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Navy Shipbuilding in the FY2003 Defense Budget: Issues for Congress

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Summary

Although the 2001 Quadrennial Defense Review (2001) did not change the plan for a fleet of about 310 ships that emerged from the 1997 QDR, DoD and Navy officials have mentioned studies that concluded a need for a 340- or 375-ship Navy.

The Administration's proposed FY2003 defense budget and FY2003-FY2007 Future Years Defense Plan (FYDP) call for the procurement of 5 new Navy ships in FY2003 and a total of 34 new Navy ships in FY2003-FY2007 that count toward the 310-ship goal, or an average of 6.8 new ships per year. If maintained over a 35-year period, this average rate would eventually result in a fleet of about 238 ships. The decline toward a fleet of that size, however, would not happen immediately. The Administration's plan, if implemented, would add to a backlog of deferred ship procurement (relative to the steady-state replacement rate of 8.9 ships per year) that has been accumulating since FY1993. Maintaining a 310-ship fleet over the long run would then require an average procurement rate of 11.2 ships per year for the 20-year period FY2008-FY2027. This can be called the post-FYDP catch-up rate.

Conversions of Trident ballistic missile submarines (SSBNs) into cruise-missile-carrying submarines (SSGNs) will add to the capabilities of the general-purpose forces of the Navy but do not contribute toward the steady-state replacement rate of 8.9 new ships per year. Current fleet average age, which the Administration has cited in explaining its proposed rate of ship procurement, is arguably best used as a preliminary rather than conclusive indicator of the urgency of procuring ships in the near term at or above the steady-state rate.

Under past standards for judging maturity and risk in Navy shipbuilding programs, three programs – the DDG-51 destroyer program, the Virginia-class submarine program and the TAKE-1 auxiliary ship program – arguably could absorb an increase in procurement rate in FY2003. In addition, the Navy has included an additional LPD-17 amphibious ship on its FY2003 unfunded requirements list.

Administration proposals to transfer certain ships out of the Shipbuilding and Conversion, Navy (SCN) appropriation account could complicate congressional oversight of Navy ship procurement by dispersing ships to multiple parts of the defense budget and funding them in accounts that are not subject to the full funding provision that normally governs the procurement of ships and other weapons.

If Virginia-class attack submarines are procured at the planned rate of 1 per year during FY2003-FY2007, then maintaining a force of at least 55 SSNs will require an average procurement rate of more than 2.5 boats per year during the 17-year period FY2008-FY2024. Procuring TAKE-1 auxiliary ships through the National Defense Sealift Fund (NDSF) will permit these ships to be procured using incremental funding or other funding methods that do not conform to the full funding provision. Unless current plans are accelerated, some of the Navy's LHA-class amphibious ships, which have a 35-year nominal life, would be replaced at or beyond age 40.

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Introduction

This report discusses issues relating to the Administration's plans for Navy ship procurement in its proposed FY2003 defense budget and FY2003-FY2007 Future Years Defense Plan (FYDP).[1] It provides background information on the planned size of the Navy and the Administration's proposed FY2003-FY2007 ship-procurement plan, and then discusses the following issues:

- the steady-state and "catch-up" rates of ship procurement associated with the currently planned 310-ship Navy;
- the relationship of Trident SSGN submarine conversions to the steady-state replacement rate for ships;
- the current average age of the Navy's ships and its relationship to the steady-state replacement rate;
- the readiness of certain Navy shipbuilding programs to absorb increased rates of procurement in FY2003;
- the potential implications for congressional oversight of Navy ship procurement of changes in the composition of the Shipbuilding and Conversion, Navy (SCN) appropriation account and proposals to procure ships in budget accounts that are not subject to the full funding provision;

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[1]It is based on CRS testimony before the House Armed Services Committee's subcommittee on Military Procurement on March 20, 2002: Statement of Ronald O'Rourke, Specialist in National Defense, Congressional Research Service, Before the House Armed Services Committee Subcommittee on Military Procurement Hearing on The Navy's Proposed Shipbuilding Program For FY2003, march 20, 2002. 49 p. This testimony was prepared and delivered at the request of the subcommittee's chairman, Representative Curt Weldon. This report does not include sections on the Navy's DD(X) and CVNX programs and the Coast Guard's Deepwater program that appeared in the testimony, because these three programs are covered in three other CRS reports: CRS Report RS21059, *Navy DD(X) Future Surface Combatant Program: Background and Issues for Congress*, by Ronald O'Rourke. Washington, 2002. (Updated periodically) 6 p.; CRS Report RS20643, *Navy CVNX Aircraft Carrier Program: Background and Issues for Congress*, by Ronald O'Rourke. Washington, 2002. (Updated periodically) 6 p.; and CRS Report RS21019, *Coast Guard Deepwater Program: Background and Issues for Congress*, by Ronald O'Rourke. Washington, 2002. (Updated periodically) 6 p.

- force levels and procurement rates for attack submarines;
- procurement of Lewis and Clark (TAKE-1) class auxiliary ships through the National Defense Sealift Fund (NDSF);
- schedule considerations for the LHA Replacement amphibious ship program.

Background

Planned Size of the Navy

Although the 2001 Quadrennial Defense Review (2001) did not change the plan for a fleet of about 310 ships that emerged from the 1997 QDR – a fleet that includes 12 aircraft carriers, 116 surface combatants, 55 nuclear-powered attack submarines (SSNs),[2] and 36 amphibious ships organized into 12 amphibious ready groups (ARGs) collectively capable of lifting the assault echelons of 2.5 Marine Expeditionary Brigades (MEBs) – there is currently some uncertainty about how long this plan will remain in effect, for the following reasons:

- The report on the 2001 QDR, in leaving the 310-ship plan and other military force-structure goals unchanged, stated that the Department of Defense (DoD) "will explore additional opportunities to restructure and reorganize the Armed Forces" as DoD's transformation efforts mature.[3]
- Administration officials in recent weeks have begun to refer to a study by the Office of the Secretary of Defense (OSD), apparently completed sometime in the second half of 2001, that concludes that the Navy should have 340 ships.
- Navy officials in recent weeks have made reference to a need for a 375-ship fleet.[4]

Although few details are available about the composition of the 340- and 375-ship fleets, Navy testimony this year suggests that the primary difference between the 375-ship fleet and the 310-ship fleet is that the 375-ship fleet includes a larger number of surface combatants. This would be consistent with the Navy's plans under the DD(X) surface combatant program to alter surface combatant force over time from one composed entirely of major surface combatants (i.e., frigates in the 4,000-ton

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[2]The 1997 QDR called for a fleet of about 305 ships, including 50 SSNs. The Clinton Administration amended the SSN force-level goal to 55 boats in 2000, increasing the total planned size of the Navy to about 310 ships.

[3]U.S. Department of Defense. *Quadrennial Defense Review Report*. Washington, 2001. (September 30, 2001) p. 23.

[4]See Castelli, Christopher J. Aldridge: Future Missions Call For Navy Fleet of 340 to 370 Ships. *Inside the Navy*, February 25, 2002; Gildea, Kerry. Clark Estimates Future Naval Fleet At 375 Ships. *Defense Daily*, February 19, 2002; Selinger, Marc. Navy Would Buy Third DDG-51 If It Had The Money, Secretrary Says. *Aerospace Daily*, February 14, 2002.

range and destroyers and cruisers in the 8,000- to 9,000-range) to one composed of a combination of major surface combatants and more numerous smaller ships called Littoral Combat Ships (LCSs).

It should also be noted that a June 2000 Defense Department report to Congress on Navy force-structure requirements (and an earlier draft version of this report) suggested that a fleet large enough "to accomplish all likely joint and combined warfighting requirements, overseas presence and support to contingency operations" would include 360 ships, including 15 carriers, 134 surface combatants, 68 or 72 attack submarines, and 43 amphibious ships (enough for 14 ARGs or to lift the assault echelons of 3.0 MEBs).[5]

This uncertainty about the longevity of the current 310-ship plan is worth remembering when discussing the relationship between the planned size of the Navy and the Administration's planned rate of Navy ship procurement.

Administration's Proposed Ship-Procurement Plan

The Administration's proposed FY2003 defense budget and FY2003-FY2007 Future Years Defense Plan (FYDP) call for the procurement of 5 new Navy ships in FY2003 and a total of 34 new Navy ships in FY2003-FY2007 that count toward the 310-ship goal, or an average of 6.8 new ships per year.[6]

The table below compares the Bush Administration's FY2003-FY2007 ship-procurement plan with previous plans. The table excludes ships that do not count toward the 310-ship goal, such as sealift ships operated by the Military Sealift Command and oceanographic ships operated by agencies such as the National Oceanic and Atmospheric Administration (NOAA).

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[5]Report on naval vessel force structure requirements, as reprinted in *Inside the Navy*, July 3, 2000: 4-8; and draft DoD report on naval force-structure requirements, as reprinted in *Inside the Navy*, March 6, 2000: 18-25. DoN officials confirmed their desire for increasing the planned size of the Navy to about 360 ships in testimony to the Military Procurement subcommittee of the House Armed Services Committee on February 29, 2000 and to the Seapower subcommittee of the Senate Armed Services Committee on March 2, 2000.

[6]The 310-ship goal, like previous numerical goals for the size of the Navy dating back to 1981, includes ships referred to as battle force ships. Battle force ships are deployable Navy ships that conduct warfighting operations or directly support Navy warfighting operations. Ships that do not qualify under this definition do not count against the 310-ship goal (or previous numerical goals for the size of the Navy dating back to 1981) and are called local defense and miscellaneous support forces ships. This category includes military sealift ships, oceanographic survey and research ships, support ships and craft that are not intended for overseas deployment, and mine warfare ships in reduced operating status. The 34-ship total for the Administration's FY2003-FY2007 plan excludes two local defense and miscellaneous support forces ships that do not count against the 310-ship goal: one TAGS-type oceanographic survey ship to be procured in FY2006 and one sealift ship for the Maritime Prepositioning Force Future (MPF[F]) to be procured in FY2007.

Table 1. Current and previous ship-procurement plans

Administration plan (year submitted)	Fiscal Year										Avg. per year
	98	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	
Bush (2002)						5	5	7	7	10	6.8
Bush (2001)					6	(not available – no FYDP)					
Clinton (2000)				8	8	8	8	7			7.8
Clinton (1999)			6	8	8	8	8	9			7.8
Clinton (1998)		5	5	7	7	7					6.2
Clinton (1997)	4	5	5	6	5	6					5.2
	92	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**00**	**01**	
Clinton (1996)						4	4	5*	7	5*	5.0
Clinton (1995)					3	3	4	4	7	6	4.5
Clinton (1994)				4	5	4	6	7			5.2
Clinton (1993)			6	(not available – no FYDP)							
Bush (1992)		6	4	9	6	8					6.6
Bush (1991)	10	9	7	9	9	7					8.5

Source: Annual Navy budget submissions, particularly as reflected in the annual Highlights of the Department of the Navy Budget book. The table includes only ships that count toward the 310-ship goal.

* The 1996 Clinton Administration plan included a notation for one additional SSN in both FY1999 and FY2001, in accordance with Congressional direction, which would increase the total number of ships requested in FY1999 and FY2001 to 6, but the Clinton Administration's 1996 plan did not include funding for the procurement of these two additional SSNs.

As can be seen in the table, the average number of new ships to be procured under the Bush Administration's current plan is less than the average number proposed by the Clinton Administration in 2000 and 1999, and by the former Bush Administration in 1991, but greater than the average number proposed by the Clinton Administration in 1994, 1995, 1996, 1997, and 1998, and by the former Bush Administration in 1992.[7]

The Bush Administration's FY2003-FY2007 plan increases the rate of ship procurement over time – the rate starts at 5 ships per year, then shifts to 7 ships a

[7]Ship-procurement plans submitted in years prior to those covered in the table proposed considerably higher average rates of ship procurement but were strongly influenced by the Cold War, which can be said to have ended with the fall of the Berlin Wall in November 1989 and the dissolution of the Soviet Union in December 1991.

year, and finishes with 10 ships in the final year. It can be noted, however, that the total of 10 ships planned for the final year of FY2007 includes 3 Lewis and Clark (TAKE-1) auxiliary dry cargo ships, which are relatively inexpensive ships.[8] In this respect, the Bush Administration FY2003-FY2007 plan is similar to the 1999 Clinton Administration plan for FY2000-FY2005, which increased the rate of ship procurement in the final year of the plan (FY2005) to 9 ships in part by including 3 TAKE-1 ships in the total.[9]

Issues for Congress

Steady-state and Catch-up Rates of Ship Procurement

The overall rate of Navy ship procurement and its relationship to the planned size of the Navy has been a concern in Congress since the mid-1990s. CRS has previously examined the issue in a 1996 report,[10] another report maintained since 1997,[11] and in 1997,[12] 1999,[13] and 2000 testimony.[14] This report updates the analysis to take into account the Administration's proposed FY2003 defense budget and FY2003-FY2007 ship-procurement plan.

