Force-Level Goal

Previous Administrations. The Reagan-era plan for a 600-ship Navy included an objective of achieving and maintaining a force of 100 SSNs. The George H. W. Bush Administration's proposed Base Force plan of 1991-1992 originally called for a Navy of more than 400 ships, including 80 SSNs.[9] In 1992, however, the SSN goal was reduced to about 55 boats as a result of a 1992 Joint Staff force-level requirement study (updated in 1993) that called for a force of 51 to 67 SSNs, including 10 to 12 with Seawolf-level acoustic quieting, by the year 2012.[10]

The Clinton Administration, as part of its 1993 Bottom-Up Review (BUR) of U.S. defense policy, established a goal of maintaining a Navy of about 346 ships, including 45 to 55 SSNs.[11] The Clinton administration's 1997 QDR supported a requirement for a Navy of about 305 ships and established a tentative SSN force-level goal of 50 boats, "contingent on a reevaluation of peacetime operational requirements."[12] The Clinton administration later amended the SSN figure to 55 boats (and therefore a total of about 310 ships).

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[8] For an account of certain U.S. submarine surveillance and intelligence-collection operations during the Cold War, see Sherry Sontag and Christopher Drew with Annette Lawrence Drew, *Blind Man's Bluff* (New York: Public Affairs, 1998).

[9] For the 80-SSN figure, see Statement of Vice Admiral Roger F. Bacon, U.S. Navy, Assistant Chief of Naval Operations (Undersea Warfare) in U.S. Congress, House Armed Services Committee, Subcommittee on Seapower and Strategic and Critical Materials, *Submarine Programs*, Mar. 20, 1991, pp. 10-11, or Statement of Rear Admiral Raymond G. Jones, Jr., U.S. Navy, Deputy Assistant Chief of Naval Operations (Undersea Warfare), in U.S. Congress, Senate Armed Services Committee, Subcommittee on Projection Forces and Regional Defense, *Submarine Programs*, June 7, 1991, pp. 10-11.

[10] See Richard W. Mies, "Remarks to the NSL Annual Symposium," *Submarine Review*, July 1997, p. 35; "Navy Sub Community Pushes for More Subs than Bottom-Up Review Allowed," *Inside the Navy*, Nov. 7, 1994, pp. 1, 8-9; *Attack Submarines in the Post-Cold War Era: The Issues Facing Policymakers*, op. cit., p. 14; Robert Holzer, "Pentagon Urges Navy to Reduce Attack Sub Fleet to 50," *Defense News*, Mar. 15-21, 1993, p. 10; Barbara Nagy, " Size of Sub Force Next Policy Battle," *New London Day*, July 20, 1992, pp. A1, A8.

[11] Secretary of Defense Les Aspin, U.S. Department of Defense, *Report on the Bottom-Up Review*, Oct. 1993, pp. 55-57.

[12] Secretary of Defense William S. Cohen, U.S. Department of Defense, *Report of the Quadrennial Defense Revie*w, May 1997, pp. 29, 30, 47.

The reevaluation called for in the 1997 QDR was carried out as part of a Joint Chiefs of Staff (JCS) study on future requirements for SSNs that was completed in December 1999. The study had three main conclusions:

- "that a force structure below 55 SSNs in the 2015 [time frame] and 62 [SSNs] in the 2025 time frame would leave the CINC's [the regional military commanders-in-chief] with insufficient capability to respond to urgent crucial demands without gapping other requirements of higher national interest. Additionally, this force structure [55 SSNs in 2015 and 62 in 2025] would be sufficient to meet the modeled war fighting requirements;"

- "that to counter the technologically pacing threat would require 18 Virginia class SSNs in the 2015 time frame;" and

- "that 68 SSNs in the 2015 [time frame] and 76 [SSNs] in the 2025 time frame would meet all of the CINCs' and national intelligence community's highest operational and collection requirements."[13]

The conclusions of the 1999 JCS study were mentioned in discussions of required SSN force levels, but the figures of 68 and 76 submarines were not translated into official Department of Defense (DOD) force-level goals.

George W. Bush Administration. The George W. Bush Administration's report on the 2001 QDR revalidated the amended requirement from the 1997 QDR for a fleet of about 310 ships, including 55 SSNs. In revalidating this and other U.S. military force-structure goals, the report cautioned that as DOD's "transformation effort matures — and as it produces significantly higher output of military value from each element of the force — DOD will explore additional opportunities to restructure and reorganize the Armed Forces."[14]

DOD and the Navy conducted studies on undersea warfare requirements in 2003-2004. One of the Navy studies — an internal Navy study done in 2004 — reportedly recommended reducing the attack submarine force level requirement to as few as 37 boats. The study reportedly recommended homeporting a total of nine attack submarines at Guam and using satellites and unmanned underwater vehicles (UUVs) to perform ISR missions now performed by attack submarines.[15]

In March 2005, the Navy submitted to Congress a report projecting Navy force levels out to FY2035. The report presented two alternatives for FY2035 — a 260-

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[13] Department of Navy point paper dated Feb. 7, 2000. Reprinted in *Inside the Navy*, Feb. 14, 2000, p. 5.

[14] U.S. Department of Defense, *Quadrennial Defense Review*, Sept. 2001, p. 23.

[15] Bryan Bender, "Navy Eyes Cutting Submarine Force," *Boston Globe*, May 12, 2004, p. 1; Lolita C. Baldor, "Study Recommends Cutting Submarine Fleet," *NavyTimes.com*, May 13, 2004.

ship fleet including 37 SSNs and 4 SSGNs, and a 325-ship fleet including 41 SSNs and 4 SSGNs.[16]

In May 2005, it was reported that a newly completed DOD study on attack submarine requirements called for maintaining a force of 45 to 50 boats.[17]

In February 2006, the Navy proposed to maintain in coming years a fleet of 313 ships, including 48 SSNs.[18] Under this plan, SSNs would account for about 15% of the fleet.

Attack Submarine Force Levels

Historical. During the first half of the Cold War, the total number of attack submarines (both nuclear- and non-nuclear-powered) accounted for an increasing percentage of the total size of the Navy, increasing from roughly 10% of total battle force ships in the early 1950s to about 17% by the late 1970s. Since that time, attack submarines have accounted for roughly 17% to 22% of total battle force ships. At the end of FY2005, they accounted for about 19% (54 ships of 282).

The SSN force included more than 90 boats during most of the 1980s, peaked at 98 boats at the end of FY1987, and then began to decline. The force included 85 to 88 boats during the early 1990s, 79 boats at the end of FY1996, 65 boats at the end of FY1998, 57 boats at the end of FY1999, and 56 boats at the end of FY2000. It has since numbered 53 to 56 boats.

As of End of FY2005. The 54 SSNs in service at the end of FY2005 included the following:

- 50 Los Angeles (SSN-688) class boats;
- 3 Seawolf (SSN-21) class boats; and
- 1 Virginia (SSN-774) class boat.

Los Angeles (SSN-688) Class SSNs. A total of 62 Los Angeles-class submarines, commonly called 688s, were procured between FY1970 and FY1990 and entered service between 1976 and 1996. They are equipped with four 21-inch diameter torpedo tubes and can carry a total of 26 torpedoes or Tomahawk cruise missiles in their torpedo tubes and internal magazines. The final 31 boats in the class (SSN-719 and higher) are equipped with an additional 12 vertical launch system (VLS) tubes in their bows for carrying and launching another 12 Tomahawk cruise

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[16] U.S. Department of the Navy, *An Interim Report to Congress on Annual Long-Range Plan for the Construction of Naval Vessels for FY 2006*. The report was delivered to the House and Senate Armed Services and Appropriations Committees on Mar. 23, 2005.

[17] Robert A. Hamilton, "Delegation Calls Report on Sub Needs Encouraging," *The Day (New London, CT)*, May 27, 2005; Jesse Hamilton, "Delegation to Get Details on Sub Report," *Hartford (CT) Courant*, May 26, 2005.

