STATEMENT OF

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HEARING ON

SHIP PROCUREMENT AND

RESEARCH AND DEVELOPMENT PROGRAMS

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Madam Chair, distinguished members of the subcommittee, thank you for the opportunity to appear before you to discuss issues relating to the Administration's proposed plans for Navy ship procurement and research and development programs.

As requested, my testimony will focus on the following issues:

- the planned size of the Navy;
- the planned overall rate of Navy ship procurement and its relationship to the planned size of the Navy; and
- planned and potential rates of procurement for certain specific types of Navy ships.

Each of these issues is discussed below.

The planned size of the Navy

Over the last year, Department of the Navy (DoN) leaders have begun to openly call into question the sufficiency in the longer term of the planned fleet of about 300 ships recommended by the 1997 Quadrennial Defense Review (QDR). The year 2000 DoN posture statement presented with the proposed FY2001 defense budget, for example, states:

> The Navy and Marine Corps continue to meet their commitments primarily by drawing upon forward-deployed, Arotational@ forces rather than requiring additional deployments of units that have just returned from or are beginning to work up for deployment. We have been able to do this mainly by demanding more from our people and equipment. But this cannot go on indefinitely. As we approach the next Quadrennial Defense Review (QDR) [in 2001], the Navy and Marine Corps will make the point that our force levels need to remain balanced with usage expected in the future security environment.... Already, there is growing evidence that our forces are stretched.... The 1997 QDR stated that a fleet of slightly more than 300 ships was sufficient for near term requirements and was within an acceptable level of risk. Three years of high-tempo operations, however, suggest that this amount should be reviewed in the next QDR.[1]

Within the last year, at least three categories of ships within the 300-ship plan have emerged as specific candidates for increased force-level goals **B** attack submarines, surface combatants, and amphibious ships.

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[1]U.S. Department of the Navy. *2000 Posture Statement, Department of the Navy, America=s 21st Century Force.* Washington, 2000. p. 19-20. Similar text can be found in Statement of Admiral Jay L. Johnson, Chief of Naval Operations, United States Navy, before the House Armed Services Committee, February 10, 2000.

Attack submarines. Although the 300-ship plan established a tentative goal of maintaining a force of 50 nuclear-powered attack submarines (SSNs), a Joint Chiefs of Staff (JCS) study on future required SSN force levels completed in late 1999 and released in unclassified summary form in early February 2000 concluded that 55 to 68 SSNs would be required in 2015 and 62 to 76 SSNs would be required in 2025.[2] These force-level benchmarks are broadly consistent with the force-level benchmark established by a previous JCS study on required SSN force levels, completed in 1992 and updated in 1993, that calculated a requirement of 51 to 67 SSNs. The Department of Defense (DoD), in its amended FY2000-FY2005 Future Years Defense Plan (FYDP), has in effect endorsed the goal of maintaining a 55-ship SSN force over the near-term by including additional funding in FY2002-FY2005 for submarine refuelings that will be needed to maintain the attack submarine fleet at about 55 boats for the next several years.

Surface combatants. Similarly, although the 1997 QDR calls for maintaining a force of 116 surface combatants, a study completed in 1999 by the Navy=s surface combatant community reportedly calls for increasing the goal to 138 ships.[3] This figure, too, is broadly consistent with the results of other force-level studies carried out by the surface combatant community in recent years.

Amphibious ships. Lastly, although the 300-ship plan calls for maintaining a 36-ship amphibious fleet organized into 12 Amphibious Ready Groups (ARGs) with a combined amphibious lift capacity of 2.5 Marine Expeditionary Brigades (MEBs), Navy and Marine Corps officials have consistently reminded others in recent years that the 2.5 MEB amphibious lift goal is a fiscally constrained figure, and that the full amphibious lift requirement for many years has been for a force with a combined lift capacity of 3.0 MEBs.[4] In testimony last year, Marine Corps officials stated that a 3.0-MEB fleet would equate to a 14-ARG, 43-ship amphibious force, with the 7 additional ships consisting of 2 large-deck (i.e., LHD-type) amphibious ships, 3 San Antonio (LPD-17) class dock landing ships, and 2 LSD-type dock landing ships.[5]

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[2]Source: Two-page DoN information paper dated February 7, 2000 entitled ASubject: Unclassified Release of the 1999 CJCS Attack Submarine Study.@

[3]Holzer, Robert. U.S. Navy Hopes To Expand Fleet. *Defense Week*, January 31, 2000: 1, 20.