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[8] TAKE-1 class ships have a unit procurement cost of roughly $400 million. This is less than one-half the unit cost of an Arleigh Burke (DDG-51) class destroyer or San Antonio (LPD-17) class amphibious ship, less than one-fifth the unit procurement cost of a Virginia (SSN-774) class attack submarine, and less than one-eighteenth the cost of the CVNX-1 aircraft carrier.

[9] At that time, the TAKE-1 class was referred to as the ADC(X) class.

[10] CRS Report 96-785 F, *Navy Major Shipbuilding Programs and Shipbuilders: Issues and Options for Congress*, by Ronald O'Rourke. Washington, 1996. (September 24, 1996) p. 41-43.

[11] CRS Report RS20535, *Navy Ship Procurement Rate and the Planned Size of the Navy: Background and Issues for Congress*, by Ronald O'Rourke. Washington, 2002. (Updated periodically) 6 p.

[12] Statement of Ronald O'Rourke, Specialist in National Defense, Congressional Research Service, Before the House National Security Committee Subcommittees on Military Procurement and Research and Development Hearing on Ship Acquisition Issues, February 26, 1997, p. 1-8.

[13] Statement of Ronald O'Rourke, Specialist in National Defense, Congressional Research Service, Before the House National Security Committee Subcommittee on Military Procurement on Littoral Warfare Protection and Ship Recapitalization, March 9, 1999, p. 1-4.

[14] Statement of Ronald O'Rourke, Specialist in National Defense, Congressional Research Service, Before the House Armed Services Committee Subcommittee on Military Procurement Hearing on Navy Shipbuilding Programs, February 29, 2000, p. 3-9, and Statement of Ronald O'Rourke, Specialist in National Defense, Congressional Research Service, Before the Senate Armed Services Committee Subcommittee on Seapower Hearing on Ship Procurement and Research and Development Programs, March 2, 2000, p. 3-9.

In previous reports and testimony, CRS has focused on the concept of the steady-state replacement rate as a tool for understanding the relationship between planned force structure and required procurement rates for ships and other types of military equipment. Navy and DoD officials began to make use of the concept in their testimony a few years ago, and particularly in presenting the proposed FY2001 defense budget and amended FY2000-FY2005 FYDP.

The steady-state replacement rate is the average rate at which new ships would need to be procured over the long run to replace the fleet's ships as they reach retirement age.[15] Assuming a fleet-wide average ship service life of about 35 years, a fleet of about 310 ships would have a steady-state ship replacement rate of about 8.9 ships per year.

As mentioned above, the Bush Administration's FY2003-FY2007 FYDP includes an average of 6.8 new ships per year. If maintained over a 35-year period, an average procurement rate of 6.8 ships per year would eventually result in a fleet of about 238 ships.

The decline toward a fleet of that size, however, would not happen immediately: As a result of the significant downsizing of the fleet during the 1990s, the Navy today is composed to a large degree of relatively young ships, and a fleet of about 300 ships consequently could be maintained in the shorter run (i.e., between now and about 2010) with a relatively low ship procurement rate. After 2010, and particularly after 2020, however, the relatively large numbers of ships procured in the 1970s and 1980s will reach retirement age, and total fleet size would drop below 300 ships.

As shown in the table below, the ship-procurement rate has been below 8.9 ships per year since FY1993, and the Administration's proposed shipbuilding plan would keep it below 8.9 ships per year through FY2007.

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[15]The steady-state replacement rate is an average figure equal to the planned force size divided by the average service life. Ships need not be procured at a steady year-to-year rate; they can also be procured at a varying year-to-year rate that changes over time to more closely match the uneven age distribution of the Navy's existing ships and the consequent uneven rate at which these existing ships reach retirement age. Depending on factors such as available funding, shipyard production conditions, and planned transitions from one ship design to another, each approach can have its advantages and disadvantages. Over the longer run, however, the average rate of ship procurement (whether resulting from steady year-to-year procurement, variable year-to-year procurement, or some combination) would need to approximate the steady-state rate of procurement if the planned fleet is to be replaced at about the time that its constituent ships reach their retirement ages. In this sense, the steady-state procurement rate can serve as an analytical tool for assessing the potential longer-term consequences of proposed ship-procurement rates. For additional discussion on the concept of the steady-state replacement rate, see Appendix A at the end of this statement.

Table 2. New Navy ships procured or proposed, FY1982-FY2007

82	83	84	85	86	87	88	89	90	91	92	93	94
17	14	16	19	20	17	15	19	15	11	11	7	4
95	**96**	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**
4	5	4	5	5	6	6	6	5	5	7	7	10

Source: CRS compilation based on examination of defense authorization and appropriation committee and conference reports for each fiscal year. The table includes only ships that count toward the 310-ship goal.

The Administration's ship-procurement plan, if implemented, would add to a backlog of deferred ship procurement (relative to the 8.9-ship-per-year figure) that has been accumulating since FY1993, and thereby increase the rate of Navy ship procurement that would be needed after FY2007 to keep the fleet from dropping below 310 ships.

As shown in the table above, during the 10-year period FY1993-FY2002, a total of 52 new ships were procured, or an average of 5.2 ships per year.[16] If the Bush Administration's FY2003-FY2007 FYDP were implemented, another 34 new ships would be procured through FY2007, bringing the total for the 15-year period FY1993-FY2007 to 86 new ships, or an average of about 5.7 new ships per year. Procuring ships at the steady-state replacement rate of about 8.9 new ships per year for 15 years would result in a total procurement of about 133 ships. Procuring an average of 6.8 new ships per year during the period FY2003-FY2007 would thus create a cumulative 15-year ship-procurement backlog since FY1993 of 47 ships relative to the steady-state ship-procurement requirement (133 minus 86).

This potential 47-ship "deficit" in ship procurement would not be immediately apparent because of the relatively large numbers of ships built in the 1970s and 1980s, when the ship-procurement rate was well above 8.9 ships per year. After 2010, and particularly after 2020, however, when the 1970s- and 1980s-era ships begin to retire, this 47-ship backlog, if not by then redressed, would become apparent, and the size of the fleet would fall below 310 ships.

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[16]This total excludes 5 oceanographic (TAGS/TAGOR-type) oceanographic ships procured through the Navy's shipbuilding account (2 in FY1994, 2 in FY1997, and 1 in FY1999), since these ships are not operated by the Navy and do not count toward the 310-ship goal. The 52-ship total does include the final 2 Osprey (MHC-51) class coastal mine hunters, even though 9 of the 12 ships in this class are maintained in reduced operating status in Mobilization Category B, where they do not count toward the 310-ship goal. The 52-ship total also includes LHD-8, an amphibious assault ship, as an FY2002-funded ship. This ship is being funded incrementally and additional funding will be needed beyond FY2002 to complete its procurement cost. Congress has given the Navy the authority to issue a construction contract for this ship, and the Administration in its FY2002 and FY2003 budget submissions records the ship as an FY2002-procured ship.

Eliminating this 47-ship backlog over the remaining 20 years in a 35-year procurement period beginning in FY1993 would require increasing procurement rate after FY2007 to 11.2 ships per year: If an average procurement rate of about 8.9 ships per year were to be achieved for the entire 35-year period FY1993-FY2027 (that is, if a total of 310 ships are to be procured in this period), then for the period FY2008-FY2027 (the remaining 20 years after FY2007) a total of 224 ships (310 less the 86 procured through FY2007) will need to be procured, or an average of 11.2 new ships per year.

This post-FY2007 rate of 11.2 new ships per year can be called the post-FYDP catch-up or recovery rate because it would gradually work off the backlog of deferred ship procurement that has accumulated since FY1993 and thereby catch up with the total number of procured ships that would result from maintaining procurement at the steady-state rate.

Procuring an average of 8.9 ships per year in a steady-state mix could cost an average of between $9.6 billion and $11.7 billion per year in FY2003 dollars, while procuring 11.2 ships per year could cost an average of between $12.5 and $15.0 billion in FY2003 dollars.[17] This compares with $6.0 billion for new ships in the FY2003 budget request and an average of about $9.1 billion per year in the FY2003-FY2007 plan. (These figures do not include additional funding that would be required in the Shipbuilding and Conversion, Navy (SCN) appropriation account for ship conversions, refuelings, and the other items regularly funded in the SCN account.)

The catch-up rate can be reduced to something less than 11.2 ships per year if ship procurement is increased above the rate planned by the Administration for FY2003-FY2007. Two notional options for reducing the catch-up rate present themselves:

- **Increase to steady-state during FYDP; halt growth in backlog.** If ships are procured during FY2003-FY2007 at the steady-state replacement rate of 8.9 ships per year (i.e., if 44 or 45 ships are procured during this period, rather than the 34 ships planned by the Administration), then the backlog of deferred ship procurement would be halted at 36 or 37 ships and the catch-up rate for the 20-year period FY2008-FY2027 would be reduced to about 10.7 ships per year.

- **Start catching up now.** Alternatively, the shipbuilding rate could be increased to the level needed to work off the current 36- or 37-ship backlog over the 25 year period FY2003-FY2027. This would involve increasing the rate to about 10.3 ships per year during FYDP (i.e., procuring 51 or 52 ships during FY2003-FY2007) and continuing that rate through FY2027.

The table below summarizes past and potential future ship procurement rates.

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[17]Rough CRS estimates, February 2002, based on ship types and potential low, medium, and high costs for each kind of ship.

Table 3. Past and potential ship-procurement rates, FY93-FY27

FY1993-FY2002 (past)		Notional options for future	FY2003-FY2007 (FYDP period)		FY2008-FY2027 (post-FYDP period)		Total pro-cured, FY93-FY27
Rate	Num-ber pro-cured		Rate	Number procured	Rate	Number procured	
5.2/yr	52	Admini-stration plan	6.8/yr	34	11.2/yr	224	310
		Steady-state during FYDP	8.9/yr	44 or 45	10.7/yr	213 or 214	310
		Start catch-up now	10.3/yr	51 or 52	10.3/yr	206 or 207	310

Some observers consider the 35-year fleet-wide average service life figure optimistic. If the figure turns out to be 30 years, as some observers predict, then required ship procurement rates will be higher. The steady-state replacement rate for a 310-ship fleet would be about 10.3 ships per year, the FY1993-FY2007 backlog would be 69 ships, and the average required rate for the period FY2008-FY2022 -- the final 15 years in a 30-year building period beginning in FY1993 -- would be about 14.9 ships per year, a rate similar to that of the 1970s and 1980s.

Trident SSGN Conversions and Steady-State Rate

Administration officials, in defending their proposed ship-procurement plan, have suggested that the number of ships requested for FY2003 is closer to the steady-state replacement rate for Navy ships of 8.9 ships per year than might seem on first inspection because the request includes funding for the conversion of two Trident ballistic missile submarines (SSBNs) into cruise missile/special operations forces (SOF) submarines (SSGNs). As a result, Administration officials have suggested, the budget request for FY2003 in effect calls for the procurement of 7 ships rather than 5.

In terms of characterizing (1) the total amount of money devoted to shipbuilding and conversion, (2) the total amount of work that the FY2003 budget will provide for shipyards and other ship-related industries, and (3) the contribution that the SSGNs will make to the general-purpose (i.e., non-strategic) forces of the Navy, it is certainly fair to take into account the FY2003 request for the two Trident conversions: The amount of funding requested in the SCN account for the Trident conversion program in FY2003 – $825.3 million – is substantial, the conversions will provide substantial

work to shipyards and other firms,[18] and the ships as converted will add both numbers and new capabilities to the general-purpose forces of the Navy.

