

NOT FOR PUBLICATION
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HOUSE ARMED SERVICES COMMITTEE

STATEMENT OF
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BEFORE THE
HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON PROJECTION FORCES
HEARING ON
SUBMARINE FORCE STRUCTURE
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Chairman Bartlett, Representative Taylor, distinguished members of the subcommittee, thank you for the opportunity to appear before you to discuss submarine force structure. As requested, my testimony will focus on the following:

- the attack submarine (SSN) force-level goal (pages 1-3); and
- procurement plans for SSNs and how they related to the SSN force-level goal (pages 3-12).¹

SSN 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.² 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 2012.³

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.⁴ 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

¹This statement is adapted from portions of CRS Report RL32418, *Navy Attack Submarine Force-Level Goal and Procurement Rate: Background and Issues for Congress*, by Ronald O'Rourke.

²For 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.

³See 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.

⁴Secretary of Defense Les Aspin, U.S. Department of Defense, *Report on the Bottom-Up Review*, Oct. 1993, pp. 55-57.

operational requirements.”⁵ The Clinton administration later amended the SSN figure to 55 boats (and therefore a total of about 310 ships).

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 CINCs [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.”⁶

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 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.”⁷

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.⁸

⁵Secretary of Defense William S. Cohen, U.S. Department of Defense, *Report of the Quadrennial Defense Review*, May 1997, pp. 29, 30, 47.

⁶Department of Navy point paper dated Feb. 7, 2000. Reprinted in *Inside the Navy*, Feb. 14, 2000, p. 5.

⁷U.S. Department of Defense, *Quadrennial Defense Review*, Sept. 2001, p. 23.

⁸Bryan Bender, “Navy Eyes Cutting Submarine Force,” *Boston Globe*, May 12, 2004, p. 1; Lolita C. Baldor, (continued...)

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-ship fleet including 37 SSNs and 4 SSGNs, and a 325-ship fleet including 41 SSNs and 4 SSGNs.⁹

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.¹⁰

In February 2006, the Navy submitted a long-range shipbuilding plan to Congress that calls for a fleet of 313 ships, including 48 SSNs and 4 SSGNs.¹¹ This is the current Navy force-level goal for submarines. For a discussion of factors influencing the SSN force-level goal, see **Appendix A**.

SSN Procurement Plans

Factors To Consider

In considering the rate at which Virginia-class submarines should be procured in coming years, key factors to consider include the following:

- the attack submarine force-level goal;
- attack submarine service lives;
- the effect of annual procurement rates on unit procurement costs;
- industrial-base considerations; and
- funding requirements for other defense-spending priorities.

Each of these factors is discussed below.

Attack Submarine Force-Level Goal

Long-Term Steady-State Replacement Rate. One potential starting point in relating a force-level goal to required procurement rates is to calculate the steady-state replacement rate, which is the average procurement rate that would be needed over the long run to maintain a force of a given size over the long run.¹² **Table 1** shows steady-state replacement rates for submarine forces varying

⁸(...continued)

“Study Recommends Cutting Submarine Fleet,” *NavyTimes.com*, May 13, 2004.

⁹U.S. Department of the Navy, *An Interim Report to Congress on Annual Long-Range Plan for the Construction of Naval Vessels for FY 2006*.

¹⁰Robert 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.

¹¹ 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.

¹²The steady-state replacement rate equals the desired force level divided by the expected service life of the
(continued...)

in size from 30 to 70. The table assumes a 33-year service life for attack submarines.

Table 1. Steady-State Replacement Rates
(assuming 33-year life for attack submarines)

Planned force size	Steady-state replacement rate (ships per year)
30	0.91
40	1.21
48	1.45
50	1.52
55	1.67
60	1.82
70	2.12

Steady-state replacement rates are averages that must be met over the long term (in this case, over a 33-year period). Over shorter periods, the actual procurement rate can be either above or below the steady-state rate, depending on factors such as the age distribution of the existing force, available funding, and industrial-base considerations. If the actual procurement rate is below the steady-state rate for some number of years, though, it must eventually be elevated above the steady-state rate, so that the average rate, calculated over the entire period in question, comes back to the steady-state rate.

Force-Level Consequences Of Steady Procurement Profiles. Table 2 presents the force-level consequences through FY2050 of steady attack submarine procurement rates of 1, 1.5, and 2 boats per year. The table also shows the 30-year procurement profile from Navy’s February 2006 report to Congress on the Navy’s 30-year shipbuilding plan, which increases the procurement rate to 2 boats per year in FY2012, and then decreases it to 1.5 boats per year for FY2029-FY2036.¹³

The force-level consequences of these procurement rates reflect the age distribution of the SSN force. The SSN force is not evenly distributed in age because it includes a large number of boats procured in the 1980s and a relatively small number procured since FY1990.

The table shows, among other things, that none of these procurement profiles — 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.

¹²(...continued)
platforms in question.

¹³ 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 2. 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		Draft Navy plan (12/30/05)		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

The projections in **Table 2** assume a 6-year construction period¹⁴ and 33-year service life for attack submarines. If service life turns out to be less than 33 years, resulting force levels would be lower than those shown in the table.

Notional Procurement Profiles for Forces of 30 to 70 Boats. **Table 3** presents notional attack submarine procurement profiles for the 25-year period FY2007-FY2031 for supporting 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 3** 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.

¹⁴Exceptions to the 6-year construction period include the second boats procured in FY2007 and FY2008, which are assumed to enter service 8 years and 7 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 3. Notional Procurement Profiles for Various Force Sizes
(Years with 3 or 4 boats shown in bold)

FY	Size of force 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.

The following points arise from the figures in the table and the data underlying the figures:

- **For a 30-boat force.** Supporting a force of 30 boats could involve maintaining an average procurement rate of about 1 boat per year into the 2020s. If all SSNs are operated to the end of their expected 33-year lives, then the force would decline to 30 boats by 2028 and remain there after that. The force could be reduced to 30 boats much sooner by accelerating the retirement of older SSNs.

- **For a 40-boat force.** Supporting a force of 40 boats could involve maintaining an average procurement rate of 2 boats per year from FY2012 to FY2023. If all SSNs are operated to the end of their expected 33-year lives, then the force would decline to 40 boats by 2028 and remain there after that. The force could be reduced to 40 boats much sooner by accelerating the retirement of older SSNs.
- **For a 48-boat force.** Supporting the Navy's reportedly planned force of 48 boats could involve procuring a total of 35 boats during the 16-year period FY2007-FY2022, or an average of about 2.2 boats per year. If all SSNs are operated to the end of their expected 33-year lives, then the force would decline to about 48 boats by 2018 (Profile A) or FY2026 (Profiles B and C) and remain about there after that. As stated earlier, starting to procure two boats per year earlier reduces the number of subsequent years in which three boats need to be procured. The force could be reduced to 48 boats sooner by accelerating the retirement of older SSNs.
- **For a 50-boat force.** Supporting a force of 50 boats could involve procuring a total of 37 boats during the 16-year period FY2007-FY2022, or an average of about 2.3 boats per year. If all SSNs are operated to the end of their expected 33-year lives, then the force would decline to 50 boats by 2026 and remain there after that. The force could be reduced to 50 boats sooner by accelerating the retirement of older SSNs.
- **For a 55-boat force.** Supporting a force of 55 boats could involve procuring a total of 42 boats during the 16-year period FY2007-FY2022, or an average of about 2.6 boats per year.
- **For a 60-boat force.** Achieving and maintaining a force of about 60 boats could involve procuring a total of 47 boats during the 16-year period FY2007-FY2022, or an average of about 2.9 boats per year. The force would reach 60 boats by 2015 and remain about there after that.
- **For a 70-boat force.** Achieving and maintaining a force of about 70 boats could involve procuring a total of 57 boats during the 16-year period FY2007-FY2022, or an average of about 3.6 boats per year. The force would reach 70 boats by 2023 and remain about there after that.

Attack Submarine Service Lives

SSNs have expected service lives of 33 years. The notional procurement profiles outlined above reflect this figure. As also mentioned earlier, however, 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 the service lives of existing SSNs turn out to be less than 33 years due to either higher-than-planned rates of reactor core use or general wear and tear on the ships, then the procurement rates needed to maintain attack submarine forces of various sizes may need to be greater than shown in the notional profiles outlined above.

Conversely, if the service lives of SSNs can be increased to something greater than 33 years, then procurement rates needed to maintain attack submarine forces of various sizes could possibly

be lower than shown in the notional profiles outlined above. If, for example, the service lives of Navy SSNs can be extended to 40 years, then an annual procurement rate of 1 or 1.5 boats per year would, over the long run, be sufficient to maintain a force of 40 to 60 boats, rather than 33 boats.

The feasibility and potential cost of extending the service lives of the Navy's SSNs is not clear. The Navy a few years ago increased the expected service lives of its SSBNs (including the four being converted into SSGNs) from 30 years to 42 years, with the new 42-year life to consist of two 20-year operating periods with a two-year refueling in between. The typical mission profile of an SSBN, however, may be less stressful on the boat than is the typical mission profile of an SSN. Compared to SSBN operations, SSN operations can involve submerging and surfacing more frequently (placing more frequent cyclic stress on the submarine's pressure hull) and more frequent high-speed runs (which can lead to higher rates of wear and tear on propulsion machinery).

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 to 40 years, if feasible, could thus involve changing their life-cycle maintenance plans to include a refueling at about age 33 or earlier.