[4]See, for example, *2000 Posture Statement, Department of the Navy*, op. cit., p. 21.

[5]Statement by Lieutenant General Martin R. Steele, Deputy Chief of Staff for Plans,

In addition to these 3 categories of ships, it has often been noted by DoN and DoD officials and others in recent years that maintaining a continuous or near-continuous presence of one aircraft carrier in each of the three major U.S. naval operating areas **B** the Mediterranean Sea, the Indian Ocean/Persian Gulf area, and the Western Pacific **B** would require a force of 15 carriers rather than the 12-carrier force called for in the 300-ship plan.

Simply adding up some or all of these potential increases **B** 5 to 26 additional SSNs, 22 additional surface combatants, 7 additional amphibious ships, and perhaps 3 additional aircraft carriers **B** would produce a requirement for as many as 37 to 58 additional ships beyond the original 300-ship plan. Such an increase would produce a required fleet size similar to 346-ship fleet called for in the 1993 Bottom-Up Review (BUR).

The combined effects of acting on some or all of these proposals, however, could be even greater, because increasing one part of the fleet could lead to a consequent need to increase other parts as well. In particular, the results of the SSN and surface combatant force-level studies do not appear dependent on an assumed increase in other parts of the fleet. Increasing the number of aircraft carriers, however, could by itself produce an increase in the requirements for surface combatants (notionally 6 per carrier group) or SSNs (notionally 2 per carrier group). Increasing the number of ARGs could by itself similarly increase the surface combatant requirement by a few or several ships. And increasing the number of carrier battle groups or ARGs could increase the required number of combat logistic force ships. As a consequence, acting on most or all of these proposals might result, at least in theory, in a requirement for a fleet of more than 360 ships.

As discussed in previous CRS reports and testimony, whether a Navy of a given size will be able to perform its stated missions will depend on how technological developments affect the capabilities of U.S. Navy ships, aircraft, weapons, and other equipment, and on how the international security environment develops over the next quarter-century. In assessing potential requirements for U.S. naval forces, it can be noted that some observers believe that the United States during this period might be confronted with a larger and more modern Chinese navy, or a rejuvenated Russian navy, or significantly improved maritime military capabilities (including so-called area-

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Policy, and Operations, Headquarters, U.S. Marine Corps, Before the Senate Committee on Armed Services Subcommittee on Seapower on 21 April 1999, On Ship Acquisition Programs and Policies. p. 15-16.

denial or anti-access capabilities) in other countries, such as Iran. The Navy during this period could be called on, as it sometimes is today, to respond to multiple simultaneous or near-simultaneous contingencies of various kinds in different regions.

Overall rate of ship procurement and size of the Navy

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,[6] a 1997 report,[7] and 1997 and 1999 testimony.[8] This testimony updates the analysis to take into account the Administration's proposed FY2001 defense budget and amended FY2000-FY2005 ship-procurement plan.

Shorter term vs. longer term. Assuming the roughly 300-ship goal remains in place for now, the challenge in maintaining a fleet of this size, as discussed in previous reports and testimony, will occur not in the shorter run (i.e., between now and about 2010), but in the longer run (i.e., after 2010, and particularly after 2020). 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 can be maintained in the shorter run 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. If ships are not procured in numbers sufficient to offset these retirements, then total fleet size at that point will drop below 300 ships.

Steady-state replacement rate. In previous reports and testimony dating back several years, 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. Over the last couple of years, and particularly in presenting its proposed FY2001 defense budget and amended FY2000-FY2005 FYDP, the Administration has begun to similarly focus on this concept.

As shown in Table 1 below, the current force-level plan for the Navy, including the Administration=s amended nearer-term SSN goal of 55 boats, includes a total of

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[6]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.

[7]CRS Report 97-981 F, *Navy/DoD Projected Long-Range (FY2004-FY2015) Ship Procurement Rate: Background and Issues for Congress*, by Ronald O'Rourke. Washington, 1997. (Updated January 25, 1999) 6 p.

[8]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; and 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.

308 ships. This planned force has a weighted average service life of about 35 years (using mid-point values for ship types whose service lives are expressed as ranges) and a corresponding steady-state procurement rate of about 8.7 ships per year.[9]

[9]The planned force size divided by the average service life equals the long-term required replacement rate.