In terms, however, of comparing the number of ships requested for procurement in FY2003 to the steady-state replacement rate of 8.9 ships per year, the inclusion of the two Trident SSGN conversions is questionable: The steady-state replacement rate of 8.9 ships per year means, in effect, that the Navy needs to purchase, over the long run, an average 310 new years of ship life per year. (8.9 new ships times about 35 years of new life per ship equals 310 new years of ship life.) The Navy can purchase new years of ship life that count against the 310-ship goal in three ways:

- it can procure new ships that count against the 310-ship goal;
- it can convert existing ships that do not count against the 310-ship goal into different kinds of ships that do count against the 310-ship goal;[19] and
- it can extend the service lives of existing ships that count toward the 310-ship goal beyond those ships' previously certified service lives.[20]

The SSGN conversions would not do any of these things: The conversions would not procure new ships (the submarines already exist); the Trident submarines, as SSBNs, are battle force ships that already count against the 310-ship goal (the conversions would not change this); and the conversions would not lengthen the 42-year expected life for which Trident submarines are certified – they will simply enable the ships to operate during the final 20 years of their 42-year lives in support of new missions.[21]

Thus, in terms of measuring the FY2003 request against the steady-state replacement rate of about 8.9 ships per year, it is not clear that there are compelling grounds for including the two SSGN conversions. In terms of new years of ship life that count against the 310-ship goal, the FY2003 budget request can be said to

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[18]Much of the shipyard work may be performed by public-sector naval shipyards rather than private-sector shipyards.

[19]The Navy did this, for example, in the early 1980s, when it acquired 3 underway replenishment ships from the British Navy and converted them into the Sirius (TAFS-8) class combat stores ships.

[20]The Navy did this, for example, in the 1980s, when it extended the service life of its some of its conventionally powered aircraft carriers (CVs) from about 30 years to about 45 years under the CV Service Life Extension Program (SLEP).

[21]It is possible that the conversions might lead to a shortening the lives of the boats to something less than 42 years. SSBNs are usually considered to have operational profiles that are on average less demanding on ship life than those of attack submarines, and SSBNs generally receive very high maintenance priority, so as to ensure the readiness of the sea-based leg of the U.S. strategic nuclear deterrent force. If the Trident submarines' certified 42-year life is a reflection, in part, of these two factors, and if one or both of these factors change as a result of the conversion of the boats into non-strategic submarines, then the total life of Trident submarines that are converted into SSGNs may turn out to be somewhat less than 42 years.

acquire 173 new years of life, or about 56% of the steady-state level of 310 new years of life per year.[22]

This is not to discount the value of the Trident conversions in terms of permitting these ships to serve out their full lives (and thus reap maximum return on the initial investment made to build the ships), or in terms of the operational merits of these submarines as SSGNs. It is merely to note that the conversions do not contribute, under the three criteria outlined above, toward a goal of procuring 8.9 new ships (or 310 years of new ship life) per year.[23]

Current Average Fleet Age and Steady-State Rate

Administration officials, in defending their proposed ship-procurement plan, have also suggested that procuring new ships at a rate at or above the steady-state replacement rate can be deferred for a number of years because the average age of the

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[22]The total of 173 years includes 33 years for 1 Virginia (SSN-774) class submarine, 35 years for each of two Arleigh Burke (DDG-51) class destroyers, 35 years for 1 San Antonio (LPD-17) class amphibious landing ship, and 35 years for one Lewis and Clark (TAKE-1) dry cargo ship. If the four surface ships are granted 40- rather than 35-year lives, then the total amount of ship years procured would be 193, or 62% of the steady-state level of 310 years of ship life per year.

[23]It can be argued that, by permitting the ships to remain in operation during the final 20 years of their 42-year lives, the conversion work should be counted as supporting the 310-ship goal because each conversion avoids the loss of 20 years of ship operation. This argument, however, can also be applied to regular submarine refuelings – or to any kind overhaul and modernization work performed on any kind of ship that enables the ship to remain in operation to the end of its expected life rather than be decommissioned prior to the end of that life. Under this standard, the Navy each year must finance not only the procurement of an average of 310 new years of ship life, but also the overhaul and modernization work that is needed on each of its existing 310 ships to enable those ships to remain in service for that year. The Trident conversions count toward the second goal, but not the first.

It can also be argued that the Trident conversions would transfer four ships from a strategic role where they will no longer be needed to a non-strategic role where they will be needed, and thus in effect would create 20 new years of *needed* ship life per boat. This argument, however, can be made of any conversion work that shifts a ship from a mission where it is surplus to one where it is needed. Suppose that, instead of procuring 8.9 new ships per year, the Navy instead financed, each year, a group of conversions that transferred 310 years of ship life from missions where they were surplus to missions where they were needed. Although the Navy's ships under this approach would be properly aligned with mission needs, no new years of ship life would be added to the fleet, the Navy's ships would eventually reach the ends of their service lives at the same pace as if they had not been converted, and the fleet would eventually decline to 0 ships at the same rate as if there had been no conversions. In this sense, it can be seen that conversions of ships that already count toward the 310-ship goal do not contribute to the gradual replacement of the 310-ship fleet.

Navy's ships – 16.0 years as of early 2002[24] – is less than 17.5 years (i.e., one-half of the 35-year average expected service life of the Navy's ships).

Current average fleet age can be used to gain an initial indication of the urgency of procuring ships in the nearer term at or above the steady-state replacement rate. A current average fleet age less than one-half of average service life suggests that it might be possible to maintain the fleet at its desired size in the nearer term with a near-term procurement rate less than the steady-state replacement rate, while a current average fleet age greater than one-half of average service life suggests that maintaining the fleet at its desired size in the nearer term might require a near-term procurement rate greater than the steady-state replacement rate.

For a fleet of 310 ships with an average life of 35 years, a current average fleet age less than 17.5 years (one-half of 35 years) suggests that an average of fewer than 8.9 ships per year might be approaching retirement age in the nearer term, while a current average fleet age greater than 17.5 years suggests that an average of more than 8.9 ships per year might be approaching retirement age in the nearer term.

Although current average fleet age can provide an initial indication of the urgency attached to meeting or exceeding the steady-state replacement rate in the nearer term, it is, like the steady-state replacement rate, a single-point measure that is limited in the amount of information it conveys. Use of current average fleet age in determining nearer-term procurement rates is complicated by factors such as variation in age within the overall fleet average by ship category, and fleet composition and capability. These factors are examined in Appendix B at the end of this statement.

Use of current average fleet age is complicated by two additional factors discussed below – the effect on procurement backlog and the catch-up rate, and the potential for a boom-and-bust cycle.

Effect on procurement backlog and catch-up rate. Although a relatively low current average fleet age can provide a preliminary basis for a decision to reduce ship procurement in the nearer term to something below the steady-state replacement rate, it does not provide any indication of the degree to which such a decision will create or add to a backlog of deferred ship procurement that eventually will need to be worked off if total fleet size is to be maintained over the longer-run. As discussed earlier, a decision to procure ships during the period FY2003-FY2007 at a rate less than the steady-state replacement a will add to a backlog of deferred ship procurement relative to the steady-state replacement rate that has been accumulating since FY1993, and thereby increase the post-FYDP (FY2008-FY2027) catch-up rate of ship procurement that will be required to maintain a 310-ship fleet.

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[24] Although fleet age is currently about 16.0 years, it is currently growing steadily. The Navy projects that it will exceed 17.5 years sometime in FY2004 or FY2005, reach 18 years by FY2007, vary between about 17.5 years and 18 years between FY2007 and FY2012, and then grow to almost 20 years by FY2022. U.S. Department of the Navy. Office of Budget. *Highlights of the Department of the Navy FY 2003 Budget.* Washington, 2002. (February 2002) Chart 5 on p. 2-7.

Potential for boom-and-bust cycle. A decision based on current average fleet age to procure ships in the nearer term at a rate below the steady-state replacement rate could set the stage for a future boom-and-bust cycle in Navy ship procurement as the lower ship-procurement rates of FY1993-FY2007 and the higher ship-procurement rates of FY2008-FY2027 are each echoed 35 years later. In a situation of constrained defense resources, such a cycle could be difficult to finance during the boom phase, unless other segments of defense procurement are in offsetting bust phases of their own boom-and-bust cycles.

Perhaps more significant, such a boom-and-bust cycle could place strains on the Navy's major shipbuilders, which do not have large amounts of non-Navy work that could compensate for lower amounts of Navy shipbuilding work during the bust phase of the Navy ship-procurement boom-and-bust cycle. Without significant amounts of offsetting non-Navy work, a boom-and-bust cycle in Navy ship procurement could put shipbuilder workforces and facilities through a roller-coaster effect that could reduce efficiencies and increase costs by lowering average worker productivity and discouraging investment in more modern production facilities.

Average worker productivity could be reduced if journeymen workers are laid off at the start of a bust phase and then replaced years later at the start of boom phase by new workers who need to be trained and who, upon completion of training, could require significant time to achieve levels of productivity equal to those of the laid-off journeymen workers. Investment in more modern production facilities could be discouraged due to either perceptions that Navy shipbuilding was inherently less stable than other areas of defense or non-defense production, or to doubts during the bust phase about the chances of realizing the next boom phase, particularly given the potential additional funding requirements associated with shifting from the bust phase back to the boom phase.

As a result of these two factors, plus those discussed in Appendix B, current average fleet age is best used as a preliminary (rather than conclusive) indicator of the urgency of procuring ships in the nearer term at a rate equal to or greater than the steady-state replacement rate.

Ships vs. aircraft. Administration officials, in defending their proposed ship-procurement plan, have noted that the average age of the Department of the Navy's aircraft is about 18.3 years. This is not only greater than the average age of the Navy's ships – the first time this has happened – but is well above 10 years (the half-way mark for an aircraft fleet with an average life of about 20 years). For these reasons, Administration officials have suggested, aircraft procurement is a higher near-term procurement priority than ship procurement.

The average age of the aircraft fleet certainly suggests that aircraft procurement is an urgent Department of the Navy priority. Without discounting this, however, the average age measure does not take into account two differences that differentiate aircraft from ship procurement.

The first of these is production lead time. Aircraft typically enter service about 2 or 3 years after they are procured, whereas ships typically enter service about 4 to 6 years after they are procured (7 years for an aircraft carrier). A decision to increase

aircraft procurement can thus begin to show results in reducing average aircraft age within 2 or 3 years, whereas a decision to increase ship procurement will not begin to show results in reducing average ship age until 4 or 6 years later.

The second is the current respective abilities of the Department of the Navy's (DoN's) aircraft and ship-procurement programs to absorb in FY2003 the increases in procurement quantities that would be needed to bring the procurement rate in both areas up to their steady-state rates. The steady-state replacement rate for DoN aircraft is 180 to 210 planes a year, based on an aircraft force-level goal of roughly 4,000 aircraft and an average aircraft life of roughly 20 years. The number requested for FY2003 is 83. It would be very difficult for the Department of the Navy to structure an aircraft procurement plan with 180 to 210 aircraft per year in FY2003, even if funding permitted, because two of the aircraft-procurement programs that would play a central role in increasing aircraft procurement numbers to 180 or more per year – the V-22 Osprey tilt-rotor and the F-35 Joint Strike Fighter – will not be ready to be procured in large annual quantities (i.e., 30 or more planes per year) until some time after FY2003. Indeed, procurement of the JSF for the Department of the Navy is not scheduled to begin until FY2006.[25]

In contrast, there are three Navy ship-procurement programs, and perhaps a fourth, that arguably could absorb increases in procurement quantities in FY2003 that could, collectively, increase the total number of ships to be procured in FY2003 from 5 ships to 9 or more ships. This issue is discussed in the following section.

Readiness of Programs For Higher Procurement Rates

Administration officials, in defending their proposed ship-procurement plan, have suggested that procuring new ships at something like the steady-state replacement would not be advisable in the near term because not enough of the Navy's ship-procurement programs are ready to absorb higher annual procurement rates in the near term. Administration officials have indicated that only one program – the Arleigh Burke (DDG-51) program, for which two ships are requested in FY2003 – is ready to absorb such an increase, and have suggested that if Congress makes available additional funds for ship procurement FY2003, they should be used to procure a third DDG-51.