Annual Procurement Rates and Unit Procurement Costs

A third factor to consider in determining the rate at which Virginia-class submarines should be procured in future years is the effect of annual procurement rates on unit procurement costs. Due to increased spreading of fixed overhead costs at the shipyards and supplier firms, and reduced loss of learning between ships at the shipyards and possibly also at supplier firms, procuring attack submarines at higher annual rates can reduce their unit procurement cost by several percent.¹⁵ Cost figures in the FY2004 and FY2005 budget submission, for example, suggest that increasing the procurement rate from one boat per year to two per year can reduce unit procurement cost by more than \$100 million.¹⁶

¹⁵For a discussion of improved economies of scale in Navy shipbuilding due to increased spreading of fixed overhead costs and reduced loss of learning between ships, see CRS Report 96-785, *Navy Major Shipbuilding Programs and Shipbuilders: Issues and Options for Congress*, by Ronald O'Rourke. The report is out of print and is available directly from the author.

¹⁶In the FY2005 budget submission, the two Virginia-class boats programmed for FY2009 have an estimated total procurement cost of \$4,940.1 million, or an average of \$2,470.0 million per boat, while the one Virginia-class boat programmed for FY2008 has an estimated total procurement cost of \$2,593.5 million. The difference in unit procurement costs between the two years is \$123.5 million. The FY2008 boat, moreover, is being procured under a MYP arrangement that is reducing its cost by roughly \$80 million, while the estimated procurement cost for the two FY2009 boats may not reflect an assumed follow-on MYP. If so, then increasing the cost of the FY2008 boat to set aside differences due to use or non-use of MYP, and thereby arrive at a more apples-to-apples comparison, would increase the cost of that boat (and consequently the difference in unit procurement costs between that boat and the FY2009 boats) by about \$80 million, for a total difference of more than \$200 million. (This figure might be increased by another 2%, reflecting an average 2% difference in purchasing power between the then-year dollars used to build a boat procured in FY2008 vs. the then-year dollars used to build boats procured in FY2009.) The cost difference might then be adjusted downward to reflect the later position on the production learning curve of the FY2009 boats compared to the FY2008 boat.

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Industrial-Base Considerations

A fourth factor to consider in determining the rate at which Virginia-class submarines should be procured in future years is the submarine construction industrial base, which currently includes something more than one complete submarine production line divided between two shipyards (General Dynamics Electric Boat [GD/EB] and Northrop Grumman Newport News [NGNN]),¹⁷ plus an array of material and component suppliers, many of which are sole sources. Industrial-base considerations include the following:

- the minimum annual production rate for maintaining the submarine construction industrial base;
- the maximum annual production rate that could be achieved by the submarine construction industrial base; and
- potential inefficiencies resulting from certain kinds of year-to-year changes in the annual submarine procurement rate.

Minimum Production Rate. The current one-per-year Virginia-class procurement rate appears to have been sufficient, in conjunction with other supporting forms of work (including aircraft carrier procurement and SSGN conversions),¹⁸ to maintain the submarine construction industrial base in recent years. The submarine construction industrial base also appears to have managed the one-year hiatus in Virginia-class procurement in FY2000, suggesting the industrial base might be able to manage occasional one-year gaps in the future. In contrast, the submarine construction industrial base appears to have had greater difficulty managing the longer gaps in submarine procurement that occurred in the 1990s.

This experience suggests that the minimum annual procurement rate for sustaining the

¹⁶(...continued)

In the FY2004 budget submission, on the other hand, the two Virginia-class boats programmed for FY2007 had an estimated procurement cost of \$4,424.0 million, or an average of \$2,212.0 million per boat, while the one Virginia-class boat programmed for FY2006 had an estimated total procurement cost of \$2,220.8 million. In this case, moving from one boat per year to two boats per year did not appear to produce a significant apparent reduction in unit procurement cost.

The FY2004 and FY2005 budget submissions can also be compared against one another to examine differences in estimated unit costs for procuring one boat per year in FY2007 and FY2008 (as in the FY2005 submission) vs. two boats per year in FY2007 and FY2008 (as in the FY2004 submissions). This comparison is more difficult to make because the two submissions appear to reflect different understandings of what Virginia-class boats would cost to procure at any annual rate (with estimated costs in the FY2005 submission generally higher). Attempting to adjust for the different understandings, however, suggests that increasing the procurement rate from one ship per year to two ships per year might reduce unit procurement cost by more than \$100 million, and possibly more than \$200 million.

¹⁷Under the current joint-production arrangement for the Virginia class, the two yards each maintain facilities for building submarine reactor compartments and for carrying out final assembly and testing of submarines.

¹⁸Procurement of aircraft carriers results in additional nuclear-ship construction work at NGNN and additional work for nuclear-propulsion component suppliers. The SSGN conversion program includes manufacturing of components for the SSGN conversions. The SSGN conversions are being carried out at government-operated naval shipyards at Norfolk, VA, and Bremerton, WA.

submarine construction industrial base in its current form might be one boat per year, or perhaps something a bit less than one per year (as a result of occasional single-year gaps in procurement), provided that other supporting forms of work, including aircraft carrier construction, are also funded.

A procurement rate of significantly less than one per year, in contrast, might not be sufficient to maintain the submarine construction industrial base in its current form. Under this scenario, critical supplier firms might be at risk of going out of business, and shipyard workers with skills critical to submarine construction might need to be laid off. Navy and industry officials have cautioned on many occasions since the 1990s that reconstituting parts of the submarine construction industrial base following a period of very-low-rate procurement could require substantial time and cost due to the need to create and certify replacement supplier firms and hire and train new submarine construction workers.

Maximum Annual Production Rate. In the mid-1990s, GD/EB officials stated that their shipyard could build a maximum of three attack submarines per year, while officials at Newport News Shipbuilding (now NGNN The report is out of print and is available directly from the author.) stated that their shipyard could build a maximum of four attack submarines per year, making for a combined maximum production capability of seven attack submarines per year.¹⁹

In the years since then, the two shipyards have streamlined their operations to bring them more into alignment with the current one-per-year submarine procurement rate. In doing so, however, the two yards do not appear to have taken any steps (such as selling critical parcels of land that would be needed for additional production facilities) that would prevent them from returning to higher rates of production. Officials at both yards state that they could return to a combined rate of four or more submarines per year.²⁰

The supplier base for submarine construction was reduced during the 1990s to bring it into alignment with the current one-per-year submarine procurement rate. Building the supplier base back up to support a procurement rate of three or four boats per year is possible. It would, however, require time and money, particularly for nuclear propulsion plant component suppliers. Increasing the production capacity of the nuclear component supplier base to support a procurement rate of three or four submarines per year would require an investment of roughly \$100 million (for a rate of three submarines per year) or \$200 million (for a rate of four submarines per year). If the procurement rate is increased to three or four per year prior to FY2011 (as it would be under some of the notional profiles shown in **Table 3**), some of the submarines procured in those years would

¹⁹Source: CRS Report 96-785, *Navy Major Shipbuilding Programs and Shipbuilders: Issues and Options for Congress*, by Ronald O'Rourke. The report is out of print and is available directly from the author. The figures were based on interviews with officials from the two shipyards. The figure for GD/EB pertained to its Land Level Construction Facility (LLCF); additional submarines could be built at GD/EB's older inclined building ways. The figure for Newport News Shipbuilding pertained to its Modular Outfitting Facility (MOF); additional submarines could be built at the yard's graving docks. As noted in the 1996 CRS report, achieving and maintaining these maximum rates could require the yards to curtail or eliminate other forms of work, or result in levels of employment at the yards that could strain the managerial and supervisory capabilities of the yards. The figures also did not take into account possible capacity limitations in critical supplier firms that could prevent these rates from being achieved.

²⁰Source: CRS telephone conversations with General Dynamics and Northrop Grumman officials, May 4, 2004.

take a year or more longer to build than usual due to nuclear component supplier bottlenecks.²¹

Inefficiencies From Certain Year-to-Year Rate Changes. Moving abruptly from a lower annual production rate to a higher rate (i.e., moving from one boat in a given year to three or four boats the following years) can lead to transitional strains at the shipyards and suppliers as they attempt to increase their production facilities and hire and train large numbers of new workers. Such strains can lead to production inefficiencies and higher costs. The notional procurement profiles in **Table 3** avoid such abrupt jumps by increasing the procurement rate from one year to the next by no more than one boat per year.

Procurement profiles that, within a period of a few years, reduce the procurement rate significantly and then increase it again (even by no more than one boat per year) can lead to production inefficiencies and higher costs due to the need to either keep skilled workers on the payroll during the period of decline, or to hire and train new workers during the subsequent period of increase. Notional examples of such “roller coaster” procurement profiles might be 2-0-1-2, 3-1-2-3, or 4-2-1-2-3. The notional procurement profiles in **Table 3** attempt to avoid such profiles, though they all drop to zero boats per year by the late 2020s.

Other Defense Spending Priorities

A fifth factor to consider in determining the rate at which Virginia-class submarines should be procured in future years is the need for the Department of the Navy, and DOD generally, to provide funding for various programs other than submarine procurement within a budget of a certain size. In considering these other defense spending priorities, a key question is how the risks of procuring fewer SSNs than preferred might compare to the risks of providing less funding than desired for one or more other priorities.

Mr. Chairman, distinguished members of the subcommittee, this concludes my testimony. Thank you again for the opportunity to appear before you to discuss these issues. I will be pleased to respond to any questions you might have.

²¹Source: Information provided to CRS by Naval Nuclear Propulsion Office (NAVSEA-08H), May 5, 2004.

Appendix A. Factors Affecting the SSN Force-Level Goal

This appendix discusses factors influencing the SSN force-level goal.