Table 1. Navy ship force-level goals, service lives, and steady-state procurement rates

Ship type	No. of ships	Service life in years (low/mid/high)			Steady-state procurement rate (based on low/mid/high service life)		
Submarines:	**69**				**2.00**		
Ballistic missile	*14*[a]	*42*[b]			*0.33*		
Attack	*55*	*33*			*1.67*		
Aircraft carriers	**12**	**50**[c]			**0.24**		
Surface combatants:	**116**[d]				**3.66**	**3.38**	**3.15**
Cruisers/destroyers	*86*[d]	*35*	*37.5*	*40*	*2.46*	*2.29*	*2.15*
Frigates	*30*[d]	*25*	*27.5*	*30*	*1.20*	*1.09*	*1.00*
Amphibious ships:	**36**[e]				**1.03**		
Large-deck (LHA/LHD)	*12*	*35*			*0.34*		
Other (LSD/LPD)	*24*	*35*			*0.69*		
Mine warfare ships	**16**[f]	30			**0.53**		
Other/auxiliary:	**59**				**1.79**	**1.52**	**1.34**
Command ships	*4*	*35*			*0.11*		
Combat logistic ships	*34*	*35*	*40*	*45*	*0.97*	*0.85*	*0.76*
Support ships	*21*	*30*	*37.5*	*45*	*0.70*	*0.56*	*0.53*
TOTAL	**308**				**9.24**[g]	**8.71**[g]	**8.34**[g]
Implied weighted average service life					33.3	35.4	36.9

Source: Prepared by CRS based on U.S. navy data. Totals for steady-state procurement rates may not add due to rounding.

Notes

a The current 18-boat SSBN force is to be reduced to 14 boats consistent with START II force structure set forth in 1994 Nuclear Posture Review.

b Life shown is for Ohio (SSBN-726) class Trident submarines with mid-life nuclear refueling overhaul. Future SSBNs, if derived from the Virginia (SSN-774) class design, would likely have a life-of-the-ship core and consequently a service life closer to the 33-year life of the Virginia class.

c Life shown includes a mid-life nuclear refueling complex overhaul (RCOH) extending service life to about 50 years.

d In the future, the surface combatant force will move toward a notional mix of 85 Aegis-equipped cruisers and destroyers and 31 DD-21 class land attack destroyers, all with a service life of 35 to 40 years. The 30 frigates shown include 8 Naval Reserve Force (NRF) ships.

e In the near term, amphibious force will include 37 to 39 active-duty ships and 2 NRF ships, pending entry into service of LPD-17 class ships, which will permit the 12-ARG, 2.5 MEB lift goal to be met with a force of 36 amphibious ships.

f Includes 5 NRF ships.

Administration=s plan. The Administration's amended FYDP, if implemented, would procure a total of 45 new-construction Navy ships over the 6-year period FY2000-FY2005, or an average of about 7.5 ships per year. This is a marginal reduction from the Administration=s plan last year, which would have procured a total of 47 ships, or about 7.8 ships per year. If maintained over a 35-year period, the amended plan=s average procurement rate of 7.5 ships per year would result in a fleet of about 263 ships.

The Administration's previous FYDP from two years ago -- the amended FY1998-FY2003 ship-procurement plan -- would have procured a total of 37 ships over 6 years, or an average of about 6.2 ships per year. If maintained over a 35-year period, this average ship procurement rate would result in a fleet of about 216 ships. Thus, although the Administration=s amended FYDP represents a marginal reduction from its submission last year, it is still considerably closer to the steady-state replacement rate for maintaining a roughly 300-ship Navy than the previous FYDP from two years ago.

Catch-up rate to eliminate backlog. In assessing ship procurement plans, it is important to compare the steady-state procurement rate not only to the planned procurement rate for the next few years, but to the actual procurement rate in previous years, because deviations between the steady-state rate and prior-year actual rate can result in an opportunity or need to adjust the planned procurement rate to a figure lower or higher than the steady-state rate.

The steady-state procurement rate is an average rate that must be maintained over the long run. For a fleet with a weighted average service life of 35 years, an average rate of 8.7 ships per year must be maintained over a 35-year procurement period, so that a total of 308 ships are procured during that period. If there are some years during that 35-year period in which the procurement rate is higher than 8.7 ships per year, then there can be other years where the ship procurement rate can be less than 8.7 ships per year, so that the average rate for the entire 35-year period works out to 8.7 ships per year. This is the opportunity the Bush and Clinton administrations encountered in the early 1990s, when their newly established force-level goals for the Navy implied steady-state procurement rates substantially lower than the Cold War-era procurement rates of the 1970s and 1980s.