For example, the Navy testified before the House Armed services Committee last month that

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[25]One option for increasing the total number of DoN aircraft procured in FY2003 to something like to 180 to 210 aircraft would be to increase procurement of F/A-18E/F strike fighters from the requested figure of 44 aircraft to three or four times that figure (i.e., to 132 or 176 aircraft). Such an increase would amount to a 175%- to 267%-increase over the 48 F/A-18E/F procured in FY2002. It is does not appear that the F/A-18E/F program could easily absorb such a large one-year increase in procurement rate: The current F/A-18E/F production line can produce up to 84 aircraft per year. An additional line would therefore need to be established to increase production above that rate – something that could not easily be done within a single year. Increasing F/A-18E/F production to 132 to 176 aircraft in a single year could pose challenges to supplier firms that manufacture various components of the F/A-18E/F.

> Although we plan to procure additional ships in the outyears, FY2003 is not the best time to further accelerate ship procurement quantities.... The Navy could use additional DDGs, and they are the most appropriate candidate for additional procurement.... While the *Virginia*[-class] design is nearing completion, there was no prior year advance procurement funding available to support building a second *Virginia* Class submarine in FY 2003. Delivery of USS Virginia will allow the class design and ship testing to complete before beginning the increased production of two *Virginias* per year later in the FYDP. We are not ready for rate acceleration this year. The LPD-17 design is still not complete. Four ships are already funded with advance procurement for another 2 ships. Although we need to replace our older amphibious force ships, LPD-17 is not ready for rate acceleration. Design work is just starting on the T-AKE lead ship and 3 T-AKE's are already appropriated.[26]

Arleigh Burke (DDG-51) class. The DDG-51 program has been in procurement since FY1985 and was selected for multiyear procurement (which requires a demonstration of program stability) starting in FY1998. The program has been funded at a level of about 3 ships per year since FY1994. The Administration has stated that the DDG-51 program could be increased to 3 ships in FY2003, and the Navy's FY2003 unfunded requirements list (URL) includes, as the 8th item on a prioritized list of 101 unfunded requirements, $810 million for the procurement of a third DDG-51 in FY2003. Given the stability of the program and available industrial capacity, it could be argued that the DDG-51 program could be increased further, to 4 ships, in FY2003, if desired. Congress added a fourth DDG-51 to the Administration's 3-ship request in FY1998.

Virginia (SSN-774) class. The Virginia class began procurement in FY1998. The Administration's argument regarding the advisability of procuring a second Virginia-class boat in FY2003 – that the procurement rate for the class should not be increased above the currently low rate of 1 ship per year until the lead ship enters service in 2004 – is an argument that has rarely, if ever, been advanced in connection with previous U.S. submarine (or surface ship) designs intended for series production, and represents a much more conservative approach to risk-management in Navy ship acquisition than has been employed in the past.

The idea of limiting procurement of an item until the first unit enters service is not necessarily burdensome for aircraft procurement programs, given the 2-3 construction time for the first aircraft. If applied to future U.S. submarine or surface ship acquisition programs, however, such an approach would prevent those programs from being increased above a minimal production rate for 4 to 6 years, which could reduce production economies of scale and preclude the introduction of competition into the production of those ships (if desired and otherwise feasible) for an extended period of time.

It is not clear whether there are any program-related reasons for adopting this new, more conservative approach for the Virginia class:

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[26]Statement of Gordon R. England, Secretary of the Navy, Before the House Armed Services Committee, 13 February 2002, Navy-Marine Corps: The Power of Teamwork.

- The construction drawings for the Virginia-class are more than 99% complete. At each stage of the lead-ship construction process, drawings for the Virginia class have been at a higher percentage of completion than drawings for the Seawolf class and other previous U.S. submarine programs.

- As of early March, construction the lead Virginia-class ship was 67% complete. The ship has encountered only about 10% as many design problems at this point in the construction process as did the lead Seawolf-class ship.

- The Virginia-class program, like other Navy ship acquisition programs, has experienced construction cost-growth, in part due to factors that do not relate to the design itself (such as higher-than-projected costs for materials and components delivered to the shipyards). The program, however, does not appear to have experienced any significant schedule delays or technology problems. The Navy testified earlier this month that construction of all 4 Virginia-class boats procure to date is progressing on schedule.[27]

- The Virginia-class design does not appear to be a high-risk submarine design compared to previous U.S. Navy submarine designs. To the contrary, the Virginia-class design appears to be the product of an early-1990s Navy effort to develop a low-risk, lower-cost, and more littoral-oriented, alternative to the Seawolf (SSN-21) class design. The Virginia-class design appears to build conservatively on technologies developed for the Seawolf and other previous U.S. submarine classes. Indeed, in the mid-1990s, when the Navy was seeking Congressional approval to procure the lead ship, the Virginia-class design was criticized in effect for being excessively conservative.[28]

Under previous standards for judging maturity and risk in a submarine-acquisition effort, these considerations would appear to support a judgment that procuring a second Virginia-class submarine in FY2003 would not create an undue amount of program schedule, technology, or management risk.

The Navy's original procurement profile for the Virginia class, presented to Congress in the mid-1990s, was to procure the lead Virginia-class boat in FY1998, the second boat in FY2000, and the third and fourth boats in FY2002. (The original FY1998-FY2002 procurement profile, in other words, was 1-0-1-0-2.) Procuring a second Virginia-class boat in FY2003 would result in an FY1998-FY2003 procurement profile of 1-1-0-1-1-2. This profile would increase the Virginia-class procurement rate to 2 boats a year later than under the original FY1998-FY2002 profile, and would do so after the procurement of 4 earlier boats, rather than 2 earlier boats as under the original plan.

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[27]Statement of Mr. John J. Young, Jr., Assistant Secretary of the Navy (Research, Development, and Acquisition), Before the House Armed Services Subcommittees on [the] FY 2002 [sic] Navy/Marine Corps Acquisition Program, March 6, 2002.

[28]See, for example, the statements of A. R. Battista, John S. Foster, Jr., Norman Polmar, and Lowell Wood before the Military Procurement subcommittee of the House National Security Committee hearing on submarine acquisition on September 7, 1995.

The absence of advance procurement funding in FY2001 or FY2002 to support the construction of long-leadtime nuclear-propulsion components for a second FY2003 Virginia-class boat does not prevent a second boat from being procured in FY2003 – it simply means that the interval between the year of procurement and the year the boat enters service would 1 or 2 years longer than usual (i.e., 7 or 8 years rather than the usual 6 years). If a second ship were fully funded in FY2003, construction of the long-lead time components would begin right away, and the rest of the ship would commence construction one or two years later, with funds being obligated accordingly.

Congress can, and has, fully funded the procurement of nuclear-powered ships for which there was no prior-year advance procurement funding for long-leadtime components. For example, Congress in FY1988 fully funded the procurement of CVN-74 and CVN-75 as a two-ship buy, even though there had been no prior-year advance procurement funding for the ships.[29] Following Congress' decision in FY1988, construction of long-leadtime components began right away, construction of CVN-74 itself began about two years later, and construction of CVN-75 began about two years after that. CVN-74 entered service in 1995, 7 years after the year of procurement (a typical time to build a carrier), and CVN-75 entered service in 1998, 10 years after the year of procurement.

Rather than recommending full funding in FY2003 for the procurement of a second Virginia-class boat, the Administration's FY2003 unfunded requirements list includes, as the 87th of 101 items, $415 million in advance procurement funding for two shipsets of Virginia-class long-leadtime items to support the potential procurement of two additional Virginia-class boats starting as early as FY2005.

It can be argued that for FY2003, providing advance procurement funding for two potential additional Virginia-class boats rather than full funding for a Virginia-class boat would more efficiently use available FY2003 budget authority, since one or two years would pass before the Navy would begin to obligate and expend most the funding for a Virginia-class boat ship that is fully funded in FY2003 without any prior-year advance procurement funding.

On the other hand, it can be argued that, from a congressional perspective, there may be some risk in adding advance procurement funding in FY2003 for two additional Virginia-class boats that might be procured in future years, since the Administration is not committing itself to procuring the two boats. The addition of advance procurement funding only in FY2003 would create a downstream requirement to finance the remainder of the cost of those two boats – something that the Administration, as part of its defense-budgeting process, may be unwilling or unable to do. Moreover, if the Administration does choose to fund the remainder of the procurement cost of the two boats in future years, it may do so at the expense of other programs of interest to Congress. Fully funding a Virginia-class boat in FY2003 would avoid a downstream unfunded obligation to finance the remainder of

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[29]The Administration's FY1988 budget and FY1988-FY1992 FYDP proposed procuring CVN-74 in FY1990, with advanced procurement funding in FY1988 and FY1989, and CVN-75 in FY1993, with advance procurement funding in FY1989-FY1992.

the ship's procurement cost and preserve congressional control over the offsetting reductions in other programs that may be needed to make this funding available.

Lewis and Clark (TAKE-1) class. Procurement of TAKE-1 class ships began in FY2000. Although design work on the TAKE-1 class has only recently begun, this program does not appear to present any significant technical or design risks:

- The TAKE-1 class, like most other auxiliary, sealift, and commercial cargo ships, is a non-complex ship.

- The TAKE-1 design is similar to other classes of auxiliary, sealift, and commercial cargo ships that the shipbuilder (National Steel and Shipbuilding Company of San Diego) has built in recent years.

- The TAKE-1 class will be the first in the U.S. Navy to employ an integrated electric-drive propulsion system, but the inclusion of this system in the TAKE-1 class design does not appear to be a high- or even moderate-risk item, because the system to be installed is a very basic (rather than advanced-technology) electric-drive system that will employ well-established, commercial-type electric-drive technology that has been used successfully on many cruise ships and other commercial ships since the late 1980s.[30] The electric-drive system will be supplied by the Alstom corporation, a leading worldwide supplier of commercial-type electric-drive propulsion systems. The shipbuilder will be installing very similar Alstom-supplied electric-drive systems on two classes of commercial cargo ships that is building. The lead ship of one of these commercial ship classes is to be delivered to the customer toward the end of 2002, and the second ship is to be delivered in May or June 2003. Construction of the lead TAKE-1 class ship will begin after this – in July 2003 – and the engines for the ship are to be installed in early 2004.

Under previous standards for judging maturity and risk in an auxiliary-ship acquisition effort, these considerations would appear to support a judgment that procuring a second or even third TAKE-1 class ship in FY2003 would not create an undue amount of program schedule, technology, or management risk. The table below compares the Bush Administration's currently proposed TAKE-1 class procurement profile with the profiles proposed by the Clinton Administration in 2000 and 1999. All the profiles include a total of 12 ships. As shown in the table, the Clinton Administration plans included procurement of 2 or 3 TAKE-1 class ships in FY2002, and another 2 or 3 ships in FY2003.

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[30]The system, for example, will use alternating-current (AC) synchronous motors controlled by synchroconverter motor drives and connected by a conventional shaft to a conventional ship's propeller. This is a very basic, low-risk electric-drive configuration. Some recently-built cruise ships, in fact, have electric-drive systems that in some respects (e.g., use of swiveling podded propulsors rather than a conventional shaft-and-propeller arrangement) are more advanced than the TAKE-1 system. For more on electric-drive propulsion technology on Navy ships, see CRS Report RL30622, *Electric-Drive Propulsion for U.S. Navy Ships: Background and Issues for Congress*, by Ronald O'Rourke. Washington, 2000. (July 31, 2000) 65 p.

Table 4. TAKE-1 Class Proposed Procurement Profiles
(annual quantities, by fiscal year; shaded cells are prior-year actuals)

Administration plan (and year)	Fiscal Year							
	0	1	2	3	4	5	6	7
Bush (2002)	1	1	1	1	1	2	2	3
Bush (2001)	1	1	1	(not available – no FYDP)				
Clinton (2000)	1	1	3	3	2	2		
Clinton (1999)	1	1	2	2	3	3		

San Antonio (LPD-17) class. Procurement of San Antonio (LPD-17) class ships began in FY1996. The program encountered significant problems in the design phase, leading to significant cost overruns and schedule delays. As a result, Congress decided to procure no additional LPD-17s in FY2001 or FY2002. Over the last year, however, the Navy and the contractor appear to have taken steps to resolve these problems. Although the Bush Administration did not request any additional LPD-17s for FY2002, it is requesting procurement of one LPD-17 for FY2003.