Summary Of Key Points

Key points discussed in this appendix include the following:

- Some Navy submarine officers in recent years have argued that an attack submarine force of roughly 55 boats — the approximate number in the force in recent years — is insufficient to meet day-to-day demands for attack submarines from U.S. regional military combatant commanders, at least not without operating attack submarines at higher-than-desired operational tempos. Much of the day-to-day demand for attack submarines appears to be for performing ISR missions. A force of 70 or more submarines, Navy submarine officers and DOD officials have argued or implied, would be needed to meet all day-to-day demands for attack submarines, at least not without operating attack submarines at an elevated operational tempo.
- Recent major U.S. warfighting operations have used relatively small numbers of attack submarines — about a dozen or less in each case. Certain potential future major U.S. warfighting scenarios, such as a conflict on the Korean Peninsula or a conflict with China, may feature a greater maritime component and consequently require a larger number of attack submarines.
- Submarine-launched unmanned underwater vehicles (UUVs), by permitting each submarine to perform a greater number of underwater missions at the same time, could, other things held equal, be used to argue in favor of having fewer attack submarines. On the other hand, submarine-launched unmanned air vehicles (UAVs), by permitting attack submarines to perform overhead and deep-inland ISR operations now performed by satellites or by aircraft launched from land bases and surface ships, could, other things held equal, be used to argue in favor of having more attack submarines.
- Homeporting up to eight additional attack submarines at Guam (beyond the three already homeported there) and operating attack submarines with dual or multiple crews — both suggested by the Congressional Budget Office (CBO) in a March 2002 report²² — could, other things held equal, reduce the number of attack submarines needed to perform a given set of submarine missions and consequently could, other things held equal, be used to argue in favor of having fewer attack submarines.
- Converting two or four additional Trident SSBNs into SSGNs (beyond the four already planned for conversion) could, other things held equal, reduce at the margin the number of attack submarines needed to perform a given set of submarine

²²U.S. Congressional Budget Office, *Increasing the Mission Capability of the Attack Submarine Force*, Mar. 2002.

missions and consequently could, other things held equal, be used to argue in favor of having fewer attack submarines. The opportunity to convert two or four additional Trident SSBNs into SSGNs would depend on a decision to reduce the SSBN force from the currently planned total of 14 ships to 12 or 10 ships.

- Submarines from allied and friendly countries, particularly the United Kingdom (UK) and Australia, might occasionally be able to perform missions that might otherwise be performed by U.S. attack submarines and thereby reduce requirements for U.S. attack submarines. The reduction in requirements for U.S. attack submarines, however, might be fairly small, and planning U.S. forces on the assumption that foreign submarines will be available to perform these missions entails some risk, given inherent uncertainty over the future policies of foreign governments.

Factors To Consider

In considering what the attack submarine force-level goal should be, key factors to consider include the following:

- day-to-day demands for attack submarines in recent years;
- recent and potential wartime demands for attack submarines;
- submarine-launched unmanned vehicles (UVs);
- attack submarine homeporting and crewing arrangements;
- the SSGN conversion program; and
- contributions by allied and friendly attack submarines.

Each of these factors is discussed below.

Day-to-Day Demands for SSNs in Recent Years

In General. Some Navy submarine officers and DOD officials in recent years have argued that an attack submarine force of roughly 55 boats — the approximate number in the force in recent years — is insufficient to meet day-to-day demands for attack submarines from U.S. regional military combatant commanders, at least not without operating attack submarines at higher-than-desired operational tempos. Navy submarine admirals have stated that since the end of the Cold War, demands for attack submarines from regional U.S. commanders have increased, not decreased, that some demands for attack submarines are going unfilled, and that the high operational tempo of the attack submarine force could reduce time available for training and expend submarine reactor core life more quickly than planned, potentially shortening attack submarine service lives.

In November 2004, Admiral Frank Bowman, who was Director of the Navy's nuclear propulsion program until November 5, 2004, stated that U.S. theater combatant commanders want the equivalent of 15 attack submarines to be on station continuously, but that the 54-boat attack submarine force at that time was sufficient to provide only about 9.²³

²³Christopher P. Cavas, “[Interview With] Adm. Frank “Skip” Bowman,” *Defense News*, Nov. 29, 2004, p. (continued...)

The reference to the Navy being able to provide about nine attack submarines refers to the fraction of the attack submarine force that, on average over the long run, can be maintained on station in overseas operating areas at any given moment. The Navy reported to CRS in 1999 that, on a global basis, an average of 5.8 attack submarines are needed to keep one attack submarine continuously on station in a distant operating area. This attack submarine “stationkeeping multiplier” changed little between 1992 and 2002, and is broadly consistent with the stationkeeping multipliers for other kinds of Navy ships.²⁴ Using this multiplier, keeping a total of about 9 attack submarines continuously on station in overseas operating areas would nominally require a total attack submarine force of about 52 boats, and keeping 15 boats continuously on station would require a total force of 87 boats.

In July 2004, Admiral Bowman stated that the theater commanders wanted the equivalent of 13.5 attack submarines to be on station continuously in six different theaters of operation, but that the 54-boat attack submarine force at that time was sufficient to provide only about 9.²⁵ In June 2004, he similarly stated that the theater commanders “asked for a continuous forward presence of more than 13 boats, whereas today’s force structure can only provide around 9.”²⁶ Also in June 2004, then-Vice Admiral Kirk Donald, who at the time was the commander of the Navy’s submarine forces, stated: “With our current force structure, depot maintenance workload, and an interdeployment readiness cycle tuned to be as efficient as we can make it, we can provide the Combatant Commanders with about 65% of the ‘presence with a purpose’ they requested.”²⁷ (In November 2004, Donald succeeded Bowman as Director of the Navy’s nuclear propulsion program and was promoted to full admiral.)

In March 2004, Admiral Bowman stated that “Today the navy is unable to meet all the combatant commanders’ submarine requirements” and that “only about 65% of requirements can be met.”²⁸ In September 2003, John Grossenbacher, a recently retired Navy submarine admiral, stated

²³(...continued)

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²⁴Source: Navy Office of Legislative Affairs (NOLA) point paper to CRS of March 25, 1999 (record number LA-586-002), and NOLA e-mail to CRS of December 17, 2002, stating that the figures in the 1999 point paper had not changed significantly. An NOLA point paper to CRS dated August 8, 1996, stated that the global stationkeeping multiplier for attack submarines was 5.8. An NOLA point paper to CRS dated September 10, 1992, stated that the number was 5.7. The 1992 figure was published by CRS in CRS Report 92-803 F, *Naval Forward Deployments and the Size of the Navy* (out of print; for a copy, contact the author at 707-7610), by Ronald O’Rourke.

²⁵Robert A. Hamilton, “New War Brings New Debate over Size of Submarine Fleet,” *New London (CT) Day*, July 5, 2004. In Aug. 2004, Rear Admiral Paul F. Sullivan, the commander of the submarine force of the U.S. Pacific Fleet, said that “At any given time, roughly eight to 10 of the Navy’s submarines are able to resound to emergent fleet requirements.” (David Rush, et al., “Submarines Vital To Navy’s Fleet Response Plan,” *Navy Newsstand* [<http://www.news.navy.mil/>], Aug. 19, 2004.

²⁶“Naval Submarine League Symposium, [Text of] Keynote Address By Admiral F. L. “Skip” Bowman, U.S. Navy, Director, Naval Nuclear Propulsion, June 9, 2004,” *Submarine Review*, July 2004.

²⁷“Naval Submarine League Symposium Remarks by VADM Kirk Donald, 09 June 2004,” *The Submarine Review*, July 2004, p. 83.

²⁸ Andrew Koch, “[Interview with] Adm. Frank Bowman, Director of US Naval Nuclear Reactors,” *Jane’s* (continued...)

that attack submarines are more in demand than at any time in the Cold War, that the attack submarine force is “about as thin as we can be and still maintain a worldwide deployable and world class submarine force,” and that as the force declines in size, some demands for submarines to perform covert ISR missions may go unmet.²⁹

In June 2003, a senior DOD official wrote a letter to the General Accounting Office stating: “Combatant commanders have requested 14.4 SSNs for [calendar year 2003] for national and

²⁸(...continued)

Defence Weekly, Mar. 31, 2004. The article stated:

[Admiral] Frank Bowman, director of US Naval Nuclear Reactors, the service’s senior submariner, says he “fully supports those studies” if they lead to a reduction in what is being asked of the force. “Today the navy is unable to meet all the combatant commanders’ submarine requirements,” Adm Bowman says, explaining that “only about 65% of requirements can be met. There is prima facie evidence in the real world that to execute the missions those commanders have been assigned, they need these submarines.

“I would not oppose a finding that said some of the submarine tasking today can be assigned to other [existing] platforms or future platforms because it would ease the tension between the desires of the combatant commanders and the [submarine] inventory and therefore the ability of the navy to meet those requirements,” Adm Bowman says.

One area being considered is whether intelligence, surveillance and reconnaissance (ISR) missions can be performed by other means, such as distributed sensor networks. Adm Bowman says he would like “to perhaps find some relief for our submarines so that missions of higher priority that we are not able to do today because of the ISR [taskings] could be [taken on].”

Except for “[Admiral],” material above in italics and brackets below appears as in the original.

²⁹ Robert A. Hamilton, “Lack of Subs Could Slow Pace of Technology, Admiral Warns,” *New London (CT) Day*, Sept. 30, 2003. The article stated:

From almost 100 submarines in the early 1990s, the number has fallen steadily to just over 50, and their services are more in demand than at any time in the Cold War, said Vice Adm. John J. Grossenbacher, who retired as commander of Naval Submarine Forces this month....

Grossenbacher said several studies that have looked at submarine force requirements have set the minimum size of the fleet at 68 to 72 submarines. Studies by other groups have set a smaller number, but he called them “misinformed,” and often don’t allow for sufficient time between deployments....

“The problem we have today is just numbers,” Grossenbacher said. “We don’t have enough. ... In my opinion, we’re about as thin as we can be and still maintain a worldwide deployable and world class submarine force.”