[18] Christopher P. Cavas, "U.S. Ship Plan To Cost 20% More," *Defense News*, December 5, 2005: 1, 8. See also David S. Cloud, "Navy To Expand Fleet With New Enemies in Mind," *New York Times*, December 5, 2005.

missiles. The final 23 boats in the class (SSN-751 and higher) incorporate further improvements and are referred to as Improved Los Angeles class boats or 688Is. As of the end of FY2005, 12 of the 62 boats in the class had been retired.

Seawolf (SSN-21) Class SSNs. The Seawolf class was originally intended to include about 30 boats, but Seawolf-class procurement was stopped after three boats as a result of the end of the Cold War and associated changes in military requirements. The three Seawolf-class submarines are the Seawolf (SSN-21), the Connecticut (SSN-22), and the Jimmy Carter (SSN-23). SSN-21 and SSN-22 were procured in FY1989 and FY1991 and entered service in 1997 and 1998, respectively. SSN-23 was originally procured in FY1992. Its procurement was suspended in 1992 and then reinstated in FY1996. It was commissioned into service on February 19, 2005. Seawolf-class submarines are larger than Los Angeles-class boats or previous U.S. Navy SSNs,[19] and are equipped with eight 30-inch-diameter torpedo tubes and can carry a total of 50 torpedoes or cruise missiles.

Virginia (SSN-774) Class Program

General. The Virginia-class attack submarine was designed to be less expensive and better optimized for post-Cold War submarine missions than the Seawolf-class design. The Virginia-class design is slightly larger than the Los Angeles-class design,[20] but incorporates newer technologies. Virginia-class boats currently cost about $2.6 billion each to procure.

Joint Production Arrangement. Virginia-class boats are built jointly by General Dynamics' Electric Boat Division (GD/EB) of Groton, CT, and Quonset Point, RI, and Northrop Grumman Newport News Shipbuilding (NGNN) of Newport News, VA.[21] Under the arrangement, GD/EB builds certain parts of each boat, NGNN builds certain other parts of each boat, and the yards take turns building the reactor compartments and performing final assembly of the boats. GD/EB is building the reactor compartments and performing final assembly on boats 1, 3, and so on, while NGNN is doing so on boats 2, 4, and so on. The arrangement results in a roughly 50-50 division of Virginia-class profits between the two yards and preserves both yards' ability to build submarine reactor compartments (a key capability for a submarine-construction yard) and perform submarine final assembly work.

The joint production arrangement is a departure from past U.S. submarine construction practices, under which complete submarines were built in individual yards. The joint production arrangement is the product of a debate over the Virginia-

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[19] Los Angeles-class boats have a beam (i.e., diameter) of 33 feet and a submerged displacement of about 7,150 tons. Seawolf-class boats have a beam of 40 feet. SSN-21 and SSN-22 have a submerged displacement of about 9,150 tons. SSN-23 was built to a configuration. It is 100 feet longer than SSN-21 and SSN-22 and has a submerged displacement of 12,158 tons.

[20] Virginia-class boats have a beam of 34 feet and a submerged displacement of 7,800 tons.

[21] GD/EB and NGNN are the only two shipyards in the country capable of building nuclear-powered ships. GD/EB builds submarines only, while NGNN also builds nuclear-powered aircraft carriers and is capable of building other types of surface ships.

class acquisition strategy within Congress, and between Congress and DOD, that occurred in 1995-1997 (i.e., during the markup of the FY1996-FY1998 defense budgets). The goal of the arrangement is to keep both GD/EB and NGNN involved in building nuclear-powered submarines, and thereby maintain two U.S. shipyards capable of building nuclear-powered submarines, while minimizing the cost penalties of using two yards rather than one to build a submarine design that is being procured at a low annual rate.

Procurement Through FY2006. The first Virginia-class boat was procured in FY1998 and entered service on October 23, 2004. As shown in **Table 1** below, a total of eight Virginia-class boats have been procured through FY2006. Virginia-class boats are being procured in FY2004-FY2008 under a multiyear procurement (MYP) arrangement.[22]

Table 1. Virginia-Class Procurement, FY1998-FY2006

FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006
1	1	0	1	1	1	1	1	1

Planned Procurement Rates. When Virginia-class procurement began in the 1990s, DOD originally projected that the procurement rate would increase to two boats per year in FY2002. In subsequent years, this date was pushed back several times. Most recently, the FY2004-FY2009 FYDP that the Administration submitted to Congress in February 2003 projected increasing the Virginia-class procurement rate to two per year starting in FY2007. The FY2005-FY2009 FYDP submitted in February 2004 delayed this projected increase to FY2009. The FY2006-FY2011 submitted in February 2005 delayed it to FY2012, and the FY2007-FY2011 FYDP

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[22] As part of its proposed FY2004 budget submitted to Congress in February 2003, the Navy requested multiyear procurement authority (MYP) to procure a total of seven Virginia-class boats during the five-year period FY2004-FY2008 (i.e., one boat per year for FY2004-FY2006, then two boats per year for FY2007-FY2008, as shown in the top line in the table above). Congress, as part of its action on the FY2004 defense budget, granted authority in appropriation bill language for a five-boat MYP during this period (i.e., one boat per year for FY2004-FY2008). The Navy estimates that the five-boat MYP arrangement will reduce the total cost of the five boats by a total of about $400 million, or an average of $80 million per boat. The Navy estimated that a seven-boat MYP arrangement would have reduced the cost of the seven boats in question by an average of about $115 million per boat.

The five-boat MYP authority was accompanied by appropriation conference report language that the Navy and other observers interpreted as strongly cautioning the Navy against including funding in future budgets to support the procurement of a second boat in either FY2007 or FY2008. (Section 8008 of the bill approved MYP authority for the Virginia-class program "Provided, That the Secretary of the Navy may not enter into a multiyear contract for the procurement of more than one Virginia Class submarine per year." For the bill and report language on Congress's decision, see H.Rept. 108-283 (FY2004 defense appropriations bill, H.R. 2658/P.L. 108-87) pp. 20, 185-186.) Consistent with this interpretation, the Administration's amended FY2005-FY2009 FYDP included funding for only one Virginia class boat per year for the period FY2005-FY2008.

submitted in February 2006 retains this plan. **Table 2** below compares planned Virginia-class procurement in these FYDPs.

Table 2. Proposed Virginia-Class Procurement

FYDP (date)	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
FY04-FY09 (2/03)	1	1	1	2	2	2		
FY05-FY09 (2/04)		1	1	1	1	2		
FY06-FY11 (2/05)			1	1	1	1	1	1
FY07-FY11 (2/06)			1	1	1	1	1	1

Source: Prepared by CRS using Navy data.

Cost-Reduction Goal. The Navy says that its plan to increase Virginia-class procurement to two per year starting in FY2012 is contingent on being able to reduce the procurement cost of Virginia-class submarines to $2.0 billion each in constant FY2005 dollars, compared to a current cost of about $2.4 billion each in constant FY2005 dollars. The Navy has established cost-reduction targets for several of its shipbuilding programs, but the Virginia-class program is apparently the only program that must meet its cost reduction target as an internal Navy condition for maintaining all ships of that type in the Navy's shipbuilding program.

The target cost of $2.0 billion in constant FY2005 dollars, when translated into FY2012 dollars, would equal about $2.5 billion, permitting two Virginia-class boats to be procured in that year for a total of about $5.0 billion.