Given the difficult recent history of the LPD-17 program, and the fact that no LPD-17s were procured in either of the previous two fiscal years, it might be more difficult to argue in favor of adding a second LPD-17 in FY2003 than it would be to argue in favor of adding an additional DDG-51, SSN-774, or TAKE-1 class ship. It can be noted, however, that the Navy's FY2003 unfunded requirements list (URL) includes, as the last item on a prioritized list of 101 unfunded requirements, $1,100 million for the procurement of a second LPD-17 in FY2003. The inclusion of this item on the Navy's FY2003 URL appears to reflect a Navy judgment that the LPD-17 program, in spite of is earlier problems, is now ready from a program-management and -execution standpoint to absorb a second ship in FY2003. The Navy testified earlier this month that "Current metrics indicate the LPD-17 program team is now performing in a predictable and disciplined manner."[31]

Options for ship procurement in FY2003. Using the cases discussed above, one can construct notional alternatives to the Administration's proposed FY2003 ship-procurement request that would procure a total number of ships about equal to or higher than, the steady-state replacement rate of 8.9 ships per year – if Congress decides to make funds available for this purpose. The table below compares the Administration's FY2003 ship-procurement request to two notional alternatives, one that would procure a total comparable to the steady-state replacement rate of 8.9 ships per year, and one that would procure a total comparable to the catch-up rates discussed earlier.

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[31]Statement of Mr. John J. Young, Jr., Assistant Secretary of the Navy (Research, Development, and Acquisition), Before the House Armed Services Subcommittees on [the] FY 2002 [sic] Navy/Marine Corps Acquisition Program, March 6, 2002.

Table 5. New Ships Procured in FY2003

Class	Admini-stration. plan (quantity)	Notional alternative 1		Notional alternative 2	
		Quantity	Approx. additional funding needed (millions)	Quantity	Approx. additional funding needed (millions)
DDG-51	2	3	810	4	1745
SSN-774	1	2	2200	2	2200
TAKE-1	1	2	400	3	800
LPD-17	1	2	1100	2	1100
Total	**5**	**9**	**4510**	**11**	**5845**

Congressional Oversight of Ship Procurement

The Administration, as part of its FY2003-FY2007 FYDP, is proposing to transfer procurement of some new-construction Navy ships from the Shipbuilding and Conversion, Navy (SCN) appropriation account to other parts of the defense budget. Specifically, it is proposing to procure the lead DD(X) ship, to be funded in FY2005, through the Navy's research, development, test and evaluation (RDT&E) account, and the remaining Lewis and Clark (TAKE-1) class ships in the National Defense Sealift Fund (NDSF). These proposed changes raise two potential issues regarding congressional oversight of ship procurement, one concerning the composition of the SCN account, the other concerning the full funding provision.

Composition of SCN Account. The Administration's proposal to procure the lead DD(X) in the Navy's RDT&E account and the remaining TAKE-1 class ships in the NDSF would, if implemented, add to other changes in recent years that have transferred procurement of new-construction sealift ships out of the SCN account and transferred items other than new-construction military ships and ship conversions[32] – specifically, service life extension programs (SLEPs) and refueling overhauls (RFOHs) for nuclear-powered ships – into the SCN account. The table below summarizes these past and proposed changes in the composition of the SCN account.

[32]The term conversions generally refers to one or more major changes to a ship's basic configuration, particularly changes that give the ship an ability to perform new or different missions.

Table 6. Changes to Composition of SCN Account

Type or class of ship	Type of work	Year or plan where change was introduced or proposed
New-construction ships transferred out of SCN account		
Sealift ships	new-construction ships	FY1993[a]
lead DDX ship	new-construction ship	FY2003-FY2007 plan
TAKE-1s	new-construction ships	FY2003-FY2007 plan
Items other than new-construction ships transferred into SCN account		
CVs	SLEPs	FY1978-FY1872 plan[b]
LPD-4s	SLEPs	FY1984-FY1988
CVNs	RFOHs	FY1990[c]
CGNs	RFOHs	FY1992-FY1997 plan
AOE-1s	SLEPs	FY1996-FY2001 plan
TAEs and TAFSs	SLEPs	FY1998-FY2003 plan
LCACs	SLEPs	FY1999-FY2003 plan
SSNs	RFOHs	FY2001-FY2005 plan[d]

[a] Congress created the NDSF through Section 1024 of the FY1993 defense authorization act (H.R. 5006; see pages 178-181 of H.Rept. 102-966 of October 1, 1992, the conference report on the act), as amended by Title V of the FY1993 defense appropriations act (H.R. 5504).

[b] Although sometimes listed as conversions, the CV SLEPs were extensive overhauls and modernizations that did not change the carriers' basic configuration or fundamental missions.

[c] Congress, in acting on the FY1990 defense budget request, transferred funding for the refueling overhaul (RFOH) of the nuclear-powered aircraft carrier (CVN) Enterprise (CVN-65) from the Operation and Maintenance, Navy (OMN) account to the SCN account, and recommended that the Navy fund all subsequent CVN RFOHs through the SCN account. Congress' decision was based on the grounds that CVN RFOHs were comparable in scope, time, and cost to CV SLEPs. (See S.Rept. 101-81 of July 19, 1989, the Senate Armed Services Committee report on S. 1352, the FY1990 and FY1991 defense authorization act, pages 55-56.)

[d] The transfer of attack submarine RFOHs from the OMN account to the SCN account starting with the FY2001 budget request helped the Clinton Administration to state that the proposed FY2001 DoD budget included a total of at least $60 billion in procurement funding – a funding target established by the Chairman of the Joint Chiefs of Staff a few years earlier. The total procurement request for FY2001 was $60.270 billion and the funding request for the one attack submarine ROH included in the SCN account in FY2001 was $283 million.

These past and proposed changes to the composition of the SCN account each have their own supporting rationales. For example:

- New-construction sealift ships were transferred to the NDSF in part on the grounds that sealift ships, which transport military equipment and supplies from one land mass to another, serve primarily the needs of the Army and Air Force and therefore should not be retained in the Navy's SCN account, where they might have to compete for scare procurement funds against other types of ships that perform missions for the Navy.

- The Administration is proposing to fund the lead DDX through the RDT&E account in part on the grounds that the ship will incorporate a number of new technologies now in development. This proposal, if implemented, could lead to proposals in the future to fund lead ships of other classes featuring new technologies through the RDT&E account.

- The Administration's proposal to procure the remaining TAKE-1 class ships through the NDSF is consistent with Congressional interest in this approach expressed in action on the FY2001 defense authorization bill.[33]

- CV SLEPs and CVN RFOHs were judged to be comparable in scope, time, and cost to conversions and new-construction ship efforts, and were included in the SCN account in part so that Congress could better understand and track the cost of the programs.

Together, however, these past and proposed changes to the composition of the SCN account raise a potential question as to whether the SCN account will be become less valuable as a tool for Congress to easily ascertain and track ship-procurement activities. Transferring new-construction ships out of SCN, and items other than new-construction ships into SCN, may make it more difficult for Congress in the future to easily ascertain and track:

- the total number of new Navy and military sealift ships that are requested for procurement each year;

- total costs and funding for procurement of new Navy and military sealift ships; and

- the relationship between the total amount of funding in the SCN account and the number of new Navy ships procured.

Full Funding Provision. Transferring procurement of the lead DD(X) to the Navy's RDT&E account, and procurement of the remaining TAKE-1 class ships to the NDSF, would mean that these ships would not be subject to the full funding provision, the defense-budgeting provision that normally requires the entire procurement cost of new-construction Navy ships to be funded in the year in which

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[33]See H.Rept. 106-616 of May 12, 2000, the House Armed Services Committee report on the FY2001 defense authorization bill (H.R. 4205), page 89; S.Rept. 106-292, the Senate Armed Services Committee report on the FY2001 defense authorization bill (S. 2549), page 93; and H.Rept. 106-945, the conference report on the FY2001 defense authorization bill (H.R. 4205), page 35 (Sec. 127).

it is procured.[34] The ships could, for example, be funded incrementally, without the special legislation that Congress provided for LHD-8 in the FY2000 and FY2001 defense appropriation acts, or in some other way that does not conform to the full funding provision.

Attack Submarines

The post-Cold War downturn in procurement began sooner and was proportionately deeper for attack submarines than for most other kinds of Navy ships. As a result, the cumulative ship procurement backlog for SSNs is particularly acute, and achieving and maintaining planned SSN force levels will be particularly challenging. This issue has been a concern in Congress since the mid-1990s, and has been discussed by CRS in testimony in 1995[35] and 1997;[36] in a 1997 CRS presentation

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[34]As discussed in CRS testimony to the House National Security Committee in 1999 (Statement of Ronald O'Rourke, Specialist in National Defense, Congressional Research Service, Before the House National Security Committee Subcommittee on Military Procurement Hearing on Littoral Warfare Protection and Ship Recapitalization, March 9, 1999, pages 7-8), the full funding provision applies to "procurements that are covered within the procurement title of the annual Department of Defense (DoD) appropriation Act. The full funding policy has no application to any other appropriation contained in other titles of the Act." (U.S. Department of Defense. Comptroller. *Financial Management Regulation, Volume 2A, Budget Formulation and Presentation*. Washington, 1993. [June 1993] p. 1-18.)

Congress imposed the full funding policy on DoD in the 1950s to make the total procurement costs of DoD weapons and equipment more visible and thereby enhance Congress' ability to understand and track these costs. Congress' intent in imposing the policy was to strengthen discipline in DoD budgeting and improve Congress' ability to carry out its oversight of DoD activities. DoD states that "The objective [of the full funding policy] is to provide funds at the outset for the total estimated cost of a given item so that Congress and the public can be fully aware of the dimensions and cost when it is first presented in the budget." (Ibid.)

Prior to the imposition of the full funding policy, DoD weapon procurement was frequently accomplished through incremental funding, under which the funding to procure a given item was provided in increments over a series of years in a pattern reflecting requirements for making progress payments to the contractor. Incremental funding fell out of favor because opponents believed it made total procurement costs more difficult for Congress to track, or created a potential for DoD to start procurement of an item without necessarily stating its total cost up front (or without ensuring that the funding needed to complete it would be available in future DoD budgets), or might permit one Congress to "tie the hands" of one or more future Congresses by providing initial procurement funding for a weapon whose cost would have to be largely paid during one or more future Congresses.

[35]Statement of Ronald O'Rourke, Specialist in National Defense, Congressional Research Service, Before the House National Security Committee Subcommittee on Military Procurement Hearing on Submarine Acquisition Issues, March 16, 1995, p. 8-12. (See also Statement of Ronald O'Rourke, Specialist in National Defense, Congressional Research Service, Before the Senate Armed Services Committee Subcommittee on Seapower Hearing on Submarine Acquisition Issues, May 16, 1995, p. 9-12.)

[36]Statement of Ronald O'Rourke, Specialist in National Defense, Congressional Research

(continued...)

to a Defense Science Board task force on the submarine of the future, which issued its report in 1998;[37] a 1999-2000 CRS report on attack submarine programs,[38] and 1999 CRS testimony in 1999[39] and 2000.[40] This report is updated to take into account the Administration's proposed FY2003-FY2007 ship-procurement plan.

SSN Procurement Backlog. The Administration's FY2003-FY2007 plan, if implemented, would result in the procurement of 12 SSNs during the 18-year period FY1990-FY2007 — the final Los Angeles (SSN-688) class boat (in FY1990), the second and third Seawolf (SSN-21) class boats (in FY1991 and FY1996), and the first 9 Virginia (SSN-774) class boats (one each in FY1998, FY1999, and FY2001-FY2007). This would be an average procurement rate of two-thirds of a boat per year for more than one-half of the SSNs' 33-year replacement period.

If, during this 18-year period, SSNs were instead procured at the steady-state replacement rate of 1.67 boats per year (a 55-boat force level divided by a 33-year life), a total of 30 SSNs would be procured. The FY2003-FY2007 plan, if implemented, would thus create an SSN procurement backlog of 18 boats for the period FY1990-FY2007.[41]

Effect on force levels after 2015. This 18-boat backlog in procurement, which is equivalent to about 33% of the 55-boat force-level objective, will be masked between now and about 2015 by the large numbers of SSNs procured during the 1980s. After about 2015, however, SSNs procured during the 1980s will reach

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[36](...continued)
Service, Before the House National Security Committee Subcommittee on Military Procurement Hearing on Submarine Acquisition Issues, March 18, 1997, p. 9-10.