As the size of the force continues to decline — the Navy is building one submarine a year, which will eventually result in a force of 30 boats — Grossenbacher said some requests for the covert surveillance services that submarines provide are going to “drop off the plate.”

“The question becomes, ‘What is it that you don’t want to know?’” Grossenbacher said.

combatant commander intelligence, surveillance and reconnaissance (ISR), Tomahawk strike, carrier battlegroup support, and Special Operations Forces equipped SSN missions.” The letter also stated that “Considering the sustainability and training requirements given its current SSN force structure, the Navy is able to provide 10.0 of the requested 14.4 SSNs deployed annually.”³⁰

In June 2003, Admiral Grossenbacher (then still on active duty) stated that the attack submarine force was operating at its maximum rate but that this was still insufficient to meet day-to-day demands for attack submarines. He stated that the Navy would need about 70 attack submarines to meet the demands being placed on the force.³¹ Another submarine admiral, in a different article, stated the same month that attack submarine operational tempo was about 15 percent to 20 percent

³⁰Hunter Keeter, “DOD Answers Concerns over Virginia-class Multiyear, Details Sub Force Shortfalls,” *Defense Daily*, June 27, 2003. The article stated:

Glenn Lamartin, director of defense programs with the office of the undersecretary of defense, in a June 23 letter to [the General Accounting Office], outlined that “the pre-9/11 demand was 9.9 SSNs and the post 9/11 demand has been 12.9 SSNs.”

“Combatant commanders have requested 14.4 SSNs for [calendar year 2003] for national and combatant commander intelligence, surveillance and reconnaissance (ISR), Tomahawk strike, carrier battlegroup support, and Special Operations Forces equipped SSN missions,” Lamartin wrote.

“Considering the sustainability and training requirements given its current SSN force structure, the Navy is able to provide 10.0 of the requested 14.4 SSNs deployed annually.”...

Citing a 1999 study by the Joint Chiefs of Staff, Lamartin said that dropping below 55 attack submarines in the 2015 time frame and 62 in the 2025 time frame would leave regional warfighting commanders “with insufficient capability to respond to urgent crucial demands without gapping other requirements of high national interest.”

³¹Jason Ma, “Grossenbacher: Sub Force Is Operating at Fastest, Sustainable Pace,” *Inside the Navy*, June 23, 2003. The article stated:

The submarine force is operating at a maximum rate that still maintains a surge capability, but that is still not enough to meet the needs of operational commanders, said Vice Adm. John Grossenbacher, commander of naval submarine forces.

Instead of the current 54 attack subs, the Navy really needs 70, he said at the Naval Submarine League’s conference June 11 in Alexandria, VA. But with 54, “operational commanders are not getting all that they need” and the sub forces are struggling to support tactical development, operational testing and long-term “self-investments,” he said.

Grossenbacher and Rear Adm. John Padgett, commander of submarine forces in the Pacific Fleet, closely monitor the fuel expenditure of the subs to meet wartime demands or surges. To avoid early depletion of the reactor core, they would reduce operations if necessary, he said. “We’re walking that fine line right now,” he added.

“I think we’re getting about as much as we can out of the force and running them at the fastest pace that we can sustain over time, maintain long-term readiness, as well as something in the bank for surges,” Grossenbacher said.

higher than preferred, and that this could affect the amount of time available for training.³²

In March 2003, Admiral Bowman stated that the high operational tempo for attack submarines has been using up reactor core life faster than planned and that as a result, Los Angeles-class submarines may need to be retired earlier than expected.³³ And in January 2003, Admiral

³²Jason Ma, “Admiral: Subs Must Be Both Surge-Ready and Deployed Forward,” *Inside the Navy*, June 16, 2003. The article stated:

In preparing for increased surge capability, the submarine force must also remain deployed forward and should avoid becoming a “garrison force,” said Rear Adm. John Padgett, commander of submarine forces in the Pacific Fleet.

Chief of Naval Operations Adm. Vern Clark’s “Fleet Response Plan” calls for a more responsive fleet that can surge a large number of ships on short notice, requiring new maintenance and training cycles to achieve increased readiness and availability.

Submarines are forward-deployed to support battle space preparations and to ensure that operators understand the battle space, Padgett said at the Naval Submarine League’s annual conference last week in Alexandria, VA.

“I am concerned that the surge mentality might become a bastion mentality,” he said. “I would argue, from my perspective, that we do not need a garrison force submarine force. We need to remain a forward-deployed force.”

Submarines must maintain forward deployment because they conduct much of their training with the navies of allied countries in the Western Pacific like Japan, South Korea, Singapore and Australia, Padgett said. Such training includes scenarios with diesel submarines, a threat that some Navy officials have noted is becoming more sophisticated. ...

Ultimately, force structure dictates the ability to forward deploy subs, and the Navy needs more subs, he said. Having submarine homeports in Guam and Japan partly addresses the lack of enough subs, but the operational tempo is about 15 percent to 20 percent higher than what he would like, affecting training and maintenance, he said. Although the Navy is managing the shortfall in subs, the tendency is to put operational requirements over exercise requirements, which could have a “detrimental effect.” The problem is Navy-wide and not unique to the sub forces, he added.

³³Jason Ma, “Industry, Navy Officials Push to Boost Annual Submarine Buy Rate,” *Inside the Navy*, Mar. 3, 2003. The article stated:

The Los Angeles-class subs may retire sooner than expected, [Admiral Frank Bowman] said.... Because demand for subs has increased since the war on terrorism, the submarine fleet has been operating longer and at faster speeds than usual. If that continues, sub reactor cores will not last for the expected 30 years, he said.

Attack submarines are nearing a 90 percent operational tempo and are transiting at 20 knots rather than 16 knots, he said. The ratio of time in port to time deployed is about 2-to-1 instead of 3-to-1 before the war on terrorism, he added.

(continued...)

Grossenbacher stated that demands for submarines to perform covert ISR missions has been high since the terrorist attacks of September 11, 2001, and that the attack submarine force was having to turn down some requests for attack submarines from regional combatant commanders due to insufficient forces.³⁴

Articles making similar points have been published since the mid-1990s, and particularly since 1999, when the attack submarine force declined to less than 60 boats.³⁵

³³(...continued)

“Something’s got to give; something will give,” Bowman said. “So we’re trying to make ends meet, but what’s going to give at the end of the day is the reactor core endurance.”

See also Dale Eisman, “Subs Could Be Exhausted Early if Heavy Usage Continues,” *Norfolk Virginian-Pilot*, Feb. 26, 2003; David Lerman, “Attack Subs May Be in Too Deep,” *Newport News Daily Press*, Feb. 26, 2003.

³⁴ Matthew Dolan, “Subs in High Demand, Force Commander Says,” *Norfolk Virginian-Pilot*, Jan. 27, 2003. The article stated:

Submarines have been pushed so hard in the war on terrorism that the Navy is having to turn down requests from combat commanders around the world....

The stealthy ability of submarines to engage in surveillance, reconnaissance and intelligence gathering has been in high demand since the Sept. 11 attacks, [Admiral Grossenbacher] said....

“The current operational tempo that we’re operating at is manageable, but I’d like it to be lower. It’s not a crisis.”

³⁵For examples between November 1994 and January 2003, see the following: Jason Ma, “Grossenbacher: Subs Can Maintain Optempo a ‘Couple More Years,’” *Inside the Navy*, Nov. 25, 2002; Vernon Loeb, “Espionage Demands Prod Navy on Sub Construction,” *Washington Post*, July 5, 2002: 19; Randy Woods, “Atlantic, Pacific Admirals Say Subs Cannot Sustain Current Optempo,” *Inside the Navy*, June 17, 2002; Greg Jaffe, “Overuse of Nuclear Submarines Risks Burning up Reactor Cores,” *Wall Street Journal*, June 26, 2002; Andrew Koch, “USN SSN Force Faces Overstretch,” *Jane’s Defence Weekly*, June 19, 2002; Hunter Keeter, “Bowman: Submarine Force Level Inadequate to Meet Requirements,” *Defense Daily*, June 13, 2002; Christian Bohmfalk, “Basing Attack Subs on Guam Expected to Increase Fleet’s Presence,” *Inside the Navy*, Feb. 12, 2001; Robert Holzer, “With Limited Subs, U.S. Navy Looks Westward to Guam,” *Defense News*, August 28, 2000: 4; Robert Burns, “U.S. Considers Increase in Submarine Fleet, Mainly for Spy Role,” *Fort Worth Star-Telegram*, August 18, 2000; David Brown, “Officials Sound Alarm on Sub Shortage,” *Navy Times*, July 10, 2000: 20; Albert H. Konetzni, Jr. “‘Two Diverging Paths’ for Pacific Fleet Submarine Force,” *Sea Power*, July 2000: 29; Frank Wolfe, “Submarine Commanders Want 75 Fast Attack Subs for Missions, Exercises,” *Defense Daily*, June 28, 2000: 5; Hunter Keeter, “Konetzni: Navy Needs Greater Funding Commitment to Submarine Force,” *Defense Daily*, June 16, 2000: 7; Robert Holzer, “Intelligence Operations Suffer as Submarine Fleet Dwindles,” *Defense News*, April 17, 2000: 1, 36; Robert Holzer, “Utility of Subs Rises as Targeting Grows More Precise,” *Defense News*, April 10, 2000: 17; Josh Corless, “Numbers Count as Submarine Commitments Stretch USN,” *Jane’s Navy International*, March 2000: 18-24; Robert A. Hamilton, “Support Growing for More Submarines,” *New London (CT) Day*, March 7, 2000; Mike Gordon, “Opposition Surfaces, ‘Silent Service’ Says No to Further Cuts,” *Navy Times*, January 17, 2000: 14-16; Bradley Graham, “Pentagon Warns Against Cutting Attack Sub Fleet,” *Washington Post*, January 4, 2000: 3; Robert Holzer, “U.S. Submariners Urge Halt to Dwindling Fleet,” *Defense News*, June 28, 1999: 6; David Abel, “Some Say US Sub Force Is Spread Too Thin,” *Boston Globe*, June 28, 1999: 5;

(continued...)