Conversely, however, if there are some years during the 35-year period in which the procurement rate is lower than 8.7 ships per year, then there will need to be other years where the ship procurement rate must be more than 8.7 ships per year, so that

the average rate again works out to 8.7 ships per year. The ship procurement rate first fell below 8.7 ships per year in FY1993, and is programmed to remain below that rate through FY2005. Given this plan to procure ships at less than the steady-state procurement rate for the 13-year period FY1993-FY2005, as we move further away from the early 1990s, examining the situation from this converse point of view becomes increasingly appropriate. FY2010 **B** roughly the year when the last ships funded under the current FYDP are delivered to the fleet **B** is within a few years of the point at which the ships procured in large numbers during the 1980s will begin to reach their end of their service lives.

If the Administration=s amended ship-procurement plan is implemented, a total of 83 ships will be procured during the 13-year period FY1993-FY2005, or an average of about 6.4 ships per year. Procuring ships at the steady-state replacement rate of about 8.7 ships per year for 13 years would result in a total procurement of about 113 ships. Implementing current ship-procurement plans will thus create a cumulative 13-year ship-procurement backlog since FY1993 of 30 ships relative to the steady-state ship-procurement requirement (113 minus 83). The amended FY2000-FY2005 FYDP will account for about 7 of the ships in this backlog, while the preceding 7-year period (FY1993-FY1999) will account for the other 23 ships.

This 30-ship "deficit" in ship procurement is not immediately apparent because of the relatively large numbers of ships built in the 1970s and 1980s, when the ship-procurement rate was well above 8.7 ships per year. After 2010, and particularly after 2020, however, when the 1970s- and 1980s-era ships begin to retire, this 30-ship backlog, if not by then redressed, will be unmasked, and the size of the fleet will fall below 308 ships.

Eliminating this 30-ship backlog over the remaining 22 years in a 35-year ship procurement period beginning in FY1993 will increase the required procurement rate by about 1.4 ships per year above the steady-state replacement rate. If an average procurement rate of about 8.7 ships per year is to be achieved for the entire 35-year period FY1993-FY2027 (that is, if a total of 308 ships are to be procured in this period), then for the period FY2006-FY2027 (the remaining 22 years after FY2005) a total of 225 ships (308 less the 83 procured through FY2005) will need to be procured, or an average of about 10.2 ships per year.[10]

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[10]As explained earlier, these figures are based on a fleet-wide average service life about 35 years. Some observers consider this figure optimistic. If fleet wide average service life in the future is closer to 30 years, as some observers argue it might be, then required ship procurement rates will be higher. The steady-state replacement rate for a 308-ship fleet would be about 10.3 ships per year, the FY1993-FY2005 backlog would be 50 ships, and the average required rate for the period FY2006-FY2022 -- the final 17 years in a 30-year building period

This adjusted post-FY2005 procurement rate of about 10.2 ships per year can be called the catch-up 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.

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beginning in FY1993 -- would be about 13.2 ships per year.

In recent years, as it became clear that the ship procurement rate would remain below the steady-state procurement rate for an extended period of time, CRS analyses have increasingly focused on the catch-up rate as well as the steady-state procurement rate in examining the Administration=s proposed ship-procurement plan. Although the Administration has recently begun to discuss steady-state procurement rates and acknowledges that backlogs of deferred procurement relative to these rates have occurred in ships and other types of equipment, Administration presentations of the defense budget have not yet begun to place much emphasis on calculating and discussing the catch-up rates implied by these backlogs.[11]

The next Administration will have an opportunity to reshape Navy ship-procurement plans, if it desires, by amending the FY2002-FY2007 FYDP that will be submitted early next year by the outgoing Administration. One option available to the next Administration would be to reduce the average catch-up rate by starting the catch-up period before FY2006. For example, by accelerating the start of the catch-up period to FY2002, the earliest possible year, the next Administration could reduce the catch-up rate from the 10.2-ships-per-year figure mentioned above to about 9.8 ships per year.[12]

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[11]There are a few exceptions. The Marine Corps, for example, has calculated and emphasized both the steady-state level of funding needed in the Procurement, Marine Corps (PMC) appropriation account (about $1.2 billion per year) and the catch-up level of funding that would be needed over the next few years (about $1.8 billion per year) to work off the backlog of deferred procurement requirements that has accumulated in this account since the early 1990s.