[37]U.S. Department of Defense. Report of the Defense Science Board Task Force on [the] Submarine of the Future. Washington, 1998. (July 1998, Office of the Under Secretary of Defense For Acquisition & Technology, Washington, D.C. 20301-3140) p. 7, 19-20.

[38]CRS Report RL30045, *Navy Attack Submarine Programs: Background and Issues for Congress*, by Ronald O'Rourke. Washington, 1999. (Updated June 1, 2000) p. 20-31.

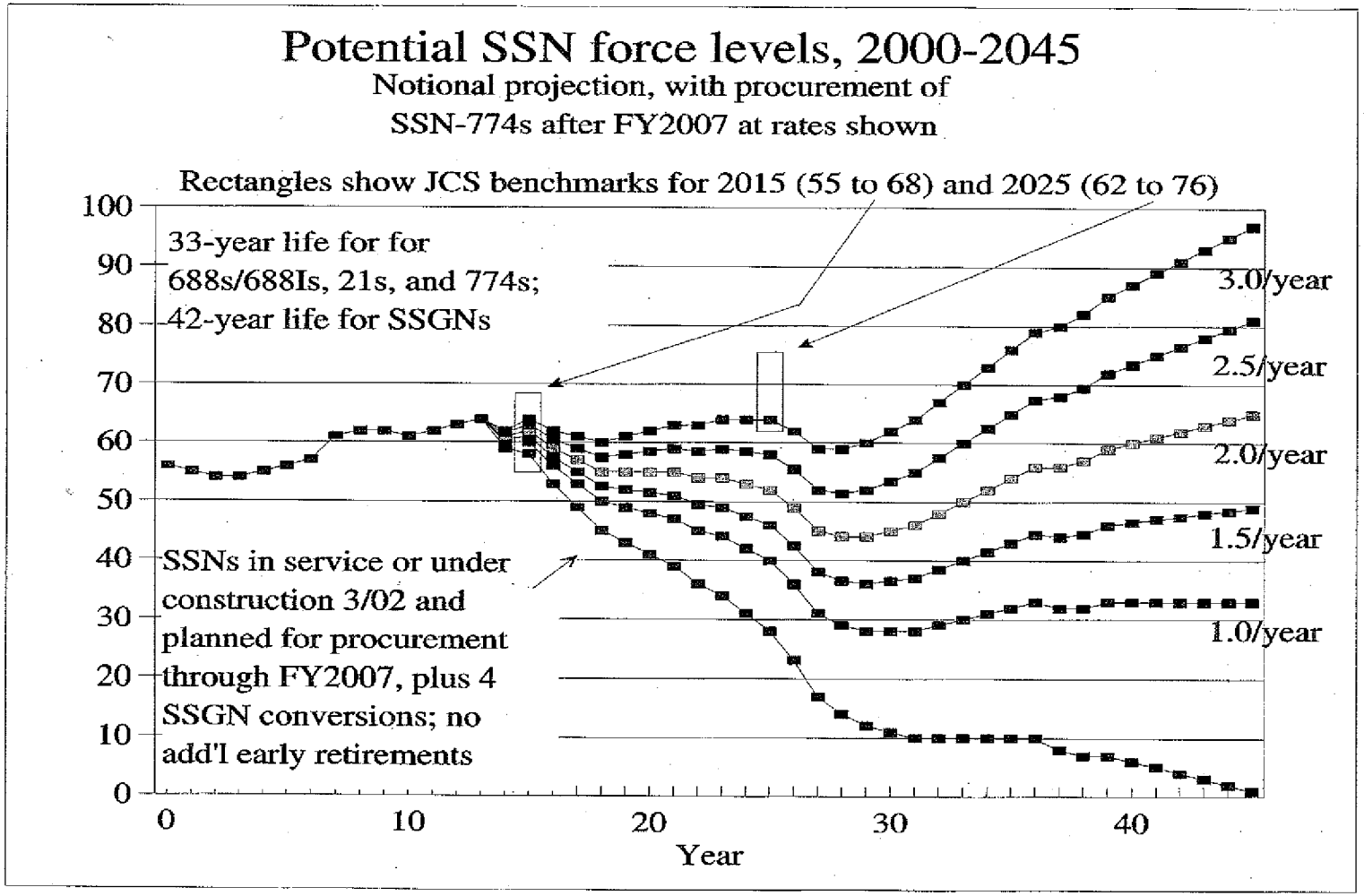
[39]Statement of Ronald O'Rourke, Specialist in National Defense, Congressional Research Service, Before the House National Security Committee Subcommittee on Military Procurement on Littoral Warfare Protection and Ship Recapitalization, March 9, 1999, p. 4-7.

[40]Statement of Ronald O'Rourke, Specialist in National Defense, Congressional Research Service, Before the House Armed Services Committee Subcommittee on Military Procurement Hearing on Navy Shipbuilding Programs, February 29, 2000, p. 10-22, and Statement of Ronald O'Rourke, Specialist in National Defense, Congressional Research Service, Before the Senate Armed Services Committee Subcommittee on Seapower Hearing on Ship Procurement and Research and Development Programs, March 2, 2000, p. 10-22.

[41]The SSN procurement backlog for the 15-year period FY1993-FY2007 would be 15 boats. (A total of 10 SSNs would be procured during this period – the third Seawolf submarine plus the first 9 Virginia-class boats – compared to the 25 SSNs that would be procured if SSNs were procured during this period at the steady-state replacement rate of 1.67 boats per year). Thus, of the 47-ship backlog in procurement of all kinds of ships for the period FY1993-FY2007 discussed earlier, 15 of these ships, or about 32%, would be SSNs.

retirement age and begin to leave service, and the FY1990-FY2007 "deficit" in SSN procurement, if not by then redressed, will begin to become apparent.

The graph on the next page shows the consequences on the size of the SSN force for the period 2014-2045 of various SSN procurement rates after FY2007, assuming a 33-year life for most existing SSNs. The graph comes close to being a best-case projection because it assumes no early retirements of SSNs beyond those that have already occurred (i.e., the refueling of all 688s that will become available for refuelings over the next several years), as well as the conversion of 4 Trident SSBNs into SSGNs.



Prepared by CRS, March 2002, based on U.S. Navy data.

Procurement Rate For Maintaining 55-Boat Force. As can be seen in the graph, by the late-2020s, most of the SSNs procured in the 1980s and earlier years will no longer be in service. As a consequence, unless the post-FY2007 SSN procurement rate is increased substantially from the 1-per-year rate programmed for FY2003-FY2007, the size of the SSN force could drop substantially below 55 boats and remain there until well into the 2030s.

As also shown in the graph, if Virginia-class boats are procured at a rate of 1 per year for the period FY2003-FY2007, as proposed by the Administration, then maintaining a force of at least 55 SSNs will require an average SSN procurement rate of more than 2.5 boats per year during the 17-year period FY2008-FY2024.[42]

1999 JCS Study on SSN Force Levels. A December 1999 Joint Chiefs of Staff (JCS) study on required SSN force levels reached three main conclusions:

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

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

- "that 68 SSNs in the 2015 [time frame] and 76 [SSNs] in the 2025 time frame would meet all of the CINCs' and national intelligence community's highest operational and collection requirements."[43]

Although the conclusions of this study are frequently mentioned in discussions of future required SSN force levels, they are not mentioned in the report on the 2001 Quadrennial Defense Review, which simply left unchanged, for the time being at least, the amended 55-boat SSN force-level goal from the final years of the Clinton Administration.

The table below summarizes potential post-FY2007 SSN procurement rates and their relationship to the force-level benchmarks set forth in the 1999 JCS SSN force-level study, assuming that the current plan to procure 1 SSN per year during the period FY2003-FY2007 is implemented.

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[42] An alternative calculation of the catch-up rate for a 55-boat force, starting in FY1993 rather than FY1990: If 10 SSNs are procured during the 15-year period FY1993-FY2007, as currently planned, and if the post-FY2007 catch-up rate is calculated without regard for whether the SSN force temporarily slips below 55 boats late-2020s, then a total of 45 SSNs would need to be procured during the remaining 18 years (FY2008-FY2025) of the SSN force's 33-year replacement period. This works out to an average post-FY2007 catch-up rate of exactly 2.5 boats per year for that 18-year period.

[43] Source: Two-page Department of the Navy information paper dated February 7, 2000 entitled "Subject: Unclassified Release of the 1999 CJCS Attack Submarine Study."

Table 7. SSN Procurement Rate and JCS Benchmarks

SSN Procurement Rate after FY2007	Resulting SSN Force Levels[a]		
	2015		2025
	Total (with 4 Trident SSGNs)[b]	Virginia (SSN-774) class SSNs	Total (with 4 Trident SSGNs)[b]
	JCS benchmark: 55 to 68	JCS benchmark: 18	JCS benchmark: 62 to 76
1.0 per year	60	11	40
1.5 per year	61	12	46
2.0 per year	62	13	52
2.5 per year	63	14	58
3.0 per year	64	15	64
3.5 per year	65	16	70
4.0 per year	66	17	76

Source: Prepared by CRS based on U.S. Navy data.

Notes

a All force levels shown assume funding of all potential SSN refuelings. These SSN refuelings would affect SSN force levels primarily between now and about 2018.

b Assumes one converted Trident SSGN enters service in 2006 and the other three in 2007. All four would thus be in service in 2025, but would be retired a year or two later.

Using the table above and the force-level graph, the following conclusions can be drawn:

- **A post-FY2007 SSN procurement rate of 1 boat per year** – a continuation of the rate planned for FY2003-FY2007 – would result in an SSN force that falls within the JCS range for the total number of SSNs in 2015 but falls about 39% short of the JCS benchmark for the number of Virginia-class SSNs in 2015 and about 35% short of the lower end of the JCS range for the total number of SSNs in 2025. The force would bottom out in 2029-2031 at 28 boats before recovering to a steady-state force-level of 33 boats in 2039.

- **A post-FY2007 SSN procurement rate of about 3 boats per year** would result in an SSN force that falls within the JCS range for the total number of SSNs in 2015 but falls 3 boats short of the JCS benchmark for the number of Virginia-class boats in 2015. The force would exceed by 2 boats the lower end of the JCS range for the total number of SSNs in 2025 and would bottom out at 59 boats in 2027-2028.

- **A post-FY2005 SSN procurement rate of about 4 boats per year** would result in an SSN force that falls within the JCS range for the total number of SSNs in 2015 and comes within 1 boat of meeting the JCS benchmark for the number of Virginia-class SSNs in 2015. The force could would meet the higher end of the JCS range for the total number of SSNs in 2025.

The clear implication of these numbers is that meeting or coming close to all three of the JCS force-level benchmarks – the two nearer-term (2015) benchmarks and the one longer-term (2025) benchmark – would require a post-FY2007 SSN procurement rate of about 3 or 4 boats per year.

Potential Implications of Higher SSN Procurement Rates. There are at least two potential implications of the higher SSN procurement rates needed to maintain a 55-boat force or achieve the benchmarks in the 1999 JCS study:

- With Virginia-class SSNs currently costing about $2.2 billion each to procure, increasing the SSN procurement rate from the current rate of 1 boat per year to 2.5 or more boats per year will by itself increase SCN funding requirements by roughly $3 billion per year.

- If the SSN procurement rate is increased to 2.5 or more boats per year, Congress and the Administration may consider exploring the relative merits of SSN acquisition strategies other than the joint-production strategy currently in place, which was initiated in 1997 as a means of maintaining submarine construction activity at two shipyards (rather than one), while also preserving some degree of production efficiency, during a period of low-rate procurement of SSNs. Potential alternatives include producing entire submarines at each of the two submarine-construction yards, with the construction contracts either allocated to the yards on a non-competitive basis or awarded to the yards on the basis of periodic (e.g., once every year or two years) competitions.

TAKE-1 Program

As noted earlier, the Administration this year is proposing to procure the remaining TAKE-1 class ships in the National Defense Sealift Fund (NDSF) rather than in the Shipbuilding and Conversion, Navy (SCN) appropriation account. This would be consistent with congressional interest for this funding approach expressed in acting on the FY2001 defense budget, but as noted earlier, it would also mean that these ships would not be subject to the full funding provision.