ISR Operations In Particular. ISR operations appear to form a key part of the discussion over day-to-day demands for attack submarines. The 2004 internal Navy study that reportedly recommended reducing the attack submarine force-level goal to as few as 37 boats reportedly recommended using satellites to perform ISR missions now done by attack submarines.

Submarine ISR operations are a sensitive issue that is rarely discussed in public in any detail. Some general comments about the matter, however, can be made.

One set of comments concerns the relative merits of SSNs as ISR platforms. SSNs offer three basic strengths as platforms for performing ISR missions. One is that they can perform such missions without their presence being detected by ISR targets, increasing the chance of getting candid observations of the targets. Potential ISR targets can consult reference sources on satellite orbits to understand when certain satellites are likely to be overhead, or use radar to detect and track aircraft flying nearby. Armed with this information, ISR targets can take steps to conceal objects or to alter or avoid certain activities. In contrast, U.S. Navy submarines operating stealthily are very difficult, if not impossible, for ISR targets to detect, increasing the chance that the targets will behave candidly.

A second advantage of SSNs as ISR platforms is persistence on station. Low-orbiting satellites can view a particular area only periodically as they pass overhead, and perhaps only for a few minutes at a time. Aircraft might be able to remain airborne in a viewing position for a matter of hours before needing to return to base. An SSN, in contrast, can remain on station in a viewing location continuously for days, weeks, or even months at a time, permitting the SSN to detect and provide evidence of patterns of behavior that may be discernible only through continuous observation over an extended period of time.

A third advantage of SSNs as ISR platforms is their viewing position offshore and just under the surface of the water. This position permits them to observe certain ISR targets — particularly ports, coastal areas, surface ships, other submarines, and underwater mines — at potentially close ranges, permitting the collection of detailed information on these targets.

SSNs, however, have two basic limitations as platforms for performing ISR missions. One concerns overhead observations, which can be helpful or even critical in understanding the totality of objects or activities being observed in a certain area. Satellites and aircraft are inherently capable of performing overhead observations, but SSNs are not. SSNs observe land targets from the side, but cannot observe the totality of objects or activities in a certain area.

A second disadvantage of SSNs as ISR platforms concerns imaging inland areas. Satellites and aircraft are inherently capable of imaging inland areas, but SSNs have relatively little ability to do

³⁵(...continued)

Josh Corless, "Problems Beneath the Waves," *Jane's Navy International*, June 1999: 10; Robert Holzer, "Overwork Strains U.S. Sub Fleet," *Defense News*, March 15, 1999: 4, 42; Robert Karniol, "Intelligence Rises for US Pacific Subs," *Jane's Defence Weekly*, December 16, 1998: 13; Frank Wolfe, "Navy Fears Drop Below 50 Attack Submarines," *Defense Daily*, June 15, 1998: 6-7; Bryan Bender, "U.S. Submarine Operations Rise Since End of Cold War," *Defense Daily*, November 1, 1996: 183; Robert Holzer, "Study Reveals U.S. Sub Force Flaws," *Defense News*, June 10-16, 1996: 3; "Navy Sub Community Pushes for More Subs than Bottom-up Review Allowed," *Inside the Navy*, November 7, 1994: 1, 8-9.

this. From their position just below the water's surface, SSNs in general can collect images of objects that are no further inland than the first row of buildings or the first row of hills.

A second general comment about submarine ISR operations concerns how the universe of ISR targets may have changed since the end of the Cold War. The end of the Cold War may have reduced demands for ISR missions against what is now Russia, but may have increased demands for ISR missions against both countries other than Russia and non-state actors such as terrorist organizations.

A third general comment concerns the relationship of ISR missions to the attack submarine force-level requirement. It is plausible that ISR missions by themselves might generate a requirement for a relatively large attack submarine force, particularly if those ISR missions require extended or continuous observations of intelligence targets. Performing such missions brings the attack submarine stationkeeping multiplier into play, and as explained earlier, only nine or 10 missions requiring continuous attack submarine presences in overseas operating areas would be needed to generate an attack submarine force level of about 55.

ISR missions, however, are not necessarily the only day-to-day missions that might require attack submarines to remain on station on an extended or continuous basis. Examples of other missions that might require such operations include protection of forward-deployed Navy surface ships, covert insertion and recovery of special operations forces, and Tomahawk strike (i.e., the mission of keeping a certain number of Tomahawks ready in a given region to be fired on short notice if needed — a mission that can also be performed, though not with the same level of covertness, by surface ships).

If submarine supporters are generally correct about the existence and findings of the 2004 internal Navy study on attack submarines (see Background section), then one potential implication is that the authors of this study believe that submarine ISR operations represent the “long pole in the tent” in driving the attack submarine force-level requirement — the only mission requiring a force of 55 or more attack submarines.

If this view is held by the authors of the 2004 internal Navy study, however, it is not necessarily shared by all others. For example, Admiral Bowman's above-cited comments from March 2004 suggest that even if attack submarine ISR missions are reduced, attack submarines will still have other, and possibly even higher-priority, day-to-day missions to perform.³⁶ This perspective suggests that a force of 55 or more attack submarines might still be needed on a day-to-day basis even if attack submarine ISR missions are reduced.

Recent and Potential Wartime Demands for SSNs

Attack Submarines in Recent Conflicts. Table A-1 summarizes the numbers of U.S. Navy attack submarines reported to have participated in recent major U.S. military operations.

³⁶See the details of Admiral Bowman's comments in the earlier footnote quoting from the Mar. 2004 article.

Table A-1. U.S. SSNs in Recent Major Military Operations

Year	Location	SSNs involved	Comments
1991	Persian Gulf War	13	2 US SSNs fired 12 of 288 Tomahawks used. SSNs also performed war-related ISR missions.
1999	Kosovo	6	1 UK SSN, 1 Italian SS,* and 1 Dutch SS were also involved. Submarines were used for sea control. Four SSNs (3 US; 1 UK) fired some portion of 218 Tomahawks used.
2001-2002	Afghanistan	2	1 UK SSN was also involved. 2 U.S. SSNs fired about 1/3 of 82 Tomahawks used by the U.S. Navy. The UK SSN fired additional Tomahawks. Submarines also conducted war-related ISR, antisubmarine warfare, and anti-surface warfare operations.
2003	Iraq	12	2 UK SSNs were also involved. 12 U.S. and UK SSNs fired about 1/3 of 802 Tomahawks used.

Sources: DOD and Navy reports and press reports; see footnotes for discussions printed below.

* SS = non-nuclear-powered attack submarine.

The following discussions elaborate on the information in the above table.

1991 Persian Gulf War (Desert Shield). A total of 13 U.S. attack submarines were deployed to the Gulf region for the 1991 Gulf War. Two of the submarines launched a total of 12 Tomahawks, or about 4% of the 288 Tomahawks fired in the war.³⁷ A Navy report on the Navy's participation in the Gulf war stated:

During Desert Shield/Storm attack submarines not only fired TLAMs, but provided an array of multimission capabilities to battle group commanders. Prior to and during hostilities, eight SSNs were involved in surveillance and reconnaissance operations. They also provided indications and warning [a form of intelligence about impending enemy actions] for the battle groups. After hostilities began, an additional five submarines bolstered Navy forces already on station.³⁸

1999 Kosovo Conflict (Operation Allied Force). U.S. and allied naval forces participating in this conflict included six U.S. SSNs, one UK SSN, one Italian non-nuclear-powered attack submarine (SS), and one Dutch SS. The mission of all these submarines was described as sea control,³⁹ which means maintaining control of the sea for one's own use while preventing enemy forces from using it for their own purposes. For submarines, this mission typically involves

³⁷ Norman Polmar, *The Naval Institute Guide to the Ships and Aircraft of the U.S. Fleet*, 15th ed. (Annapolis: Naval Institute Press, 1993), p. 63; Norman Polmar, "Going Downtown the Safe Way," *U.S. Naval Institute Proceedings*, Aug. 1992, pp. 105-106.

³⁸ U.S. Department of Defense, Department of the Navy, Office of the Chief of Naval Operations, "*The Untied States Navy in "Desert Shield" [and] "Desert Storm,"*" May 15, 1991, p. 40. Curiously, Appendix B of the report, which presents a list of ships participating in Desert Shield/Storm, includes only five submarines rather than 13.

³⁹ Source: Information sheets on Operation Allied Force provided to CRS by the Joint Staff, October 19, 1999.

conducting antisubmarine and anti-surface ship operations.⁴⁰ A total of 218 Tomahawks were fired in the conflict by six U.S. surface combatants, three U.S. attack submarines, and one UK attack submarine.⁴¹ The UK submarine fired 21 of the Tomahawks.⁴²

2001-2002 War in Afghanistan (Operation Enduring Freedom). Published reports indicate that two U.S. attack submarines and at least one UK attack submarine participated in the war in Afghanistan, that the U.S. submarines launched about one-third of the 82 Tomahawks fired by U.S. Navy ships, and that the U.S. and UK submarines together launched 37% of the more than 82 Tomahawks that were collectively launched by U.S. and UK ships.⁴³ A Navy submarine admiral stated that, in addition to firing Tomahawks, the Navy attack submarines during the war in Afghanistan conducted ISR operations, antisubmarine operations, and anti-surface ship operations, such as maritime intercept operations.⁴⁴ Since Afghanistan is a landlocked country with no navy, the anti-submarine operations were presumably tracking operations against third-party submarines operating in the region.