[12]If the Administration=s ship-procurement plan for FY2001 is implemented, a total of 52 ships will be procured during the 9-year period FY1993-FY2001. The remaining 256 ships would then need to be procured during the 26-year period FY2002-FY2027, for an average of about 9.8 ships per year.

Similarly, if the weighted average service life of the fleet is closer to 30 (as opposed to 35) years, then remaining 256 ships would need to be procured during the 21-year period FY2002-FY2022, for an average of 12.2 ships per year (compared to the 13.2 ships per year that would be needed if the catch-up period begins in FY2006, as discussed in a previous footnote).

Mix of ships in plan. An additional way to assess the Administration=s amended FY2000-FY2005 ship-procurement plan is to examine the mix of ships to be procured in the plan. Examining the mix can be useful because the various kinds of Navy ships have widely varying unit procurement costs. As a consequence, a ship-procurement plan that calls for procuring ships at a rate equal to (or less than or higher than) the steady-state procurement rate in terms of total numbers of ships may not compare that way in terms of the average required amount of procurement funding associated with a steady-state procurement rate.

The Administration=s amended FY2000-FY2005 ship-procurement plan, if implemented, would procure 45 ships, or about 86 percent of the 52 or so ships that would be procured under a plan maintaining the steady-state average of 8.7 ships per year. The funding in the Administration=s plan for new ship procurement (which nets out advanced procurement funding provided before FY2000 for ships procured within the plan, as well as advanced procurement funding provided within the plan for ships to be procured after FY2005) averages about $7.9 billion per year.[13] This compares to an average of roughly $10 billion per year, or an average of roughly $1.15 billion per ship, that might be needed for procuring new ships at the steady-state rates shown in Table 1.[14]

Using this $10-billion figure, the Administration=s amended shipbuilding plan provides an average of roughly 80 percent of the average annual funding required to procure new ships at a steady-state rate and a steady-state mix B somewhat less than the 86-percent figure derived from examining the numbers of ships to be procured. This appears due principally to submarines and surface combatants, which are relatively expensive ships that are under-represented in the plan relative to their steady-state procurement rates, and auxiliary ships, which are relatively inexpensive ships that are over-represented in the plan relative to their steady state procurement rates.

The shortfall in funding, like the shortfall in numbers of ships, will have an effect on the downstream (i.e., post-FY2005) procurement requirement. In the future, procuring ships at the steady-state procurement rate of 8.7 ships per year (or the post-FY2005 catch-up rate of 10.2 ships per year) might be more expensive than might be suggested solely by the total number of ships per year, because the mix of ships at some point would need to shift to one that included proportionately larger numbers

[13]The average funding level for the entire Shipbuilding and Conversion, Navy (SCN) appropriation account, which also includes funding for aircraft carrier nuclear refueling complex overhauls, submarine nuclear refueling overhauls, a service-life extension program for air-cushioned landing craft (LCACs), and other miscellaneous items, is about $9.4 billion a year.

[14]Source for $10 billion figure: CRS estimate based on lower, mid-point, and higher steady-state procurement rates by ship type as shown in Table 1, combined with notional lower, mid-point, and higher unit procurement costs for each ship type based on recent or projected procurement costs for each type. The lower steady-state rates combined with lower unit procurement costs (Alower/lower@) produced an estimate of about $9.1 billion; the mid-point/mid-point combination produced an estimate of about $9.9 billion, and the higher/higher combination produced an estimate of about $10.8 billion.

of relatively expensive submarines and surface combatants, and proportionately smaller numbers of relatively inexpensive auxiliary ships. Procuring ships at the steady-state rate of 8.7 ships per year, in other words, might in some years cost more than $10 billion per year, while procuring ships at the catch-up rate of 10.2 ships per year might in some years require more than $11.7 billion per year (the cost to procure 10.2 ships per year at an average cost of $1.15 billion per ship).

Procurement rates for specific ship types

Within the Administration=s overall shipbuilding plan, at least four ship categories merit individual discussion **B** attack submarines, aircraft carriers, surface combatants, and large-deck amphibious ships. Each of these is discussed below.

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[15] and 1997;[16] in a 1997 CRS presentation to a Defense Science Board task force on the submarine of the future, which issued its report in 1998;[17] a 1999 CRS report on attack submarine programs,[18] and 1999 CRS testimony.[19] This testimony is updated to take into account three key developments that occurred over the past year.

Three key developments.