The Navy says that, in constant FY2005 dollars, about $200 million of the $400 million in sought-after cost reductions would be accomplished simply through the improved economies of scale (e.g., better spreading of shipyard fixed costs and improved learning rates) of producing two submarines per year rather than one per year. The remaining $200 million in sought-after cost reductions, the Navy says, is to be accomplished through changes in the ship's design and in the shipyard production process. The design changes, the Navy says, are scheduled to be ready for boats procured in FY2012. Consequently, the Navy says, the $2.0 billion target cost cannot be fully achieved before FY2012. The Navy says that if improved economies of scale and changes in the ship's design and in the shipyard production process are insufficient to achieve the $2.0-billion target, it may consider reducing the capabilities of the Virginia class in certain areas until the target is achieved.[23]

Another option for reducing Virginia-class procurement costs, the Navy says, would be to modify the joint-production agreement for producing Virginia-class boats so as to better optimize the overall production process. Such a change, the Navy says, might reduce the cost of each boat by $25 million to $80 million. This proposal could shift certain Virginia-class production work from one of the two

[23] For more on the Navy's plan for reducing the procurement cost of the Virginia-class design, see William Hilarides, "2 For 4 in 2012, The Virginia-Class Road Ahead," *U.S. Naval Institute Proceedings*, June 2006: 68-69.

production shipyards to the other, increasing the amount of work done by one yard while reducing amount done by the other. Since the joint-production agreement cannot be modified without the agreement of both of both yards, the Navy does not include the idea of modifying agreement as part of its plan for achieving the Virginia-class cost-reduction goal.

The Navy's goal to reduce the cost of each Virginia-class boat to $2.0 billion in constant FY2005 dollars as a condition for increasing the procurement rate to two boats per year in FY2012 is a goal that the Navy has set for itself. While Congress may take this goal into account, it need not control congressional action. Congress may decide to fund the procurement of two boats per year in FY2012 or some other year even if the goal is not met.

Funding Requirements For Accelerated Production. Some observers have proposed accelerating the start of two-per-year Virginia-class production to a year earlier than FY2012, such as FY2009, so as to mitigate a projected future shortfall in SSNs that is discussed in the next section. **Table 3** below shows the additional funding that would be needed during the FY2007-FY2011 FYDP to accelerate the start of two-per-year Virginia-class procurement to FY2009. As shown in the table, the Navy estimates that accelerating the start of two-per-year Virginia-class procurement to FY2009 would require $400 million in additional funding in FY2007, and a total of $7.4 billion in additional funding over the FY2007-FY2011 FYDP.

Table 3. Funding For Accelerated Virginia-Class Procurement
(procurement funding in billions of then-year dollars, rounded to nearest tenth)

	FY07	FY08	FY09	FY10	FY11	FY09-FY11 total
FY2007-FY2011 FYDP						
Ship quantity	1	1	1	1	1	5
Funding	2.5	2.5	3.5	3.8	3.8	16.1
Acceleration of two-per year procurement to FY2009						
Ship quantity	1	1	2	2	2	8
Funding	2.9	3.1	6.0	5.9	5.6	23.5
Additional funding for acceleration relative to FY2009-FY2011 FYDP						
	0.4	0.6	2.5	2.1	1.8	7.4

Source: U.S. Navy Office of Legislative Affairs, March 3, 2006.

SSN Procurement Plan and Future SSN Force Levels

The Navy's 30-year SSN procurement plan, if implemented, would not be sufficient to maintain a force of 48 SSNs consistently over the long run. As shown in **Table 4**, the Navy projects that the SSN force under this plan would fall below 48 boats during the 14-year period 2020-2033, reaching a minimum of 40 boats in 2028-2029. Since the Navy plans to retire the four SSGNs by 2029 without procuring any

replacements for them, no SSGNs would be available in 2029 and subsequent years to compensate for a drop in SSN force level below 48 boats.

Table 4. SSN Force Level, 2007-2036 (Navy Projection)

07	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
52	53	54	53	53	54	55	53	52	50	50	48	48	47	47
22	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
47	46	45	44	43	42	40	40	41	42	44	46	48	49	51

Source: *Report to Congress on Annual Long-Range Plan for Construction of Naval Vessels for FY 2007*.

The potential for the Navy's long-range SSN procurement plan to produce a shortfall in the SSN force over the long run has been discussed by CRS since 1995, in the form of testimony to Congress in 1995, 1997, 1999, 2000, 2002, 2004, and 2006, a 1997 CRS presentation to a Defense Science Board task force on the submarine of the future, which issued its report in 1998;[24] a 1999-2000 CRS report,[25] a 2002 CRS report,[26] and this report since its inception in 2004.

Table 5 presents CRS projections of SSN force levels through FY2050 using attack submarine procurement rates of 1, 1.5, and 2 boats per year. The table also shows, in the middle column, a CRS projection of the SSN force-level through 2036 using the Navy's 30-year SSN procurement plan.[27] The CRS projection using the Navy's SSN procurement plan differs from the Navy's projection shown in **Table 4** in two ways. First, the CRS projection retains all existing SSNs in service to age 33, resulting in higher SSN force levels in the earlier years of the projection than under the Navy projection. Second, CRS measures the ages of existing SSNs slightly differently than does the Navy, resulting in some differences in when existing SSNs are retired. As a result, for example, the CRS shows the SSN force dropping below 48 boats in 2018, two years earlier than under the Navy's projection. Both the CRS and Navy projections show the SSN force reaching a minimum of 40 boats in 2028 and 2029, and recovering to 48 boats by 2034.

Among other things, **Table 5** shows that none of the SSN procurement profiles presented — not even 2 boats per year starting in FY2007 — is sufficient to avoid dropping below 48 attack submarines for some period of time starting between FY2018 and FY2026.

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[24] U.S. Department of Defense, Office of the Under Secretary of Defense For Acquisition & Technology, *Report of the Defense Science Board Task Force on [the] Submarine of the Future*, July 1998, pp. 7, 19-20.

[25] CRS Report RL30045, *Navy Attack Submarine Programs: Background and Issues for Congress* (out of print; for a copy, contact the author at 707-7610), by Ronald O'Rourke.

[26] CRS Report RL31372, *Navy Shipbuilding in the FY2003 Defense Budget: Issues for Congress* (out of print; for a copy, contact the author at 707-7610), by Ronald O'Rourke.

[27] U.S. Department of the Navy, *Report to Congress on Annual Long-Range Plan for Construction of Naval Vessels for FY2007*. Washington, 2006. 8 pp.

Table 5. Steady Procurement Rates & Resulting Force Levels

(number procured each [left] and number in service that year [right])

FY	1/year		1.5/year starting FY12		1.5/year starting FY09		Navy plan		2/year starting FY12		2/year starting FY09		2/year starting FY07	
07	1	56	1	56	1	56	1	56	1	56	1	56	2	56
08	1	57	1	57	1	57	1	57	1	57	1	57	2	57
09	1	57	1	57	2	57	1	57	1	57	2	57	2	57
10	1	56	1	56	1	56	1	56	1	56	2	56	2	56
11	1	57	1	57	2	57	1	57	1	57	2	57	2	57
12	1	58	2	58	1	58	2	58	2	58	2	58	2	58
13	1	59	1	59	2	59	2	59	2	59	2	59	2	59
14	1	55	2	55	1	55	2	55	2	55	2	55	2	55
15	1	55	1	55	2	56	2	55	2	55	2	56	2	58
16	1	51	2	51	1	52	2	51	2	51	2	53	2	55
17	1	49	1	49	2	51	2	49	2	49	2	52	2	54
18	1	46	2	47	1	48	2	47	2	47	2	50	2	52
19	1	45	1	46	2	48	2	47	2	47	2	50	2	52
20	1	44	2	46	1	47	2	47	2	47	2	50	2	52
21	1	43	1	45	2	47	2	47	2	47	2	50	2	52
22	1	41	2	44	1	45	2	46	2	46	2	49	2	51
23	1	40	1	43	2	45	2	46	2	46	2	49	2	51
24	1	38	2	42	1	43	2	45	2	45	2	48	2	50
25	1	36	1	40	2	42	2	44	2	44	2	47	2	49
26	1	33	2	38	1	39	2	42	2	42	2	45	2	47
27	1	31	1	36	2	38	2	41	2	41	2	44	2	46
28	1	29	2	35	1	36	2	40	2	40	2	43	2	45
29	1	28	1	34	2	36	1	40	2	40	2	43	2	45
30	1	28	2	35	1	36	2	41	2	41	2	44	2	46
31	1	28	1	35	2	37	1	42	2	42	2	45	2	47
32	1	29	2	37	1	38	2	44	2	44	2	47	2	49
33	1	30	1	38	2	40	1	46	2	46	2	49	2	51
34	1	31	2	40	1	41	2	48	2	48	2	51	2	53
35	1	32	1	41	2	43	1	49	2	50	2	53	2	55
36	1	33	2	43	1	44	2	51	2	52	2	55	2	57
37	1	33	1	43	2	45	n/a	51	2	53	2	56	2	58
38	1	33	2	44	1	45	n/a	52	2	54	2	57	2	59
39	1	33	1	44	2	46	n/a	52	2	55	2	58	2	60
40	1	33	2	45	1	46	n/a	53	2	56	2	59	2	61
41	1	33	1	45	2	47	n/a	53	2	57	2	60	2	62
42	1	33	2	46	1	47	n/a	54	2	58	2	61	2	63
43	1	33	1	46	2	48	n/a	n/a	2	59	2	62	2	64
44	1	33	2	47	1	48	n/a	n/a	2	60	2	63	2	65
45	1	33	1	47	2	49	n/a	n/a	2	61	2	64	2	66
46	1	33	2	48	1	49	n/a	n/a	2	62	2	65	2	66
47	1	33	1	48	2	50	n/a	n/a	2	63	2	66	2	66
48	1	33	2	49	1	49	n/a	n/a	2	64	2	66	2	66
49	1	33	1	49	2	50	n/a	n/a	2	65	2	66	2	66
50	1	33	2	50	1	49	n/a	n/a	2	66	2	66	2	66