The funding history for the Large, Medium-Speed Roll-on/Roll-off (LMSR) sealift ships procured in the NDSF in the 1990s provides one example of how ships procured through the NDSF can be funded. As discussed in a 1996 CRS report,[44] although individual LMSRs were ostensibly fully funded each year by Congress, like ships procured in the SCN account, DoD in some cases actually applied LMSR funding provided in a given year to partially finance the construction of LMSRs

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[44]CRS Report 96-257 F, *Sealift (LMSR) Shipbuilding and Conversion Program: Background and Status*, by Valerie Bailey Grasso. Washington, 1996. (March 19, 1996) 6 p.

authorized in various years. For example, although Congress ostensibly approved $546.4 million in FY1995 for the procurement of 2 LMSRs, the FY1995 funds were actually applied to help finance portions of 16 LMSRs whose construction contracts were awarded between FY1993 and FY1997. In explaining its use of funds in the LMSR program, DoD stated:

> The National Defense Sealift Fund (NDSF) is not a procurement appropriation but a revolving fund. Dollars appropriated by Congress for the fund are not appropriated to purchase specific hulls as in the case of, for example the Navy's DDG-51 program. Rather, dollars made available to the NDSF are executed on an oldest money first basis. Therefore, full funding provisions as normally understood for ship acquisition do not apply.[45]

Procuring the remaining TAKE-1 class ships in the NDSF may have advantages in terms of insulating these ships from competition against other Navy ships (particularly combat ships) for scarce SCN dollars, or relieving financial pressure on the SCN account. It may also, however, make it more difficult for Congress to track the ships' costs and the ways in which annual TAKE-1 procurement funds are applied to the program.

LHA Replacement LHA(R) Program

The program for procuring ships to replace the Navy's five aging Tarawa-class amphibious assault ships (LHA-1 through LHA-5) poses at least three potential questions for Congress. The first concerns current uncertainty over the Navy's plans for using the $10 million in FY2002 funds that DoD made available, as part of its FY2003 defense budget and FY2003-FY2007 FYDP, for procurement of LHD-9, a modified Wasp (LHD-1) class amphibious assault ship. The second concerns the potential for the basic Wasp (LHD-1) class design, or modifications of that design, to accommodate future Marine Corps air wings featuring F-35 Joint Strike Fighters and V-22 Osprey tilt rotor aircraft. These two questions have already received some attention.[46]

A third question, which has received less attention than the other two, concerns the potential urgency of proceeding with the LHA(R) program if all five LHAs, which are certified for 35-year lives, are to be replaced on a timely basis.

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[45]DoD information paper on strategic sealift acquisition program provided to CRS by U.S. Navy Office of Legislative Affairs, January 25, 1995, p. 1.

[46]See, for example, Castelli, Christopher J. Facing McCain's Criticism, Zakheim Says Navy Not Blindsided On LHD-9. *Inside the Navy*, March 18, 2001; Castelli, Christopher J. Kennedy, McCain Press Jones On LHA(R) As Focus Turns To Size of LHD-9. *Inside the Navy*, March 11, 2002: 1; Castelli, Christopher J. McCain Concerned About LHD Added To Navy Budget At Lott's Urging. *Inside the Navy*, March 4, 2002; Castelli, Christopher J. At the Pentagon, Views Differ on a Last-Minute Budget Change: LHD-9. *Inside the Navy*, February 25, 2002; Ratnam, Gopal, and Amy Svitak. U.S. Navy Officials Seek New Ship Design. *Defense News*, February 18-24, 2002: 8; Ratnam, Gopal, and Amy Svitak. Opponents Rap Funding For New LHD-Class Ship. *Defense News*, February 11-17, 2002: 6.

LHD-8, the replacement for LHA-1, is being funded incrementally at the direction of Congress, with the final increment of funding programmed for FY2006. The ship was recorded by the Administration as an FY2002 procurement, and construction work on the ship is planned to proceed at about the same pace as if LHD-8 were fully funded in FY2002. LHA-8 may thus enter service around 2007, replacing LHA-1 at about age 31, four years before the end of its nominal 35-year life.

Although LHA-1 will likely be replaced prior to the end of its 35-year life, current plans if implemented could result in LHAs 2 through 5 being replaced after age 35, in some cases several years after age 35: Although the Administration has set aside $10 million in FY2002 funds for procurement of LHD-9 as a replacement for LHA-2, the Administration's FY2003-FY2007 ship-procurement plan includes no additional procurement funding for LHD-9 or any other replacement ship for LHA-2. The implication of the Administration's plan is that the replacement ship for LHA-2 will not be procured until FY2008 at the earliest.

As shown in the table below, if the replacement for LHA-2 is procured in FY2008, the replacement ships for LHAs 3 through 5 are procured at 2- or 3-year intervals thereafter, and the replacement ships, like LHAs and LHDs, take about 5 years to build, then LHAs 2 through 5 will be replaced after age 35. If the replacement ships are procured at 3-year intervals, then two of the ships will be replaced at ages 40 and 42. (The Navy testified earlier this year that its current plan would replace LHA-5 in 2024, at age 44.[47])

If LHAs 2 through 4 are to be replaced closer to age 35, one option would be to accelerate the completion of procurement funding for LHD-8[48] and procure the replacement ship for LHA-2 within the FY2003-FY2007 FYDP. The table below shows the affect of procuring the LHA-2 replacement ship in FY2005 on reducing the ages at which LHAs 2 through 5 are replaced.

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[47]Statement of Mr. John J. Young, Jr., Assistant Secretary of the Navy (Research, Development, and Acquisition) and Vice Admiral Michael Mullen, United States Navy, Deputy Chief of Naval Operations (Resources, Requirements and Assessments) Before the Seapower Subcommittee of the Senate Armed Services Committee on FY 2003 Navy/Marine Corps Shipbuilding Programs, March 19, 2002, page 12.

[48]The Navy's FY2003 unfunded requirements list includes, as the 12th of 101 items, $536 million to fully fund the remainder of the cost of LHD-8.

Table 8. Potential Ages of LHAs at Replacement

Alternative LHA(R) procurement profiles	Ages at which LHAs are replaced			
	LHA-2	LHA-3	LHA-4	LHA-5
LHA-2 replacement procured in FY2008, subsequent ships at rate of:				
1 every 3 years	36	38	40	42
1 every 2 years	36	37	38	39
LHA-2 replacement procured in FY2005, subsequent ships at rate of:				
1 every 3 years	33	35	37	39
1 every 2 years	33	34	35	36

Another factor to consider is the effect of the schedule for procuring the LHA-2 replacement ship on the production line at Ingalls Shipbuilding, the shipyard that builds LHA/LHD-type ships. Since LHD-8 is being built on a schedule generally the same as if it had been fully funded in FY2002, procuring the LHA-2 replacement ship in FY2008 would create a 6-year gap between the two ships. This is longer than the optimum gap between ship procurements from the standpoint of maintaining efficient heel-to-toe production of LHA/LHD-type ships at Ingalls. Procuring the LHA-2 replacement ship in FY2005 would reduce the gap between the two procurements to 3 years, which might better maintain production efficiencies at Ingalls for the LHA-2 replacement ship and thereby reduce its cost.

Appendix A: Steady-State Replacement Rate

The steady-state replacement rate is equal to size of the fleet to be maintained divided by the average expected life of the units that make up the fleet. It is the average rate of procurement that must be maintained over the long run (that is, over a period equivalent to average expected life) if the size of the fleet is to be maintained at about the stated level over the long run. Given a planned Navy of 310 ships and a fleet-wide average ship life of 35 years, the steady-state replacement (i.e., procurement) rate would be 8.9 new ships per year – an average rate that would need to be maintained over a 35-year period.

If a fleet of 310 ships with an average life of 35 years is to be maintained across a 35-year period, and there are some years during the corresponding 35-year procurement period[49] during which the actual ship-procurement rate is below 8.9 ships per year, then there must be other years during the same 35-year period during which the actual ship-procurement rate is above 8.9 ships per year, so that the average actual ship-procurement rate over the entire 35-year period works out to about 8.9 ships per year.

Although the steady-state replacement rate measures the average level of effort in ship procurement that must be maintained over the long run to maintain a fleet of a given size over the long run, it is a single-point measure whose utility is complicated by considerations in at least four areas:

- **Nearer-term urgency of effort.** The steady-state replacement rate by itself provides no indication of the nearer-term urgency attached to that level of effort – that is, of the procurement rate required in the nearer term to maintain the fleet at a given size over the nearer term.

- **Composition of procurement.** The steady-state replacement rate provides no indication of the required composition of ship procurement – the kinds of ships to be procured, and the numbers of each.

- **Changes in fleet size or average life.** Use of the steady-state replacement rate as a procurement-planning tool can be complicated by potential changes in the size of the fleet to be maintained or in average ship life.

- **Expected service life as measure of ship life.** The steady-state replacement rate is usually calculated using expected service life (ESL) as the measure of ship life.

ESL, which focuses on the overall mechanical condition of the ship as it ages, is only one major measure of potential ship life. Another measure that the Navy has used in the past is mission effectiveness life (MEL), which focuses on the ability of the ship's combat system equipment to perform effectively the ship's intended missions

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[49]Since Navy ships require, on average, about 5 years to build, the corresponding 35-year ship-procurement period begins and ends about 5 years sooner than the 35-year period during which the fleet is to be maintained.

against projected threats. The distinction between ESL and MEL was discussed in a 1994 CRS report on the DDG-51 program.[50] As discussed in the 1994 report, MEL in general can be equal to or somewhat shorter than ESL, depending on the rate at which potential adversary capabilities increase.

A third potential measure of ship life, which might be called cost-effective life (CEL), would take into account not only the ship's ability to perform its missions effectively, but its ability to do so cost-effectively relative to other potential ways of performing the mission (such as with newer ship designs or other, non-ship platforms and systems). In general, CEL can be equal to, or shorter than, MEL. CEL can be shorter than MEL if the ship's operating and support (O&S) costs rise substantially as the ship ages, or if new technologies emerge that permit newer ship designs or other, non-ship platforms to perform the mission at lower cost.

Using these concepts, ships can thus be retired under at least four scenarios:

- ESL, MEL, and CEL have not expired but a shift or reduction in the Navy's missions eliminates the need for a ship. This was the reason for many of the ship retirements carried out during the post-Cold War downsizing of the Navy in the 1990s.

- Wear and tear and the effects of aging bring the ship to the end of its ESL and ESL either cannot be extended (through service life extension work) or cannot be extended at a cost that would avoid bringing the ship to the end of its CEL.

- Advances in potential adversary capabilities bring the ship to the end of its MEL and MEL either cannot be extended (through system modernization and upgrades) or cannot be extended at a cost that would avoid bringing the ship to the end of its CEL.

- Rising ship O&S costs or new technologies bring the ship to the end of its CEL.

ESL is thus the longest (some might say the most generous or most optimistic) measure of potential ship life. Using MEL or CEL rather than ESL would accelerate the dates by which some replacement ships would need to be procured, and would result in higher steady-state (i.e., notionally required long-term average) procurement rates for some ship types.

Navy and industry officials themselves have noted that historically, some Navy ships (especially some surface combatants) have been retired several years in advance of the expiration of their ESLs. The reasons for some of these accelerated retirements may relate more to MEL or CEL, or to shifts or reductions in the Navy's missions, than to errors in estimating ESL. Shifts or reductions in the Navy's missions appear to have been a significant cause of accelerated ship retirements in the 1990s.

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[50]CRS Report 94-343 F, *Navy DDG-51 Destroyer Procurement Rate: Issues and Options for Congress*, by Ronald O'Rourke. Washington, 1994. (April 25, 1994) p. 14-15.

Due to these four areas of consideration, the steady-state replacement rate is best used as a preliminary (rather than conclusive) indicator of the overall rate of ship procurement needed to maintain a Navy at a certain size, particularly in the nearer run.

Appendix B: Current Average Fleet Age

Variation in age within overall fleet average

Current average fleet age, like any average figure, provides no indication of variation within the overall average. Although current average fleet age is 16.0 years, ship ages vary above or below this figure by category, within category by class, and within class by individual ship. The tables below show the average age of the Navy's ships by category, within category by class, and within some classes by youngest and oldest ship.