2003 Iraq War (Operation Iraqi Freedom). At the height of the buildup for the Iraq war, a total of 14 attack submarines — 12 U.S. boats and two UK boats — were in the Iraq theater of operations. Ten U.S. boats were in the Red Sea, while two U.S. and two UK boats were in the Persian Gulf.⁴⁵ Twelve of the 14 submarines launched Tomahawks, accounting for about one-third of the 802 Tomahawks fired in the Iraq war.⁴⁶

⁴⁰The Yugoslav navy at the time had a small number of aging diesel-electric submarines that might have posed a threat to U.S. and allied surface ships.

⁴¹U.S. Department of Defense, *Kosovo/Operation Allied Force After-Action Report*, Jan. 31, 2000, p. 92.

⁴²Slide entitled “Operational Firsts” from a package of briefing slides on the Kosovo operation entitled “A View from the Top: Admiral James O. Ellis, U.S. Navy, Commander-in-Chief, U.S. Naval Forces, Europe, Commander, Allied Forces Southern Europe, Commander, Joint Task Force Noble Anvil during Operation Allied Force.”

⁴³Bill Gertz and Rowan Scarborough, “Navy Message,” *Washington Times*, June 14, 2002, p. 10 [item in the Inside the Ring Column]; Hunter Keeter, “Bowman: Submarine Force Level Inadequate To Meet Requirement,” *Defense Daily*, June 13, 2002; Jason Ma, “Grossenbacher: Subs Can Maintain Optempo a ‘Couple More Years,’” *Inside the Navy*, Nov. 25, 2002. Of the 82 Tomahawks fired by the Navy in the war, 65 were launched during the first two days of the conflict. Greg Seigle, “Experts Fear Shortage of Missiles for War in Iraq,” *Denver Post*, Jan. 5, 2003, p. 1.

⁴⁴“Grossenbacher: Subs Can Maintain Optempo a ‘Couple More Years,’” *Inside the Navy*, Nov. 25, 2002. For additional accounts of Navy attack submarine operations in the war in Afghanistan, mostly in connection with firing Tomahawks, see John E. Mulligan, “Fire! Submarine Providence Helps Counter the Attacks,” *Providence Journal*, Sept. 17, 2002; and Scott Bawden, “Call to Action: A Submarine CO’s Account of the First Hours of the War on Terror,” *Undersea Warfare*, Summer 2002, pp. 12-13.

⁴⁵David Rush and Mark Savage, “Submarine Warriors Return from Operation Iraqi Freedom,” *Undersea Warfare*, Summer 2003, p. 3; “Remarks by CDR Michael Jabaley, Commanding Officer, USS Louisville (SSN 724) to the Naval Submarine League Symposium,” June 11, 2003. *The Submarine Review*, July 2003, p. 66.

⁴⁶Statement of Honorable Gordon R. England, Secretary of the Navy, in U.S. Congress, House Armed Services Committee, Feb. 12, 2004, p. 3; and David Rush and Mark Savage, “Submarine Warriors Return from Operation Iraqi Freedom,” *Undersea Warfare*, Summer 2003, p. 3; Robert A. Hamilton, “USS

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Potential Demands for Attack Submarines in Future Conflicts. Although the recent major U.S. military operations discussed above used relatively small numbers of attack submarines, certain potential future conflicts might feature a greater maritime component and consequently require a larger number of attack submarines. Examples of such potential future conflicts include a war on the Korean Peninsula or a conflict with China.

If China invests significantly in naval modernization for a number of years, it could eventually field a sizeable and fairly modern fleet. Such a fleet would represent the first significant naval competitor to the U.S. Navy since the dissolution of the Soviet Union in 1991 and the subsequent collapse of the large and capable Soviet fleet. Estimates of when China might possess a large and capable fleet, should it choose to build one, vary from as early as several years from now to as late as roughly 2030. A CRS report discusses this issue in greater detail.⁴⁷

As mentioned earlier, the 1999 JCS study on requirements for attack submarines concluded that a force of 55 SSNs in 2015 and 62 in 2025 “would be sufficient to meet the modeled war fighting requirements.” One suggestion of this conclusion is that a force of less than 55 boats might not be sufficient to meet the modeled warfighting requirements. If so, this conclusion contrasts with the reported conclusion of the previously mentioned 2004 internal Navy study that a force of as few as 37 submarines would be sufficient to meet warfighting requirements.

Submarine-Launched Unmanned Vehicles (UVs)

Submarine-launched UVs promise to “extend their eyes and ears” of submarines and give them the ability to perform multiple missions at the same time. Submarine-launched UVs could lead to arguments in favor of having either larger or smaller numbers of attack submarines. On the one hand, UVs, by increasing the capabilities of attack submarines, could make attack submarines more cost effective as platforms, which could argue in favor of having more of them in the fleet. On the other hand, UVs, by increasing the capabilities of attack submarines (and SSGNs), could permit a smaller number of attack submarines (in conjunction with SSGNs) to perform a given set of submarine missions, which could argue in favor of having fewer attack submarines in the fleet.

Unmanned Underwater Vehicles (UUVs). As mentioned earlier, a 2004 internal Navy study that reportedly recommended reducing the attack submarine force-level goal to as few as 37 boats reportedly recommended using unmanned underwater vehicles (UUVs) to perform ISR missions now done by attack submarines.

Public comments from Navy officials similarly suggest that the Navy may be focusing on the potential for submarine-launched UUVs to permit a reduction in the number of attack submarines needed to perform a given set of underwater submarine missions. For example, at a hearing before the Projection Forces subcommittee of the House Armed Services Committee on March 30, 2004,

⁴⁶(...continued)

Pittsburgh Pave the Way for Submarines to Fire on Iraq,” *New London (CT) Day*, Sept. 21, 2003; Hunter Keeter, “Bowman: Undersea Communications Top Priority for Sub Force Transformation,” *Defense Daily*, June 12, 2003.

⁴⁷See CRS Report RL33153, *China Naval Modernization: Implications for U.S. Navy Capabilities — Background and Issues for Congress*, by Ronald O’Rourke.

Vice Admiral John Nathman, Deputy Chief of Naval Operations for Warfare Requirements and Programs — that is, the Navy’s chief officer for determining Navy requirements — stated the following in answer to a question from Representative Langevin about submarine procurement and the future size of the attack submarine fleet:

I think everyone should appreciate — and I come back to what the chairman has asked before about unmanned, underwater vehicles. But there are a lot of dynamics in how you build force structure requirements for the submarine force.

Right now currently it is built on war-fighting and this compelling need by the intelligence community for a distributed ISR surveillance capability that our submarines bring because of their ability to get into those access areas.

The other debates that I see inside of this is there is a tremendous requirement for intelligence preparation of the battlespace, again because of the submarine’s covertness to get into those parts of the battlespace, as they build that battlespace preparation before a conflict. And at the same time, there is this dynamic of adding SSGNs to our budget over the last several years, buying four of those. And then how do you leverage the [payload] volume of SSGN and trying to understand what your total submarine force structure ought to be?

And I will make this point about ISR right now. Submarines do that very well. And they do it for national needs primarily.

But it seems to make sense to me that if you are going to be asked to take a very high value, very expensive, very complex device and — like a submarine — and keep it in a constrained battlespace so that it can detect certain communications and signals intelligence in a very confined area, that we might be better off in the near term looking at investments in leveraging the volume of SSGN to putting unmanned, underwater vehicles in those very same places.

A submarine would probably be the delivery vehicle. But it could be an SSGN or it could be an SSBN.

So why couldn’t you leverage the force structure that you need by taking more of this requirement and going offboard into unmanned, underwater vehicles and that potentially leveraging the investment in SSGNs the same way.

So this is part of the debate we are having. We are having that debate now in an underwater sea superiority study with the joint staff and our own significant study, as you would expect, another study that says let’s look at our total force structure requirements around the capabilities that we will need in these very specific fights that we have been looking at, that we see in the future.

So this is the kind of rigor that we are trying to get to, sir, to understand what that force structure requirement should be so we don’t under- or overinvest in the total size of our submarine force.⁴⁸

⁴⁸Source: Transcript of hearing as provided by Federal Document Clearing House, Inc. See also Jason Ma, “Navy Mulls UUVs Taking over Attack Subs’ Surveillance Missions,” *Inside the Navy*, Apr. 5, 2004. For more on Navy UV programs, see CRS Report RS21294, *Unmanned Vehicles for U.S. Naval Forces: Background and Issues for Congress*, by Ronald O’Rourke.

Unmanned Air Vehicles (UAVs). Equipping attack submarines with unmanned air vehicles (UAVs) would give attack submarines an ability to conduct deep-inland and overhead observations, potentially permitting attack submarines to perform ISR missions now performed by satellites or by aircraft.

Compared to the option of performing these missions with satellites, the option of performing them with submarine-launched UAVs offers potential advantages in terms of greater persistence over the ISR target (hours for the UAV vs. perhaps minutes for the satellite) and less predictability about when the observations are made.