Source: Prepared by CRS using Navy data. n/a = data not available

Table 6 presents notional attack submarine procurement profiles for the period FY2007-FY2031 that would fully support attack submarine forces of 30, 40, 48, 50, 55, 60, and 70 boats (excluding any SSGNs). None of the profiles calls for procuring more than four boats per year — the maximum annual rate that was achieved for attack submarines during the Cold War years of the 1980s, when the Navy was working toward achieving and maintaining a force of 100 SSNs.

For the Navy's reported planned force level of 48 SSNs, **Table 6** shows three profiles — A, B, and C — that increase the procurement rate to two boats per year in FY2012, FY2009, and FY2007, respectively. As can be seen from these three profiles, starting to procure two boats per year earlier reduces the number of subsequent years in which three boats need to be procured.

The projections in **Table 5** and **Table 6** assume a six-year construction period[28] and 33-year SSN service life. If SSN service life turns out to be less than 33 years, force levels could be lower than those shown in **Table 5**, and the number of SSNs to be procured to support a force of a given target size could be greater than shown in **Table 6**. The current high operational tempo for the attack submarine force could reduce the service lives of SSNs to something less than 33 years by accelerating the rate at which reactor core life is used up.

If SSN life can be extended to more than 33 years, force levels could be higher than those shown in **Table 5**, and the number of SSNs to be procured to support a force of a given target size could be less than shown in **Table 6**. The feasibility and potential cost of extending the service lives of the Navy's SSNs is not clear. Unlike earlier Navy SSNs, which were built with reactor cores intended to last about 15 years, Seawolf- and Virginia-class boats have cores that are intended to last the 33-year expected life of the ship. Extending the lives of Seawolf- or Virginia-class boats 40 years, if feasible, could involve changing their life-cycle maintenance plans to include a refueling at about age 33 or earlier.

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[28] Exceptions to the six-year construction period include the second boats procured in FY2007 and FY2008, which are assumed to enter service eight years and seven years after they are procured, respectively, due to lack of advance procurement funding for the FY2007 boat in FY2005 and FY2006 and for the FY2008 boat in FY2006.

Table 6. Notional Procurement Profiles for Various Force Sizes

(Years with 3 or 4 boats shown in bold)

FY	Target size of force to be supported — total number of boats in force																	
	30		40		48						50		55		60		70	
					A (2/year starts FY12)		B (2/year starts FY09)		C (2/year starts FY07)									
07	1	56	1	56	1	56	1	56	2	56	2	56	2	56	2	56	2	56
08	1	57	1	57	1	57	1	57	2	57	2	57	2	57	**3**	57	**3**	57
09	1	57	1	57	1	57	2	57	2	57	2	57	2	57	**3**	57	**4**	57
10	1	56	1	56	1	56	2	56	2	56	2	56	2	56	**4**	56	**4**	56
11	1	57	1	57	1	57	2	57	2	57	2	57	**3**	57	**4**	57	**4**	57
12	1	58	2	58	2	58	2	58	2	58	2	58	**3**	58	**3**	58	**4**	58
13	1	59	2	59	2	59	2	59	2	59	2	59	**3**	59	**3**	59	**4**	59
14	1	55	2	55	**3**	55	2	55	2	55	2	55	2	55	2	55	**4**	55
15	1	55	2	55	2	55	2	56	2	58	2	58	2	58	2	60	**4**	61
16	1	51	2	51	**3**	51	2	53	2	55	2	55	**3**	55	**3**	59	**4**	60
17	1	49	2	49	**3**	49	2	52	2	54	2	54	**3**	55	**3**	60	**4**	61
18	1	46	2	47	**3**	47	**3**	50	2	52	**3**	52	**3**	54	**3**	59	**3**	61
19	1	45	2	47	**3**	47	**3**	50	2	52	**3**	52	**3**	55	**3**	60	**3**	63
20	1	44	2	47	**3**	48	**3**	50	**3**	52	**3**	52	**3**	55	**3**	60	**4**	65
21	1	43	2	47	**3**	48	**3**	50	**3**	52	**3**	52	**3**	55	**3**	60	**3**	67
22	2	41	2	46	**3**	48	**3**	49	**3**	51	**3**	51	**3**	55	**3**	60	**3**	68
23	2	40	2	46	2	49	2	49	2	51	2	51	2	56	2	61	2	70
24	1	38	1	45	1	49	1	49	1	50	1	51	1	56	1	61	1	70
25	1	36	1	44	1	49	1	49	1	49	1	51	1	56	1	61	1	70
26	0	33	0	42	0	48	0	48	0	48	0	50	0	55	0	60	0	70
27	0	31	0	41	0	48	0	48	0	48	0	50	0	55	0	60	0	70
28	0	30	0	40	0	48	0	48	0	48	0	50	0	55	0	60	0	70
29	0	30	0	40	0	48	0	48	0	48	0	50	0	55	0	60	0	70
30	0	30	0	40	0	48	0	48	0	48	0	50	0	55	0	60	0	70
31	1	30	1	40	1	48	1	48	1	48	1	50	1	55	1	60	1	70

Source: Prepared by CRS using U.S. Navy data.

Submarine Construction Industrial Base

General. In addition to GD/EB and NGNN, the submarine construction industrial base includes scores of supplier firms, as well as laboratories and research facilities, in numerous states. About 80% of the total procured material from supplier firms (measured in dollars rather than pieces, parts, or purchase orders) comes from single or sole source suppliers. Observers in recent years have expressed concern for the continued survival of many of these firms.

The submarine construction industrial base went through a period of significant stress due to very low levels of work in the 1990s, after procurement of Seawolf submarines was terminated and before procurement of Virginia-class submarines began. The situation appears to have stabilized in recent years under one-per-year procurement of Virginia-class boats. For nuclear-propulsion component suppliers, an additional source of stabilizing work is the Navy's nuclear-powered aircraft carrier construction program.[29] In terms of work provided to these firms, a carrier nuclear propulsion plant is roughly equivalent to five submarine propulsion plants.

Design and Engineering Portion. The part of the submarine industrial base that some observers are currently most concerned about is not the construction portion, but the design and engineering portion, much of which is resident at GD/EB and NGNN. With Virginia-class design work now winding down and no other submarine-design projects underway, the submarine design and engineering base is facing the near-term prospect, for the first time in about 50 years, of having no major submarine-design project on which to work.