Extended (33-year life) for 688s/688Is. The first development was a determination by the Navy that it could safely extend the service lives of all its Los Angeles (SSN-688) and Improved Los Angeles class submarines **B** all its 688s and 688Is **B** by 3 years, to 33 years. This reduced somewhat the steady-state procurement

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[15]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.)

[16]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 18, 1997, p. 9-10.

[17]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.

[18]CRS Report RL30045, *Navy Attack Submarine Programs: Background and Issues for Congress*, by Ronald O'Rourke. Washington, 1999. (February 4, 1999) p. 28-31.

[19]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.

rate needed to maintain an SSN force of a given size, and delayed by a couple of years **B** from the mid-2020s to the late 2020s **B** the point at which the size of the SSN force might bottom out due to rapid retirements of 688Is procured in large numbers during the 1980s.

JCS SSN force-level study. The second key development is the 1999 JCS SSN force-level study mentioned earlier. This study had three main conclusions:

- Athat 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;@

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

- Athat 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.@[20]

Additional funding for submarine refuelings. The third key development was the Administration=s decision to add $1.1 billion in funding to the shipbuilding plan in the period FY2002-FY2005 for submarine refuelings beyond those that had already been programmed.[21] The money is to be used for maintaining additional SSN force structure by funding either refuelings of 688-class submarines now scheduled for early retirement, or refuelings and conversions of older Ohio (SSBN-726) class Trident ballistic missile submarines (SSBNs) into cruise missile submarines (SSGNs) with an additional capability for supporting large numbers of special operations forces. There

[20]Department of Navy point paper dated February 7, 2000, op. cit.

[21]The funding is $199 million in FY2002, $298 million in FY2003, $297 million in FY2004, and $297 million in FY2005, for a total of $1,091 million.

are currently 7 older 688s that would require refueling to avoid early retirement and whose refuelings were not funded in last year=s plan; the $1.1 billion would be roughly enough to refuel 4 of them.[22] The Navy is also considering the option of converting up to 4 older Trident SSBNs into SSGNs; the $1.1 billion would be roughly enough to convert 2 of them.[23]

[22]Each SSN refueling overhaul would cost $235 million to $290 million, according to the Navy, but would avoid in the short run a deactivation/dismantlement/disposal cost of about $30 million to $45 million, resulting in a net short-term cost in the budget of roughly $200 million to $250 million per boat.

[23]Each Trident SSGN refueling and conversion would cost upwards of $500 million, according to DoN estimates, assuming a conversion that leaves the boats= ballistic missile submarine launch tubes in place. A conversion that replaced the boats= mid-hull launch-tube sections with a new section containing smaller-diameter tubes would cost considerably more per boat.

Backlog in procurement. Current plans call for the procurement of a total of 10 SSNs during the 16-year period FY1990-FY2005 **C** 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 7 Virginia (SSN-774) class boats (one each in FY1998, FY1999, and FY2001-FY2005). This is an average rate of five-eighths of a boat per year for almost one-half of the SSNs= 33-year replacement period. If, during this 16-year period, SSNs were instead procured at the steady-state replacement rate of 1.67 boats per year, a total of 26 or 27 SSNs would have been procured. Current plans, if implemented, would thus create an SSN procurement backlog of 16 or 17 boats for the period FY1990-FY2005.[24]

Effect on force levels after 2015. This 16- or 17-boat backlog in procurement, which is equivalent to about 30 percent 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 retirement age and begin to leave service, and the FY1990-FY2005 "deficit" in SSN procurement, if not by then redressed, will begin to be unmasked.

The graph on the next page shows the consequences on the size of the SSN force for the period 2015-2045 of various SSN procurement rates after FY2005, 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 7 688s whose refuelings were not funded in last year=s plan), as well as the conversion of 4 Trident SSBNs into SSGNs. This is an 11-boat addition to the nearer-term SSN force structure, as opposed to the 4-SSN or 2-SSGN addition that would be funded by the Administration=s $1.1 billion in additional FY2002-FY2005 funding.

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[24] The SSN procurement backlog for the 13-year period FY1993-FY2005 is 13 or 14 boats. (A total of 8 SSNs are to be procured during this period **B** the third Seawolf submarine plus the first 7 Virginia-class boats **B** compared to the 21 or 22 SSNs that would have been procured if SSNs had been procured during this period at the steady-state replacement rate of 1.67 boats per year). Thus, of the 30-ship backlog in procurement of all kinds of ships discussed earlier, 13 or 14 of these ships, or roughly 43 percent to 47, are SSNs.