Compared to the option of performing these missions with manned aircraft or UAVs launched from land bases or surface ships, the option of performing them with submarine-launched UAVs offers three potential advantages:

- **In-theater land bases.** In-theater land bases for U.S. manned aircraft or UAVs may not always be available. When such bases are available, host nations might place restrictions on how U.S. manned aircraft or UAVs launched from the bases could be used. And the launch of manned aircraft or UAVs from such bases might be observable to agents working on behalf of the intended ISR target. Personnel at the ISR target, warned by the agent of the approaching aircraft, could conceal objects, alter their behavior, or make preparations for attempting to shoot the aircraft down. In contrast, submarines could launch UAVs without need for host-nation base access, with no host-nation limits on use, and from locations at sea where there may be less risk of enemy agents observing the launch, particularly if the submarine was not known by others to be in the area.
- **Land bases in the United States.** Manned aircraft or UAVs launched from bases in the United States would likely require many hours to reach the ISR target area, making them potentially unsuitable for transitory ISR targets that could disappear during the aircraft's flight from the U.S. base. UAVs launched from land bases in the United States would need to be large enough to fly long distances to the ISR target area, making them potentially more expensive and easier to detect and shoot down. In contrast, submarines could launch UAVs from in-theater locations, permitting relatively short flight times to the ISR target area and the use of smaller UAVs that might be more difficult to detect and shoot down.
- **Surface ships.** The offshore presence of a surface ship equipped with manned aircraft or UAVs could become known to personnel at the ISR target area, which could prompt them to conceal objects, alter their behavior, or make preparations for attempting to shoot the aircraft down. The offshore presence of an attack submarine, however, is less likely to become known to personnel at the ISR target area, making them less likely to take such actions.

The Navy expressed interest in operating UAVs from attack submarines as early as 1995.⁴⁹ It conducted its first such experiment in 1996, in which the submarine assumed control of a Predator

⁴⁹John Robinson, "Submarine to Test Linkup with Predator UAV Later this Year," *Defense Daily*, June 7, 1995, p. 345; Robert Holzer, "U.S. Subs Gear for Broader Mission," *Defense News*, June 12-18, 1995, p.3.

UAV that had been launched from a land base.⁵⁰ The Navy publicly expressed further interest in the submarine-UAV concept in 2001.⁵¹

Directing a UAV from a submarine could require the submarine to remain close to the surface, so as to keep an antenna exposed to the air, potentially compromising the submarine's stealth. Launching and recovering a UAV from a submarine, moreover, is technically much more complex than doing so from land bases of surface ships, particularly when the submarine is submerged, which may be critical to maintaining the submarine's stealth.

Launching a UAV from a submerged submarine would require a UAV that could rise up through the water after leaving the submarine and then launch itself from the surface. The Navy in the past has accomplished something similar with the submarine-launched versions of the Tomahawk and Harpoon cruise missiles, and with an older weapon, no longer in service, called the Submarine Rocket (SUBROC).

Bringing a UAV back aboard a submerged submarine would require a UAV that could land safely on water and then perhaps be recovered by a grappling mechanism of some kind from the submarine. The technical challenges of recovering the UAV, and the cost of a grappling system, could be avoided by designing the UAVs as expendable assets to be used on one-way missions. This strategy, however, could substantially increase costs for procuring UAVs (due to the need to buy replacement UAVs) and limit the number of UAV ISR missions that a submarine could perform while operating on its own.

Another option would be to launch the UAV from the submarine but land it at a land base or on a surface ship. This would permit the UAV to be reused and avoid the cost of a grappling system, but still limit the number of UAV ISR missions a submarine could perform while operating on its own. In addition, if personnel at the ISR target learn that a UAV has landed at a land base or on a surface ship, it would alert them to the possibility that their activities had recently been observed, and possibly encourage them to take steps to reduce the effectiveness of any follow-on UAV ISR operations against that site that U.S. commanders might want to conduct.

SSN Homeporting and Crewing Arrangements

Forward Homeporting. The Navy in early 2004 completed an initiative announced in 2001 to transfer three Pacific Fleet attack submarines to the U.S. island territory of Guam in the Western Pacific.⁵² Guam is thousands of miles closer to potential attack submarine operating areas in the

⁵⁰Bryan Bender, "Submarine Takes Control of UAV in Demonstration," *Defense Daily*, June 13, 1996, pp. 434-435; Roman Schweizer, "Submarine Force Looks to UAVs, NTACMS to Bolster Littoral Capabilities," *Inside the Navy*, Nov. 11, 1996, pp. 1, 10; Vincent Vigliotti, "Demonstration of Submarine Control of an Unmanned Aerial Vehicle," *Johns Hopkins APL Technical Digest*, vol. 19, no. 4, 1998, pp. 501-512.

⁵¹Christian Bohmfalk, "Navy Exploring Large and Small UAVs, Better Comm. Relays for Subs," *Inside the Navy*, Apr. 9, 2001; Robert Wall, "Navy Investigates UAV-Sub Teaming," *Aviation Week & Space Technology*, July 9, 2001.

⁵²The first attack submarine to be homeported at Guam arrived in 2002, the second in 2003, and the third in early 2004. The third SSN to arrive, the San Francisco, was significantly damaged in a collision with an
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Western Pacific and Indian Ocean than are the Navy's other Pacific Fleet attack submarine home ports at Pearl Harbor and San Diego. In addition, attack submarines homeported in Guam use a different operating cycle than attack submarines homeported at Pearl Harbor or San Diego.

As a result of both these factors, Guam-homeported attack submarines can generate significantly more days on station in Pacific Fleet attack submarine operating areas than can attack submarines homeported in the other two locations. Navy officials have stated that in terms of operating days, a Guam-homeported attack submarine is the equivalent of an average of about 2.3 attack submarines homeported in the Third Fleet (i.e., in San Diego or Pearl Harbor).⁵³ CBO, in a March 2002 report on the attack submarine force, stated that the ratio might be higher, with a Guam-homeported attack submarine equivalent in operating days to about three attack submarines homeported elsewhere.⁵⁴

In general, homeporting additional attack submarines at Guam could reduce the total number of attack submarines needed to fulfill day-to-day Pacific Fleet attack submarine missions. In its March 2002 report, CBO presented an option for homeporting up to eight additional attack submarines at Guam, for a total of 11.⁵⁵ CBO estimated the construction cost of the additional facilities needed to implement this option at about \$200 million, which is less than 10% of the procurement cost of a Virginia-class submarine. CBO noted that homeporting additional attack submarines posed some potential disadvantages, including reduced opportunities for training with Navy ships based in Hawaii or on the U.S. West Coast. Even so, CBO concluded that homeporting additional attack submarines at Guam was the most cost effective of the various options it explored for increasing the mission capabilities of the attack submarine fleet.⁵⁶ As mentioned earlier, a 2004 internal Navy study that reportedly recommended reducing the attack submarine force-level goal to as few as 37 boats reportedly recommended homeporting a total of 9 attack submarines at Guam.

Crewing Arrangements. The March 2002 CBO report also presented an option for increasing submarine operating days through the use of dual crewing (two crews for each submarine)

⁵²(...continued)

undersea mountain near Guam in January 2005. The ship was transferred to the Puget Sound Naval Shipyard at Bremerton, WA, for repairs. The San Francisco reportedly will be replaced at Guam by another SSN, the Buffalo, in September 2006. (David V. Crisostomo, "Guam To Receive Third Home-Ported Submarine In 2006," *Pacific Daily News (Guam)*, November 1, 2005.)

⁵³In a "memorandum for interested members of Congress" on the homeporting of attack submarines in Guam dated Jan. 22, 2001, the Navy stated: "Three attack submarines homeported in Guam will provide a total of 300 days (on average) of operations and engagement per year. Those submarines would provide 130 days of operations and engagement per year if they were homeported in [the] Third Fleet [i.e., Eastern Atlantic] and deployed to [the] Seventh Fleet [i.e., Western Pacific] in accordance with current guidelines." 300 divided by 130 is about 2.3. The text of the memo was reprinted in the Feb. 12, 2001 issue of *Inside the Navy* under the headline, "Text: Navy Memo on Subs in Guam." For the accompanying news story, see Christian Bohmfalk, "Basing Attack Subs on Guam Expected To Increase Fleet's Presence," *Inside the Navy*, Feb. 12, 2001.

⁵⁴U.S. Congressional Budget Office, *Increasing the Mission Capability of the Attack Submarine Force*, Mar. 2002, p. 11.

⁵⁵*Increasing the Mission Capability of the Attack Submarine Force*, op. cit., pp. xvii, 30-32.

⁵⁶*Increasing the Mission Capability of the Attack Submarine Force*, op. cit., pp. ix, 32.

or multiple crewing (three crews for two submarines). The Navy has long used dual crewing for its SSBNs and plans to do so with its SSGNs. CBO estimated that dual-crewing could produce an 80% increase in an attack submarine's operating days, while multiple crewing could result in a 100% increase.

CBO noted in its report that implementing this option would require additional spending to support the additional crews, and that the Navy raised several concerns about the option, including the time needed to recruit and train the additional crews, the challenge of keeping the crews trained between deployments without access to their boats, and increased wear and tear on attack submarines (which, unlike SSBNs, are not engineered to be used intensively at sea by more than one crew).⁵⁷ On at least two occasions in 2000, however, Navy officials expressed some interest in the idea.⁵⁸

SSGN Conversion Program

SSGNs can perform some missions that might otherwise be performed by attack submarines, particularly Tomahawk strike, support of special operations forces, and, in the future, missions enabled by UVs. Compared to an attack submarine, an SSGN can carry much larger numbers of Tomahawks, SOF personnel, and UVs. SSGNs can also deploy larger-sized UVs than can be deployed by today's attack submarines. The cost-effectiveness of the SSGNs in performing these missions is increased by the Navy's plan to operate these boats with dual crews so as to increase the percentage of time that each SSGN is at sea in an operating area.

In light of the SSGNs' capabilities, the Navy's planned force of four SSGNs may reduce the number of attack submarines needed to perform submarine missions. By the same token, increasing the number of SSGNs in the fleet beyond the four now planned could, other things held equal, further reduce the number of attack submarines needed to perform a given set of submarine missions.