Some Navy and industry officials are concerned that unless a major submarine-design project is begun soon, the submarine design and engineering base will begin to atrophy through the departure of experienced personnel. Rebuilding an atrophied submarine design and engineering base, these Navy and industry officials believe, could be time-consuming, adding time and cost to the task of the next submarine-design effort, whenever it might begin. Concern about this possibility among some Navy and industry officials has been strengthened by the UK's recent difficulties in designing its new Astute-class SSN. The UK submarine design and engineering base atrophied for lack of work, and the subsequent Astute-class design effort experienced considerable delays and cost overruns. Submarine designers and engineers from GD/EB were assigned to the Astute-class project to help the UK overcome these problems.[30]

On December 6, 2005, GD/EB announced that it would reduce its workforce by 1,900 to 2,400 people by the end of 2006.[31] Included in this planned reduction are 300 to 400 employees who belong to the Marine Draftsmen Association (MDA), the union that represents submarine designers at GD/EB.

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[29] For more on this program, see CRS Report RS20643, *Navy CVN-21 Aircraft Carrier Program: Background and Issues for Congress*, by Ronald O'Rourke.

[30] See, for example, Andrew Chuter, "U.K. Spending Mounts for U.S. Help on Sub," *Defense News*, September 13, 2005: 4; Richard Scott, "Electric Boat Provides Project Director for Astute Class," *Jane's Navy International*, May 2004: 33; Richard Scott, "Astute Sets Out on the Long Road to Recovery," *Jane's Navy International*, Dec. 2003, pp. 28-30; Richard Scott, "Recovery Plan Shapes Up for Astute Submarines," *Jane's Defence Weekly*, Nov. 19, 2003, p. 26.

[31] Christopher P. Cavas, "Electric Boat To Lay Off Up To 2,400 Workers," *NavyTimes.com*, December 6, 2005; Geoff Fein, "Lack Of Sub Work Leads To Layoffs At Electric Boat," *Defense Daily*, December 7, 2005; Renae Merle, "General Dynamics May Lay Off 2,400," *Washington Post*, December 7, 2005: D2.

Issues for Congress

The current situation regarding attack submarines poses at least three potential issues for Congress:

- Is 48 the correct number of SSNs to meet future needs?
- Should the start of two-per-year Virginia-class procurement be accelerated from FY2012 to an earlier year, such as FY2009, so as to come closer to maintaining a force of 48 SSNs in the 2020s-2030s?
- How should the submarine design and engineering base be maintained in coming years?

Each of these issues is addressed below.

48-Boat Attack Submarine Force-Level Goal

Is 48 the correct number of SSNs to meet future needs?

Navy View.[32] In support of its position that 48 is the correct number of SSNs to meet future needs, the Navy argues the following:

- The figure of 48 SSNs was derived from a number of force-level studies that converged on a figure of about 48 boats, making this figure an analytical "sweet spot."
- A force of 48 boats is a moderate-risk (i.e., acceptable-risk) force, as opposed to the low-risk force called for in the 1999 JCS study.
- A force of 48 boats will be sufficient in coming years to maintain about 10 forward-deployed SSNs on a day-to-day basis — the same number of forward-deployed boats that the Navy has previously maintained with a force of more than 50 SSNs. The Navy will be able to maintain 10 forward-deployed SSNs in coming years with only 48 boats because the force in coming years will include an increased number of newer SSNs that require less maintenance over their lives and consequently are available for operation a greater percentage of the time.
- U.S. regional military commanders would prefer a day-to-day forward-deployed total of about 18 SSNs, but total of 10 will be sufficient to meet their most important needs.

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[32] This section is based on Navy testimony to the Projection Forces subcommittee of the House Armed Services Committee on March 28, 2006, and to the Seapower subcommittee of the Senate Armed Services Committee on March 29, and April 6, 2006.

- All 10 of the forward-deployed SSNs are needed for day-to-day missions such as intelligence, surveillance and reconnaissance (ISR), while about 7.5 of these submarines are also needed to ensure that an adequate number of SSNs are in position for the opening phases of potential conflicts in various locations.

Alternative View. Some observers believe that more than 48 SSNs will be needed to meet future needs. One such observer — retired Vice Admiral Albert Konetzni, Jr., a former commander of the U.S. Pacific Fleet submarine force — argues the following:[33]

- The Navy's SSN force-level analyses called for a force of 48 to 60 SSNs. In this context, a force of 48 SSNs looks more like a sour spot than a sweet spot.

- The Navy's SSN force-level analyses reflect "reverse engineering," in which an SSN force-level number is selected at the outset for affordability reasons, and assumptions used in the force-level study are then adjusted to produce that figure.

- The 1999 JCS study on SSN requirements remains valid today.

- All of the U.S. regional military commanders' requirements for day-to-day forward-deployed SSNs, and not just the 60% or so of those requirements that are being met, are critical.

- In light of the potential size of China's submarine force in 2020, a force of 48 SSNs in that year will be insufficient.[34]

On the issue of meeting U.S. regional military commanders' requirements for day-to-day forward-deployed SSNs, the Navy states:

> Each Combatant Commander (COCOM) requests assets to execute required missions utilizing the Global Force Management Process. Broad categories of mission types are used to make requests including: National and Fleet ISR, Exercise and Training (supporting US tactical development), Exercise and Operations (supporting US engagement strategy), Carrier Strike Group (CSG) /Expeditionary Strike Group (ESG) tasking, OPLAN (war plans) support, and Other. As assignment of Critical, High Priority, Priority or Routine is assigned to each of the requested missions. The theater allocation request process prior to 2004 did not include a priority breakdown. In general, ISR missions have been assigned as Critical or High Priority requirements. Other mission areas have been assigned from High Priority to Routine, based on the relative

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[33] These points are based on Konetzni's testimony to the Projection Forces subcommittee of the House Armed Services Committee on March 28, 2006.

[34] For more on China's submarine force, and China's naval modernization effort in general, see CRS Report RL33153, *China Naval Modernization: Implications for U.S. Navy Capabilities — Background and Issues for Congress*, by Ronald O'Rourke.

importance to the theater commander. No allocation is currently requested to support OPLAN or Other mission areas.

Each COCOM has authority to use its allocated SSNs as required to meet current national and theater priorities. The CJCS [Chairman Joint Chiefs of Staff] allocation order to the Submarine Force strictly directs an allotted number of SSN days of presence be provided, capable of meeting each theaters' [sic] taskings. The breakdown of mission priorities into Critical, High Priority, Priority and Routine is predominantly a construct to demonstrate how a COCOM could meet their priorities, given a specific level of SSN presence. It serves as an aid to the CJCS in apportioning limited SSN presence to the various theaters.

The number of SSNs allocated against Critical Missions enabled COCOMs to meet all requirements in 2004 and 2005, and 99% of the requirements in 2006. For High Priority missions, sufficient SSNs were allocated to meet 25%, 50% and 34% of requirements in 2004, 2005, and 2006 respectively. Overall, the number of SSNs forward deployed was sufficient to cover 66%, 61% and 54% of Combatant Commanders' requested SSN mission taskings in 2004, 2005, and 2006 respectively.[35]

Accelerated Virginia-Class Procurement

Should the start of two-per-year Virginia-class procurement be accelerated from FY2012 to an earlier year, such as FY2009, so as to come closer to maintaining a force of 48 SSNs in the 2020s-2030s?

Navy View. In support of its position that two-per-year Virginia-class procurement should not start until FY2012, the Navy argues the following:

- Given constraints on Navy funding, the Navy cannot afford to accelerate the start of two-per-year procurement to a year earlier than FY2012 without reducing funding for one or more other Navy programs budgeted that year. Accommodating the $7.4 billion in additional funding that would be needed between FY2007 and FY2011 to accelerate the start of two-per-year procurement to FY2009 would require substantial reductions to other Navy programs. The operational risk that would be created by reducing funding for these other programs is greater than the operational risk that would result from waiting until FY2012 to start two-per-year procurement of Virginia-class boats.