As can be seen in the graph, by the mid-2020s, most of the SSNs procured in the 1980s and earlier years will no longer be in service. As a consequence, unless the post-FY2005 SSN procurement rate is increased substantially from the 1-per-year rate programmed for FY2001-FY2005, the size of the SSN force could drop substantially below 55 boats and remain there until well into the 2030s.

[SSN force-level graph]

Sufficiency of various potential SSN force levels. If the world security environment between now and 2015 and 2025 evolves in a benign direction, then such a reduction in the size of the SSN force might be acceptable. If the world security environment evolves in a less benign direction, however, then such a reduction could have negative implications for U.S. security. As mentioned earlier, the period after 2015 could feature a significant military challenge from modernized foreign military forces. More particularly, this is the period by which some analysts believe the proliferation of advanced sensors and weapons will make surface ships highly vulnerable to attack, which in turn might argue in favor of having a U.S. Navy that included an increased (rather than a reduced) number of SSNs.

Achieving and maintaining force-levels set forth in JCS study. Table 2 below summarizes potential post-FY2005 SSN procurement rates (assuming that the current plan to procure 1 SSN per year during the period FY2001-FY2005 is implemented), and their relationship to the force-level benchmarks set forth in the JCS SSN force-level study.

Table 2. Post-FY2005 SSN procurement rate and JCS SSN study force-level benchmarks

SSN procurement rate after FY2005	**Resulting SSN force levels**[a]		
	2015		**2025**
	Total (with/without 4 Trident SSGNs)[b]	**Virginia (SSN-774) class SSNs**	**Total (with/without 1 Trident SSGN)**[b]
	JCS benchmark: 55 to 68	**JCS benchmark: 18**	**JCS benchmark: 62 to 76**
1.0 per year	60/**56**	11	37/36
1.5 per year	62/58	13	44/43
2.0 per year	64/60	15	51/50
2.5 per year	66/62	**17**	58/57
3.0 per year	**68**/64	**19**	**65/64**
3.5 per year	70/66	21	**72/71**
4.0 per year	72/**68**	23	**79/78**

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

Notes

a All force levels shown assume funding of all 7 SSN refuelings not funded in last year's plan. (This year's plan provides for either 4 additional SSN refuelings or 2 Trident SSGN

conversions.) These additional SSN refuelings would affect SSN force levels primarily between now and about 2018.

b Assumes 1 converted Trident SSGN enters service each year in 2003, 2004, 2005, and 2006 and remains in service for 20 years. All 4 would thus be in service in 2015, while 1 would remain in service in 2025.

Using Table 2 and the force-level graph, the following conclusions can be drawn:

- **A post-FY2005 SSN procurement rate of 1 boat per year B** a continuation of the rate planned for FY2001-FY2005 **B** would result in an SSN force that would slightly exceed the lower end of the JCS range for the total number of SSNs in 2015 but fall about 40 percent short of both the JCS benchmark for the number of Virginia-class SSNs in 2015 and the lower end of the JCS range for the total number of SSNs in 2025. This procurement rate would also result in a force that bottoms out in 2029-2031 at 28 boats before recovering to a steady-state force-level of 33 boats in 2036.

- **A post-FY2005 SSN procurement rate of about 3 boats per year** would result in an SSN force that would equal the higher end of the JCS range for the total number of SSNs in 2015, provided that 4 Trident SSGN conversions are funded. The force would slightly exceed the JCS benchmark for the number of Virginia-class SSNs in 2015 and meet the lower end of the JCS range for the total number of SSNs in 2025. This procurement rate would also result in a force that bottoms out at 63 boats in 2026-2028.

- **A post-FY2005 SSN procurement rate of about 4 boats per year** would result in an SSN force that would equal the higher end of the JCS range for the total number of SSNs in 2015, without funding any Trident SSGN conversions. The force would exceed the JCS benchmark for the number of Virginia-class SSNs in 2015 by about 28 percent, and slightly exceed the higher end of the JCS range for the total number of SSNs in 2025. This procurement rate would also result in a force that bottoms out at 78 boats in 2026.