The Navy procured a total of 18 SSBNs between FY1974 and FY1991. The ships entered

⁵⁷*Increasing the Mission Capability of the Attack Submarine Force*, op cit, p. xv-xvi, 20-30. For articles expressing Navy concerns with dual- or multiple crewing of attack submarines, see Paul F. Sullivan, "Letter to the Editor," *U.S. Naval Institute Proceedings*, Dec. 2002, pp. 14, 16; and Christian Bohmfalk, "Fages Says Navy Wary Of Double-Crewing Subs To Increase Presence," *Inside the Navy*, May 8, 2000. Sullivan's letter to the editor was in response to an article in the magazine based on the March 2002 CBO report. (See Eric J. Labs, "Countering Attack Sub Shortfalls," *U.S. Naval Institute Proceedings*, Sept. 2002, pp. 46-48, 50.)

⁵⁸See Christian Bohmfalk, "Submarine Chiefs Willing to Explore Double Crewing for SSNs," *Inside the Navy*, July 3, 2000; and P. J. Skibitski, "Pacific Submariners Consider Basing Nuclear Attack Boats in Guam," *Inside the Pentagon*, July 13, 2000, p. 1. The second article about a Pacific Fleet study on forward-homeporting submarines at Guam stated:

If one sub were based [in Guam], the service could "dual-crew" the boat by shuttling sailors from Hawaii, [Rear Admiral Albert] Konetzni said. One crew could take a sub on a deployment, and when it got back, another crew could take the boat out....

If two or three of the early [Los Angeles-class submarines] were homeported in Guam, sailors and their families could live there and only single-crewing would be necessary. Numerous other arrangements, such as three crews for two ships, are also being looked at in the study, Konetzni said."

service between 1981 and 1997. The Clinton Administration's 1994 Nuclear Posture Review (NPR) recommended a strategic nuclear force for the START II strategic nuclear arms reduction treaty that included 14 Tridents rather than 18. The Bush Administration's 2002 NPR retained the idea of reducing the Trident SSBN force to 14 boats. The reduction in the planned Trident SSBN force from 18 boats to 14 made the first four Tridents available for conversion into SSGNs. Any future decision to reduce the SSBN force further — to 12 or 10 boats, for example — could make two or four additional Tridents available for conversion to SSGNs.

Allied and Friendly Attack Submarines

As mentioned in the section reviewing recent wartime demands for attack submarines, allied submarines on occasion have participated in U.S.-led military operations. In theory, allied submarines might also be able to perform day-to-day missions that might otherwise be performed by U.S. attack submarines. In light of the close security relationship that the United States maintains with the UK,⁵⁹ and the apparent growing security relationship that the United States is developing with Australia,⁶⁰ submarines from these two countries might be of particular interest as candidates

⁵⁹The United States and the UK have a history of close cooperation on sensitive security issues that dates back to World War II and the wartime effort to develop a nuclear weapon. Following the war, the United States assisted the UK's effort to develop nuclear-powered submarines, which was experiencing technical difficulties, by providing the UK with a complete U.S. submarine reactor plant for installation in the UK's first SSN. The United States closely guards its submarine and naval nuclear propulsion technology and has shared the latter only with the UK. The United States has sold the UK Tomahawk cruise missiles and Trident SLBMs for use on UK SSNs and SSBNs, respectively. U.S. facilities are used to provide life-cycle maintenance support for the UK SLBMs.

⁶⁰In 1998-2000, it was reported that Australia's new submarines, which were designed in Sweden and built in Australia by the Australian Submarine Corporation (ASC), were experiencing acoustic problems (i.e., excessive noise), problems with their combat systems, and other difficulties, and that the U.S. Navy was helping to fix the acoustic and combat-system problems. ("Australia Say Serious Problems with New Submarines," *Reuters* wire service, Oct. 10, 1998; Antony Preston, "'Serious Problems' Reported With New Australian SSKs," *Sea Power*, Dec. 1998, pp. 31-32; Gregor Ferguson, "Report Slams Australia's Project Management," *Defense News*, July 19, 1999; Norman Friedman, "Sub Problems Down Under Continue," *U.S. Naval Institute Proceedings*, Sept. 1999, pp. 121-123; "Report Targets Collins Class," *Jane's Navy International*, Sept. 1999, p. 4; David Lague, "U.S. Experts In Salvage Efforts For Stricken Subs," *Sydney Morning Herald*, Mar. 20, 2000; Norman Friedman, "Fixing the Collins Class," *U.S. Naval Institute Proceedings*, May 2000, pp. 98-100, 102; David Lague, "Sweden Goes to War: Australia Blasted over Submarine Secrets," *Sydney Morning Herald*, Dec. 29, 2000, p. 1.)

In 2000, it was reported that the U.S. Navy granted GD/EB permission to explore how it might help Australia fix problems with its submarines, and that GD/EB sent a team of experts to Australia. (Gregor Ferguson and Robert Holzer, "U.S. Releases Sub Info to Australian Navy," *Defense News*, Mar. 6, 2000, pp. 1, 26; Robert A. Hamilton, "EB Looking for Business Down Under," *New London (CT) Day*, Mar. 1, 2000.)

In 2001, it was reported that the U.S. Navy and the Australian Navy signed a statement of principles for sharing classified technology and otherwise promoting interoperability between the U.S. and Australian submarine fleets. (Robert Garran, "US Threat to Sink Strategic Alliance," *The Australian*, Dec. 23, 2000; Craig Skehan, "Huge Payout After US Applies Pressure Over Defence Tenders," *Sydney Morning Herald*, July 10, 2001; Robert Garran, "Navy Ties Up to Uncle Sam," *The Australian*, July 11, 2001; Jason Sherman, "Australian, U.S. Navies to Share Classified Work," *Defense News*, Aug. 27-Sept. 2, 2001, p. 6; Ian Bostock,

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for performing missions that might otherwise be performed by U.S. attack submarines.

The UK currently operates a force of 11 SSNs, while Australia operates a force of six large diesel-electric submarines. UK submarines might be able to assist the United States in performing attack submarine missions in locations such as the Barents Sea, the Norwegian Sea, the Mediterranean, the Red Sea, and the Indian Ocean/Persian Gulf region. Australian submarines might be able to assist the United States in performing attack submarine missions in locations such as parts of the Indian Ocean and the waters around the Indonesian archipelago.

Given the relatively small sizes of the UK and Australian submarine forces, each country might have only one or two submarines in deployed status at any given time. Deployed UK and Australian submarines, moreover, might spend much of their deployed time performing missions of specific interest to their own governments, rather than missions that may also be of interest to the United States. And Australia's diesel-electric submarines may not be well suited for performing certain missions of interest to the United States, particularly day-to-day ISR missions that might require long, stealthy transits to the operating area, extended periods of submerged operations in the operating area, and long, stealthy transits back to home port. Non-nuclear-powered submarines are less well suited than SSNs for performing such missions. As a result, the number of occasions when UK or Australian submarines might be able to perform missions of interest to the United States might be fairly small.

The submarine forces of U.S. allies and friendly countries other than the UK and Australia are also rather small. In addition, with the exception of France, some of whose attack submarines are nuclear-powered, the submarine forces of these other countries consist entirely of non-nuclear-powered boats, which may limit their ability to perform certain missions of interest to the United States. The reduction in requirements for U.S. attack submarines that might be possible through use of submarines from U.S. allies and friendly countries other than the UK and Australia consequently would also likely be limited.

On the other hand, as suggested by the earlier discussion of the stationkeeping multiplier for U.S. Navy attack submarines, even the occasional performance of a submarine mission of interest to the United States by a submarine from the UK, Australia, or another allied country could have a somewhat leveraged effect in relieving strain on the U.S. attack submarine force, particularly for performing short-duration missions that are relatively close to the allied country in question but far from the home ports of U.S. attack submarines.

⁶⁰(...continued)

“About Face on RAN’s Collins Combat System,” *Jane’s Navy International*, Sept. 2001, p. 6; Gregor Ferguson, “Australian, U.S. Navies to Sign Agreement Sept. 10,” *Defense News*, Sept. 10-16, 2001; Ian Bostock, “RAN-USN Pact on Submarine Strategy,” *Jane’s Defence Weekly*, Oct. 10, 2001, p. 29.)

In 2002-2003, it was reported that GD/EB had become a “capability partner” to ASC and would provide technical support for Australia’s submarines. (“Australia to Buy Raytheon Submarine Combat System,” *Defense Daily*, Sept. 16, 2002; “Australia Commissions Final Collins-Class Submarine,” *Defense Daily*, Apr. 1, 2003.)

In 2005, it was reported that the United States had agreed to grant Australia increased access to U.S. intelligence. (Janaki Kremmer, “Austriali Gains From US Intel,” *Christian Science Monitor*, October 17, 2005.)

It can also be noted, however, that as a general matter, planning U.S. military forces on the assumption that forces from other countries, even close allies, will be available to perform certain missions of interest to the United States entails some risk, given inherent uncertainty over the future policies of foreign governments. The UK or Australia, for example, might decide at some point to reduce the size of its submarine force for affordability reasons, reducing the contribution that the force could make to performing missions of interest to the United States. The UK in July 2004 announced that, as part of a plan to reduce the size of its Navy, it would reduce its SSN force to eight boats by December 2008.⁶¹

⁶¹“British Plan Smaller Fleet for Future Contingencies,” *Defense Daily*, July 27, 2004; Richard Scott, “Navy See Cuts Across Fleet,” *Jane’s Defence Weekly*, July 28, 2004, pp. 14; Richard Scott, “UK Royal Navy Sees Cuts Across Surface Fleet and Submarines,” *Jane’s Navy International*,” Sept. 2004, p. 5.