- The Navy can manage the operational risk of having fewer than 48 SSNs in the 2020s-2030s by taking steps at that time (such as deferring maintenance) to maximize the operational availability of

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[35] Source: Written response by Vice Admiral Charles L. Munns, Commander Naval Submarine Forces, to a question posed by Representative Rob Simmons at a March 28, 2006, hearing before the Projection Forces Subcommittee of the House Armed Services Committee on submarine force structure. Munns' written response was provided to CRS on July 5, 2006, by the office of Representative Simmons and is used here with the permission of that office.

SSNs, and by shifting SSNs from lower-risk areas of operation to higher-risk areas. Although the force will be below 48 boats for 14 years, for some of these years, the shortfall will be only one or two or three boats.

- The Navy can mitigate or eliminate the projected SSN shortfall without accelerating the start of two-per-year Virginia-class procurement by adding up to eight additional SSNs to the procurement plan in the period 11-year FY2012-FY2022.

- If two Virginia-class boats were procured per year before FY2012, those boats would not meet the Navy's unit procurement cost target of $2.0 billion each in FY2005 dollars, because certain cost-reducing technologies needed to meet the $2.0-billion target will not be ready until FY2012.

Alternative View. Supporters of accelerating Virginia-class procurement to a year earlier than FY2012 could argue one or more of the following:

- The operational risks of allowing the SSN force to drop below 48 are unacceptable. The Navy has described the 48-boat goal as a moderate-risk force, so dropping substantially below 48 boats would imply a high-risk force. If the force drops to 40 boats, as currently projected, the Navy would be without one of every six SSNs it is supposed to have. Although the deepest part of the projected SSN shortfall lasts only a certain number of years, potential adversaries can know in advance when this will occur and make plans to take advantage of it.

- If the Navy attempts to manage the shortfall period by deferring maintenance on SSNs, this will likely create an SSN maintenance backlog that will reduce SSN operational availability in the years after the shortfall, creating a virtual SSN shortfall in those years. If the Navy attempts to manage the SSN shortfall by shifting SSNs from some operational areas to others, it could increased operational risks in the vacated areas.

- Accelerating the start of two-per-year Virginia-class procurement to FY2009 would mitigate the projected SSN shortfall to a meaningful degree by creating a force that would bottom out at 43 boats rather than 40, and by reducing the projected shortfall period from 14 years to about eight years. (See **Table 5**, column entitled "2/year starting FY09.")

- The Navy may find it very difficult to fund three Virginia-class boats per year in future years without forcing undue reductions in other Navy programs. Accelerating the start of two-per-year Virginia-class procurement to a year earlier than FY2012 would reduce the number of years in FY2012 and beyond where three SSNs per year would need to be procured to further mitigate, or fully eliminate, the

SSN shortfall. (See **Table 6**, column entitled "48 B — 2/year starts FY09.")

- Accelerating the start of two-per-year Virginia-class procurement to a year earlier than FY2012 would mitigate a potential roller-coaster effect on shipyard and supplier-firm workloads and employment levels that would result if SSNs were procured for several years at one per year, then increased at some future point to three per year, then fell back to 1.5 or two per year.

- Accelerating the start of two-per-year Virginia-class procurement to a year earlier than FY2012 would permit the Navy to begin reaping sooner the cost-reducing effects of procuring two SSNs per year. The boats might cost more than the Navy's target of $2.0 billion each in FY2005 dollars, but this is an internal Navy goal that need not control congressional action.

Maintaining The Design and Engineering Base

How should the submarine design and engineering base be maintained in coming years?

Navy and industry officials appear to agree that preserving the submarine design and engineering base over the next several years will require funding submarine design and engineering work that is in addition to the amount of such work currently planned. In assessing options for additional submarine design and engineering work, issues of interest include the total volume of work that the options would provide, and the number of submarine design and engineering skills they would engage and thereby help preserve. The Navy believes that roughly two dozen design and engineering skills areas need to be preserved for the United States to retain an ability to design nuclear-powered submarines. Options for additional work for the submarine design and engineering base over the next few years include the following:

- **Expanded Virginia-class modification effort.** The Navy is currently funding certain work to modify the Virginia-class design, in part to reach the Navy's Virginia-class cost-reduction target. The scope of this effort could be expanded to include a greater number and variety of modifications. An expanded modification effort would add to the amount of submarine design and engineering work currently programmed, but by itself might not be sufficient in terms of volume of work or number of skills areas engaged to fully preserve the submarine design and engineering base.

- **New Advanced SEAL Delivery System (ASDS).** The ASDS is a mini-submarine that is attached to the back of an SSGN or SSN to support operations by Navy special operations forces (SOF), who are called SEALs, an acronym that stands for Sea, Air, and Land. DOD has decided, after building one copy of the current ASDS design, not to put that design into serial production. Some observers have proposed developing a new ASDS design with the intention of

putting this new design into serial production. This option, like the previous one, would add to the amount of submarine design and engineering work currently programmed, but by itself might not be sufficient in terms of volume of work or number of skills areas engaged to fully preserve the submarine design and engineering base.

- **Diesel-electric submarine for Taiwan.** In April 2001, the Bush Administration announced a proposed arms-sales package for Taiwan that included, among other things, eight diesel-electric submarines.[36] Since foreign countries that build diesel-electric submarines appear reluctant to make their designs available for a program to build such boats for Taiwan, some observers have proposed that the United States develop its own design for this purpose. This option would generate a substantial volume of work and engage many skill areas. Uncertainty over whether and when this project might occur could make it difficult to confidently incorporate it into an integrated schedule of work for preserving the U.S. design and engineering base. Although the project would engage many skill areas, it might not engage all of them. Skills related to the design of nuclear propulsion plants, for example, might not be engaged. This project might raise concerns regarding the potential for unintended transfer of sensitive U.S. submarine technology — an issue that has been cited by the Navy in the past for not supporting the idea of designing and building diesel-electric submarines in the United States for sale to foreign buyers.[37]

- **New SSN design**. Developing a completely new SSN design as the successor to the Virginia-class design would fully support the design and engineering base for several years. The Navy estimates that the cost of this option would be roughly equivalent to the procurement cost of three SSNs. The House version of the FY2006 defense authorization bill (H.R. 1815) proposed this idea, but the idea was not supported by the Navy, in large part because of its cost, and the conference version of the bill did not mandate it.

- **Accelerated start of next SSBN design.** Given the ages of the Navy's 14 current SSBNs, work on a replacement SSBN design

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[36] For more on the proposed arms sales package, including the diesel-electric submarines, see CRS Report RL30957, *Taiwan: Major U.S. Arms Sales Since 1990*, by Shirley A. Kan.

[37] An additional issue that some observers believe might be behind Navy resistance to the idea of designing and building diesel-electric submarines in the United States for sale to foreign buyers, but which these observers believe the Navy is unwilling to state publicly, is a purported fear among Navy officials that the establishment of a U.S. production line for such boats would lead to political pressure for the Navy to accept the procurement of such boats for its own use, perhaps in lieu of nuclear-powered submarines. The Navy argues that non-nuclear-powered submarines are not well suited for U.S. submarine operations, which typically involve long, stealthy transits to the operating area, long submerged periods in the operating area, and long, stealthy transits back to home port.

would normally not need to start until FY2012-FY2014. The start of this project, however, could be accelerated to FY2007. The project would then be carried out as a steady-state effort over several years, rather than as a more-concentrated effort starting in FY2012-FY2014. This option could provide a significant amount of submarine design and engineering work for several years, and could engage all submarine design and engineering skills. The total cost of this effort would be comparable to that of the previous option of designing a new SSN, but this option would accelerate a cost that the Navy already plans to incur, whereas the option for designing a new SSN would be an additional cost.

The Navy has stated that it is aware of the need to devise a strategy to preserve the submarine design and engineering base, and that it has asked the RAND Corporation to study the issue and report back to the Navy later this year. Some supporters of the submarine design and engineering base are concerned that elements of the design and engineering base might atrophy below critical minimum levels during the time that the Navy is waiting to learn the results of the RAND study.