Table B-1. Ship average age by category

Category	Number in service	Average age (years)
Ballistic missile submarines	18	12.9
Attack submarines	54	14.1
Aircraft carriers	12	22.9
Surface combatants	115	13.7
Amphibious ships	39	20.2
Command ships	4	33.1
Mine warfare ships	18	11.6
Combat logistics ships	33	20.9
Support ships	21	17.3
Total	**314**	**16**

Source: Data on ship average ages provided to CRS by the Navy Office of Legislative Affairs on February 22, 2002. The Navy stated that the data provided was less than two months old. A check of the ages provided for some of the ship classes suggests that the data may reflect ship ages as of January 2002.

Table B-2. Ship average age by class

Category	Class	Number in service	Average age (years)
Ballistic missile submarines	SSBN-726	18	12.9
Attack submarines	SSN-21	2	3.9
	SSN-637	1	27.5
	SSN-688	51	14.2
Aircraft carriers	CV	3	38.8
	CVN-65	1	40.2
	CVN-68	8	14.8
Surface combatants	CG-47	27	12.5
	DDG-51	36	4.9
	DD-963	19	23.5
	FFG-7	25	18.1
	NRF FFG-7	8	20.4
Amphibious ships	LHA-1	5	23.6
	LHD-1	7	6.6
	LPD-4	11	33.6
	LSD-36	3	31.4
	LSD-41	8	13
	LSD-49	4	5.7
	NRF LST	1	32.4
Command ships	AGF	2	35
	LCC-19	2	31.2
Mine warfare ships	MCM-1	9	10.4
	MHC-51	2	5.5
	NRF MCM-1	5	12.4
	NRF MCS	1	32.3
	NRF MHC-51	1	9.1
Combat logistics ships	AOE-1	4	34.4
	AOE-6	4	5.8
	AE-26	6	31.2
	AFS	6	34.1
	AO-187	13	10.5
Support ships	ARS-50	4	15.9
	AS-39	2	22.6
	TAGOS	8	12.3
	TATF	7	22.2
Total		**314**	**16**

Source: Data on ship average ages provided to CRS by the Navy Office of Legislative Affairs on February 22, 2002. The Navy stated that the data provided was less than two months old. A check of the ages provided for some of the ship classes suggests that the data may reflect ship ages as of January 2002.

The table below shows examples of classes with large variations in individual ship ages due to production runs that ran over extended periods of time.

Table B-3. Variation in ship ages within classes

Class	Number in service	Age of youngest (years)	Age of oldest (years)	Difference between youngest and oldest (years)
SSBN-726	18	4.5	20.3	15.8
SSN-688	51	5.5	25.3	19.8
CVN-68*	8	3.7	26.8	23.1
CG-47	27	7.8	19.2	11.4
DDG-51*	36	0.5	10.8	10.3
FFG-7	33	12.6	22.3	9.7
LHD-1*	7	0.8	12.8	10

Source: Ages for the youngest and oldest ships in these classes are from the Naval Vessel Register as of February 27, 2002.

* Additional ships in these classes are under construction.

Although a current average fleet age less than one-half of average service life suggests that it might be possible to maintain a fleet at its desired size in the nearer term with a near-term procurement rate less than the steady-state replacement rate, this might not always be the case. Due to variation in ages by category, within category by class, and within class by individual ship, it is possible (though perhaps not very likely) that a fleet with an average age less than one-half of average service life might in the nearer term still have ships approaching retirement age at a rate equal to or higher than the steady-state replacement rate.

Variation in age by class also creates the possibility that the overall effectiveness of a fleet with a relatively low average age might have its effectiveness reduced in some ways by the presence of certain classes of ships with high average ages. Ships with high average ages might not be able to perform their stated missions with maximum effectiveness due to technological obsolescence, or might be at greater risk of being unavailable when needed due to age-related increases in required maintenance. The overall effectiveness of the amphibious force, for example, might be affected by the presence within the force of the 14 LPD-4 and LPD-36 class ships (average ages 33.6 and 31.4 years, respectively), while the effectiveness of combat ships in need of at-sea replenishment might be affected by the presence in the combat logistics force of the 16 AOE-1, AE-26, and AFS-type ships (average ages 34.4, 31.2, and 34.1 years, respectively).

Absolute age vs. percent of service life expended

Current average fleet age also does not take into account the fact that ship service life varies by ship category and class. The average expected life of the fleet – 35 years – is a weighted average figure. Some categories or classes of ships have expected lives less than 35 years, while others have expected lives greater than 35 years. As a result, average age for some classes of ships may not be as good an indicator of nearer-term need for replacement as percent of expected life expended (i.e., age divided by expected life, and then converted into percent). The table below shows, by class, percent of service life expended, using expected service lives (ESLs) for various classes. For some classes, low, medium, and high versions of ESL are shown.

Table B-4. Percent of service life expended

Class	Number in service	Average age (years)	Notional expected life (low/med/high) (years)	Average percent of service life expended (low/med/high)
SSBN-726	18	12.9	42	30.7
SSN-21	2	3.9	33	11.8
SSN-637	1	27.5	30	83.3
SSN-688	51	14.2	33/33/38	43.0/43.0/37.4
CV	3	38.8	45	86.2
CVN-65	1	40.2	50	80.4
CVN-68	8	14.8	50	29.6
CG-47	27	12.5	35/40/40	35.7/31.3/31.3
DDG-51	36	4.9	35	14
DD-963	19	23.5	30/35/35	78.3/67.1/67.1
FFG-7	25	18.1	25/30/30	72.4/60.3/60.3
NRF FFG-7	8	20.4	25/30/30	81.6/68.0/68.0
LHA-1	5	23.6	30/35/35	78.7/67.4/67.4
LHD-1	7	6.6	35	18.8
LPD-4	11	33.6	30/35/35	112.0/96.0/96.0
LSD-36	3	31.4	30/35/35	104.7/89.7/89.7
LSD-41	8	13	35	37.1
LSD-49	4	5.7	35	16.3
NRF LST	1	32.4	30	108
AGF	2	35	30/35/35	116.7/100.0/100.0
LCC-19	2	31.2	35	89.1
MCM-1	9	10.4	30/30/35	34.7/34.7/29.7
MHC-51	2	5.5	30/30/35	18.3/18.3/15.7
NRF MCM-1	5	12.4	30/30/35	41.3/41.3/35.4
NRF MCS	1	32.3	30/35/35	107.7/92.3/92.3
NRF MHC-51	1	9.1	30/30/35	30.3/30.3/26.0
AOE-1	4	34.4	35/40/40	98.3/86.0/86.0
AOE-6	4	5.8	35/40/40	16.6/14.4/14.5
AE-26	6	31.2	30/35/35	104.0/89.1/89.1
AFS	6	34.1	30/35/35	113.7/97.4/97.4
AO-187	13	10.5	35/40/49	30.0/26.3/26.3

ARS-50	4	15.9	30/35/35	53.0/45.4/45.4
AS-39	2	22.6	35/40/40	64.6/56.5/56.5
TAGOS	8	12.3	30/30/35	41.0/41.0/35.1
TATF	7	22.2	30	74
Total	**314**	**16**	**33.1/35.3/36.5**	**48.3/45.3/43.8**

On reviewing instances where percent of service life expended is 90% or higher, it is worth noting that ESLs are average figures for ship classes based on projections of how the mechanical condition of a typical ship in a given class might change over time. Individual ships within a class can vary from this average, depending on differences in initial construction and lifetime use and maintenance. In past discussions with CRS, Navy officials have sometimes suggested that service lives for individual ships in a class might vary by as much as 10 percent in either direction from the ESL for the class due to these factors. On this basis, an individual ship in a class with a 30-year ESL might have a potential ESL of 27 to 33 years.

Expected service life as measure of ship life

Calculating average ship life based on mission effectiveness life (MEL) or cost-effective life (CEL) rather than expected service life (ESL) would reduce average ship life to something less than 35 years. This would reduce the half-way point to something less than 17.5 years and lead to figures for percent of ship life expended that are somewhat higher than those shown in the previous table.

Current average fleet age by itself, in other words, does not take into account that the aging process might affect categories or classes of ships in different ways in terms of their ability to perform their respective missions effectively (or cost-effectively). Changes in technology, adversary capabilities, and concepts of operation can affect ship categories or classes unevenly. Examining MEL and CEL can help take into account the possibility that categories or classes of ships may have varying sensitivities to the aging process.

Fleet composition and capability

Current average fleet age does not by itself provide information about the current composition of the fleet (i.e., force mix), and whether that force mix meets stated requirements for performing various missions. A fleet with a relatively low overall average age, and a relatively low average age for a particular category of ship, might nevertheless be considered in urgent need of additional procurement of ships in that category, if there are insufficient ships in that category to perform a key mission.

For example, the current fleet of 39 amphibious ships does not meet the vehicle-lift component of the overall 2.5-Marine Expeditionary Brigade (MEB) amphibious lift requirement, and the amphibious force will not meet this goal under current procurement plans until all 12 of the planned San Antonio (LPD-17) class amphibious ships enter service. If the currently planned procurement rate of one LPD-17 per year is maintained through the FYDP and beyond, and if LPD-17s enter service 4 or 5

years after the year in which they are procured, then the vehicle-lift component of the 2.5 MEB lift goal will not be met until 2014 or 2015.[51]

As a potential second example, although the surface combatant force has a current average age of 13.7 years, and although the 115 surface combatants currently in the fleet roughly equals the 116-ship force-level goal for surface combatants, this 115-ship force, armed with 5-inch guns (cruisers and destroyers) and 3-inch guns (frigates) does not have enough collective naval surface fire support (NSFS) capability to meet current NSFS goals for supporting Marine Corps forces ashore. Until the Navy's decision in November 2001 to replace the DD-21 program with the restructured DD(X) program, the Navy had planned to meet the goal for NSFS in substantial part by building a force of about 32 DD-21s, each armed with two 155-mm advanced gun systems (AGSs). If current requirements for NSFS capability are not revised, then the NSFS goal might not be met until the Navy procures additional surface combatants equipped with a collective NSFS capability comparable to that of the previously planned force of 32 DD-21s.

As a third potential example, a December 1999 study by the Joint Chiefs of Staff on SSN force-level requirements recommended, among other things, that the Navy have 18 Virginia-class SSNs in service by the year 2015. Assuming a 6-year construction time for SSNs, this equates to procuring 18 Virginia-class boats through FY2009. If the 1999 JCS recommendation is adopted as an official force-planning goal,[52] and if the currently planned Virginia-class procurement rate of one boat per year through the FYDP is implemented, then a total of 9 Virginia-class boats will need to be procured in the two years of FY2008 and FY2009 to meet the goal – a two-year procurement that observers might view as very unlikely due to both its cost and the transitional strain it would place on a submarine-construction industrial base that has been producing one SSN or less per year since the early 1990s.

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[51]Vehicle-carrying capacity is projected to be equivalent to 2.01 MEBs in FY2003 and 2.26 MEBs in FY2009. It should also be noted, however, that the current 39-ship amphibious fleet currently exceeds the 2.5-MEB lift requirement in the other four components of the amphibious lift footprint – troop-carrying capacity, cargo-carrying capacity, vertical takeoff or landing (VTOL) aircraft spots, and LCAC landing craft well-deck spots – and is projected to continue exceeding the requirements in these four other components through at least FY2009. The FY2003 and projected FY2009 figures, respectively, in MEB equivalents, for these other components of the lift footprint are as follows: troops (2.68 and 2.65), cargo (3.70 and 3.77), vertical takeoff or landing (VTOL) aircraft spots (3.30 and 3.41) and LCAC landing craft well-deck spots (3.42 and 3.63).

[52]The Clinton Administration amended its 1997 Quadrennial Defense Review (QDR) to increase the SSN force-level requirement from 50 boats to 55 boats – the minimum number of total SSNs recommended by the JCS study – but did not appear to adopt the JCS recommendation for having at least 18 SSN-774s in service by 2015. The Bush Administration's 2001 QDR maintained the 55-boat SSN force-level goal, at least for the time being, but does not mention the JCS recommendation for having at least 18 SSN-774s in service by 2015.