Legislative Activity for FY2007

FY2007 Defense Authorization Bill (H.R. 5122/S. 2766)

House. **Section 121** of H.R. 5122 would amend 10 USC 5062 to state that "The naval combat forces of the Navy shall include not less than 48 operational attack submarines. For purposes of this subsection, an operational attack submarine includes an attack submarine that is temporarily unavailable for worldwide deployment due to routine or scheduled maintenance or repair."

Section 331 of the bill would require the Navy to submit a report on submarine depot maintenance "describing the criteria used when a nuclear attack submarine is sent to a facility other than a facility located within 200 miles of the homeport of the submarine for maintenance...."

Section 1221 of the bill makes findings supporting the proposed sale of eight diesel-electric submarines to Taiwan, and states: "It shall be the policy of the United States to make available to Taiwan plans and options for design work and construction work on future diesel electric submarines under the United States foreign military sales process. The availability of such design work and construction work shall be made in a manner consistent with United States national disclosure policy and is subject to the provisions of the Arms Export Control Act (22 U.S.C. 2751 et seq.) and any other export control law of the United States." The section also requires DOD to submit a report "on the present and future efforts of the Department of the Navy to execute the policy of the President to sell diesel electric submarines to the Republic of China on Taiwan."

The House Armed Services Committee's report on the bill (H.Rept. 109-452 of May 5, 2006) recommends $400 million in additional FY2007 advance procurement

funding to support the **acceleration of two-per year Virginia-class procurement** to FY2009. The report states:

> The Navy recently published a long-term shipbuilding plan that supports the goal of building and maintaining a 313 ship Navy by 2020. Although this plan provides the needed "stability" that the U.S. shipbuilding industry has been looking for, it does not appear to generate enough work to keep the major U.S. shipbuilders operating at their current capacity. Evidence of this is most obvious at General Dynamics Electric Boat Division where the contractor is planning to lay off hundreds of designers and engineers and thousands of production workers in the next several years. The plan to increase the procurement of Virginia class submarines from 1 to 2 per year has been delayed for over 10 years and the latest plan has the increase happening in fiscal year 2012. (Page 70)

The report also states:

> The committee believes that the Navy's attack submarine force structure must be maintained at no less than 48 submarines in order to meet potential global commitments. The Navy's Annual Long-Range Plan for Construction of Naval Vessels for fiscal year 2007 shows that the force will decrease below 48 attack submarines between 2020 and 2033, reaching a low of 40 attack submarines in 2028 and 2029. The committee believes that a reduction below 48 attack submarines puts the country in a position of unacceptable risk. (Page 71)

The report recommends an additional $25 million in research and development funding for design work on a **flexible payload module and payload interface module** for Virginia-class SSNs. The report states:

> The budget request contained $169.6 million in PE 64558N for the [Virginia-class design], but included no funds for flexible payload module and payload interface module development.
>
> The committee understands the flexible payload module will allow payloads, such as Tomahawk missiles, to be located outside of the submarine's pressure hull, resulting in significant cost savings. The flexible payload module will house the new or existing payloads in a pressure proof or free-flooded environment. The payload interface module is the shipboard structure and standardized interface linking the submarine's combat system with the payload. (Page 189)

The report recommends an additional $20 million in research and development funding for development of **a large-aperture bow (LAB) sonar array** for Virginia-class SSNs. The report states:

> The budget request contained $169.6 million in PE 64558N for the new design SSN, but included no funds for the development of the large aperture bow (LAB) array sonar for the Virginia class attack submarine.
>
> The committee is aware that the LAB array is a water-backed replacement for the air-backed spherical array in the bow of Virginia class submarines. The LAB uses longer-lived, lower cost sensors and commercial-off-the-shelf electronics, yielding a cost savings of about $15.0 million per ship and additional lifecycle cost savings. The committee is also aware that with a larger aperture

> and expanded frequency coverage, there will be a significant improvement to the anti-submarine warfare capabilities of the Virginia class submarine. Importantly, the LAB also allows additional payload by providing bow dome arrangement flexibility and allows for rapid insertion of future sensor technologies, and is a transformational approach to outboard sonar array design. The committee understands the preliminary design will be completed in 2006 and if inserted in the 2009 Virginia class hull, would provide $300.0 million in savings for the remainder of the Virginia class submarine construction program. (Page 190)

The report recommends $10 million in research and development funding for a competition to design a new **Advanced SEAL Delivery System (ASDS)** mini-submarine. The report states:

> The budget request contained $32.5 million in PE 1160426BB for advanced SEAL delivery systems development, but included no funds for a new design competition.
>
> The committee understands that the Department of Defense recently cancelled the advanced SEAL delivery system (ASDS) due to its performance and reliability to date. The committee believes a new design competition will ensure that the most current technologies are incorporated into future ASDS designs and will provide valuable information for future decisions regarding the ASDS program.
>
> The committee recommends $42.5 million in PE 1160426BB for advanced SEAL delivery systems development, an increase of $10.0 million for a new design competition. (Page 240)

The report also states:

> The committee acknowledges the Department of Defense's recent decision to cancel the Advanced SEAL Delivery System (ASDS) program due to its performance and reliability to date. The committee has expressed its continued concern regarding technical issues, contractor performance, and cost growths throughout the life of the program and will continue to closely monitor the development and fielding of this capability. Additionally, due to the troubled history surrounding the development of ASDS, the committee wants to ensure that the ASDS improvement program (AIP) and accompanying ASDS concept study consider the most current technologies for incorporation into future ASDS capabilities and designs.
>
> Therefore, the committee directs the Secretary of Defense to conduct an ASDS design competition during fiscal year 2007 and authorizes an additional $10.0 million in research and development funding specifically for this competition. Design competition in fiscal year 2007 will ensure that ASDS program decisions made upon completion of the critical systems review portion of the AIP and of phase three of the ASDS concept study take into account current technologies and designs available through related industry research and development as well as the lessons learned from the critical systems review and ASDS concept study. Finally, the committee directs the Secretary of Defense to report to the Senate Committee on Armed Services and the House Committee on Armed Services by June 1, 2007, on the results of the AIP's critical systems review and on the status of an overall ASDS program decision. (Page 131)

Senate. The Senate Armed Services Committee, in its report (S.Rept. 109-254 of May 9, 2006) on S. 2766, recommended approving the Navy's requested amount for FY2007 procurement funding for the Virginia-class program. The report states:

> The Secretary of the Navy submitted a report to Congress on the long-range plan for construction of naval vessels with the fiscal year 2007 budget request. This plan reflects the determination by the Chief of Naval Operations (CNO) that the National Defense Strategy requires a fleet of 313 ships, including 48 attack submarines, to meet the threat in future years. In testimony before the Subcommittee on Seapower of the Committee on Armed Services, the Navy witnesses described the level of 48 attack submarines as the minimum level necessary to support both wartime and peacetime requirements.
>
> The Navy also indicated that, with currently planned construction, attack submarine forces drop below 48 submarines for 15 years. The future-years defense program (FYDP) supports building only one attack submarine per year through fiscal year 2011, with sufficient advance procurement during the FYDP to support increasing the production rate to two boats per year in fiscal year 2012. The Navy's leadership has stated that they need to get the price of Virginia-class attack submarines to a level of $2.0 billion per boat before increasing the build rate. The committee completely agrees with the Navy's affordability focus, but simultaneously views the most important step to improve affordability is to increase the production rate of the Virginia-class to more than one boat per year.
>
> The committee understands that the Navy is trying to modernize in a constrained fiscal environment. However, the committee does not understand the continuing delays in increasing the construction rate. By the Navy's own assessment: (1) submarines perform a uniquely Navy mission; (2) the minimum requirement is to have 48 attack submarines; (3) submarine force levels will fall below 48 during the next decade and remain there for 15 years; (4) the Navy needs to achieve cost reductions in attack submarine construction in order to increase production rates without impinging on other priority shipbuilding programs; and (5) there are potential technology insertion opportunities that might help reduce costs and permit the Navy to increase the production rate.
>
> Having said that, the Navy's and industry's plan for achieving the $2.0 billion per boat cost goal requires greater definition. The Navy has referred to efforts to develop a number of improvements for the Virginia-class that target cost reductions. The committee is concerned, however, that without more specific plans with defined goals and benchmarks, the Navy will get to the end of the FYDP and not necessarily be any closer to achieving real cost reductions in this program. Therefore, the committee directs the Secretary of the Navy to submit with the fiscal year 2008 budget request a detailed plan for developing cost reduction measures with defined goals and benchmarks for the Virginia-class production program. (Pages 115-116)

The report recommends $65 million in additional research and development funding for **Virginia-class design work**, and $10 million in additional research and development funding to begin **design work on the next SSBN**. The report states:

> The budget request included $169.6 million in PE 64558N for the continuing development of the Virginia-class submarine, and $140.4 million in PE 63561N for advanced submarine systems development. The design and

development efforts in these programs are to evaluate a broad range of system and technology alternatives to directly support and enhance the mission capability of the Virginia-class and future submarine concepts.

The budget request included $20.0 million for affordability design, but included no funding for concept formulation for the next generation strategic submarine platform. Similarly, the budget request included no funding to continue development of a family of systems and capabilities, the focus of which is to spirally incorporate capabilities needed to enhance undersea superiority of the Virginia-class. The committee believes that continued investment in these capabilities is needed to meet the future threat. However, the most important measure to increase operational capability of the Virginia-class is to increase the program's building rate as soon as practical. The committee is concerned that the Navy's proposed shipbuilding program is insufficient to meet the submarine force structure requirements outlined in the Secretary of the Navy's report on the long-range plan for the construction of naval vessels. The committee urges the Navy to mitigate this shortfall by moving toward a production goal of two submarines per year beginning in 2010. The committee is aware that the Chief of Naval Operations has established an affordability threshhold as a criterion for increasing the submarine procurement rate, and recognizes that initiatives to add critical capabilities to the Virginia-class need to be accomplished in a manner that supports the established affordability objectives.

The committee recommends an increase of $65.0 million in PE 64558N to support cost reduction initiatives for the Virginia-class design and construction. This additional funding is to include the design and development, leading to affordable integration of the following capabilities into the Virginia-class:

(1) Multi-Mission Module;
(2) Large Aperture Bow Array;
(3) spiral Alpha for the Virginia-class Warfare Management System;
(4) Common Open Architecture Weapon System Components;
(5) Submarine Network-centric Capability Technology Insertion; and
(6) Submarine Command & Control Systems Advanced Technology Insertion.

The committee is further concerned that, for the first time in more than 50 years, the United States is not actively engaged in the design of a new class of nuclear submarine. The current Navy schedule to initiate the next generation submarine platform design causes a significant gap in the design and engineering industrial workload such that the industrial base will not likely be able to preserve the critical skills and capabilities needed for this effort. Testimony by industry and Navy experts before the Subcommittee on Seapower of the Committee on Armed Services emphasized the criticality of maintaining a viable submarine design industrial base to avoid the severe delays and cost overruns experienced by other navies, whose design base atrophied during lengthy periods between new design efforts. The committee recommends an increase of $10.0 million in PE 63561N to initiate concept formulation on the next generation submarine platform, including alternate design approaches, integration of future weapons systems, and mission capabilities. (Pages 177-178)

FY2007 Defense Appropriations Bill (H.R. 5631)

House. The House Appropriations Committee, in its report (H.Rept. 109-504 of June 16, 2006) on H.R. 5631, recommended approval of the request for FY2007 procurement funding for the Virginia-class program (page 141). The report stated:

> The Navy currently procures Virginia class submarines at the inefficient rate of one ship per year under a multiyear contract. Individual submarines are built in sections in three different shipyards in three different states. Over 90 percent of the sub-vendor base is constituted by single suppliers, many under sole source contracts. The Navy's plan to increase the procurement rate to two ships per year would cut unit cost, but the plan has been deferred many times due to budget constraints. Currently, two submarines per year is planned for fiscal year 2012. Although the Committee acknowledges the problem created by this situation, accelerating the higher production rate would cause significant instabilities in the Navy's outyear shipbuilding program, requiring the service to add as much as $7,000,000,000 in additional resources over the future years defense program (FYDP) or cut other programs. Because of this long-term uncertainty, the Committee bill does not include funding to accelerate the higher production rate at this time. (Page 139)

The report recommended reducing by $68 million the $136-million request for FY2007 procurement funding to cover cost growth Virginia-class submarines procured in prior years. The report stated:

> The Committee remains concerned over the lack of cost control in Navy shipbuilding programs. In last year's report, the Committee noted the rising cost growth in ongoing ship construction contracts, and required the Navy to submit a plan on resolving these issues. That report was submitted two months late, and was little more than a summary of cost overruns in shipbuilding over the past two decades. The Committee is concerned about the gap between the Navy's public statements about the need for firm cost controls, and the programmatic and contractual actions needed to accomplish that objective. Navy briefings this year document a litany of programs, including the CVN-77 aircraft carrier and certain attack submarines of the Virginia class, that continue to defy attempts to control costs.... The fiscal year 2007 budget requests $136,000,000 for further cost growth in the U.S.S. Texas (SSN-775), and cost performance on the U.S.S. North Carolina (SSN-777) is seriously below Navy expectations. In fact, current cost performance on the Virginia class jeopardizes the ability of the Navy to meet the performance goals of the multiyear contract signed in 2004 as well as cost targets needed to increase the submarine production rate in future years. The Committee is unwilling to provide increased appropriations for cost overruns in the absence of compelling justification or a realistic and detailed plan for cost control. The Committee recommendation provides $436,449,000 for Completion of Prior Year Shipbuilding Programs, a reduction of $141,400,000 from the request. The reduction should be allocated against the following programs: ... SSN-777 (-$48,000,000); SSN-776 (-$10,000,000); SSN-775 (-$10,000,000).... (Page 140)

The report recommended increasing the FY2007 request for Virginia-class research and development work (PE 0604558N, "New Design SSN") by $20.4 million, including $2 million for submarine low-power computing advanced technology insertion and cost-reduction initiative for command and control; $9 million for Virginia-class large-aperture bow array; $4 million for a flexible payload

module and a Virginia-class payload interface module; and $5.4 million for submarine modernization and technology insertion (page 241).

The report recommended increasing the FY2007 request for advanced submarine system development (PE 0603561N) by $15 million, including $4.5 million for experimental research on a transformational submersible; $2 million for a cryogenic power system for unmanned underwater development; $4 million for large-displacement unmanned underwater vehicle (UUV) at-sea launch and recovery; and $4.5 million for inner and outer decoupler materials for fiberoptic conformal arrays (page 239).

Senate. The Senate Appropriations Committee, in its report (S.Rept. 109-292 of July 25, 2006) on H.R. 5631, recommended approval of the Navy's request for FY2007 procurement funding for the Virginia-class program (page 114). The report recommended reducing by $5 million the $136-million request for FY2007 procurement funding to cover cost growth on Virginia-class submarines procured in prior years (Section 8083).

The report recommended increasing the Navy's request for FY2007 research and development funding for the Virginia-class program by $47.2 million (page 179). Of this increase, $16 million is for a large-aperture bow array for the Virginia class, $15 million is for a flexible payload module and Virginia-class payload-interface module, $6.2 million is for a large-scale demonstration item for the Virginia-class bow dome, $2 million is for a multilevel secure wireless network, and $8 million is for advanced submarine research (page 187).

The report recommended increasing the FY2007 request for advanced submarine system development by $18.5 million (page 177). Of this increase, $1 million is for a low-cost, thin-line, fiber-optic towed array, $10 million is for large-displacement unmanned underwater vehicle (UUV) at-sea launch and recovery technology, $4.5 million is for a fiber-optic conformal acoustic velocity system (FO-CAVES), and $3 million is for submarine automated simulation (page 185).