The clear implication of these numbers is that meeting all three of the JCS fore-level benchmarks **B** the two nearer-term (2015) benchmarks the one longer-term (2025) benchmark **B** would require a post-FY2005 SSN procurement rate of 3 to 4 boats per year. This would represent a significant change from the situation last year, where a post-FY2005 SSN procurement rate of 2 boats per year (in conjunction with the decision to extend the service lives of 688s and 688Is to 33 years) would have been sufficient to maintain a force of at least 50 SSNs through about 2027 (without funding either the refueling of any of the 7 SSNs scheduled for early retirement or any Trident SSGN conversions).

Notional procurement profiles for meeting JCS benchmarks. The average SSN procurement rate in FY2006 and later years needed to meet the JCS benchmarks

could be reduced somewhat if the rate in the current FYDP is modified to increase the procurement rate above 1 boat per year prior to FY2006.

18 Virginia-class boats in 2015. For example, assuming a six-year lag between the year that an SSN is procured and the year it enters service, achieving the JCS benchmark of an SSN force with 18 Virginia-class SSNs by 2015 would require a total of 18 Virginia-class SSNs to be procured through FY2009. As shown in the table below, including the 2 Virginia-class boats already procured in FY1998 and FY1999, this could be accomplished either by holding the procurement rate at 1 boat per year through FY2005 (as currently planned) and then increasing it to 2.75 boats per year starting in FY2006, or by increasing it to 2 boats per year starting in FY2003.

Table 3. Notional procurement profiles for funding 18 Virginia-class SSNs through FY2009 (to achieve 18 Virginia-class SSNs in 2015)

Fiscal year											
98	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**
1	1	0	1	1	1	1	1	2	3	3	3
1	1	0	1	1	2	2	2	2	2	2	2

68 SSNs in 2015. Similarly, achieving the upper end of the JCS benchmark for the total number of SSNs in 2015 (68 boats) would require procurement through FY2009 of a total of 19 Virginia-class SSNs (if all 4 Trident SSGN conversions are also funded) or 23 Virginia-class SSNs (if no Trident SSGN conversions are funded). As shown in the table below, this could be accomplished either by holding the procurement rate at 1 boat per year through FY2005 and then increasing it to 3 or 4 boats per year starting in FY2006, or by increasing it to about 2.1 or 2.5 boats per year starting in FY2002.

Table 4. Notional procurement profiles for funding 19 or 23 Virginia-class SSNs through FY2009 (to achieve 68 total SSNs in 2015 with 4 or 0 Trident SSGNs)

Fiscal year											
98	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**
19 Virginia-class SSNs through FY2009											
1	1	0	1	1	1	1	1	3	3	3	3
1	1	0	1	2	2	2	2	2	2	2	3
23 Virginia-class SSNs through FY2009											
1	1	0	1	1	1	1	1	4	4	4	4
1	1	0	1	2	3	2	3	2	3	2	3
1	1	0	1	2	2	2	2	3	3	3	3

62 SSNs in 2025. Achieving the lower end of the JCS benchmark for the total number of SSNs in 2025 (62 boats) would require procurement through FY2019 of a total of 46 Virginia-class SSNs (assuming 1 of the 4 Trident SSGNs still in service that year) or 47 Virginia-class SSNs (assuming no Trident SSGNs still in service). As shown in the table below (which shows profiles for a total of 47 Virginia-class boats), this could be accomplished either by holding the procurement rate at 1 boat per year through FY2005 and then increasing it to 2.86 boats per year starting in FY2006, or by increasing it to about 2.44 boats per year starting in FY2002.

Table 5. Notional procurement profiles for funding 47 Virginia-class SSNs through FY2019 (to achieve 62 total SSNs in 2025 with no Trident SSGNs)

Fiscal year																					
98	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
1	1	0	1	1	1	1	1	2	2	3	3	3	3	3	3	3	3	3	3	3	3
1	1	0	1	2	2	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3
1	1	0	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3

76 SSNs in 2025. Lastly, achieving the higher end of the JCS benchmark for the total number of SSNs in 2025 (76 boats) would require procurement through FY2019 of a total of 60 Virginia-class SSNs (assuming 1 of the 4 Trident SSGNs still in service that year) or 61 Virginia-class SSNs (assuming no Trident SSGNs still in

service). As shown in the table below (which shows profiles for a total of 61 Virginia-class boats), this could be accomplished either by holding the procurement rate at 1 boat per year through FY2005 and then increasing it to 3.86 boats per year starting in FY2006, or by increasing it to about 3.22 boats per year starting in FY2002

Table 6. Notional procurement profiles for funding 61 Virginia-class SSNs through FY2019 (to achieve 76 total SSNs in 2025 with no Trident SSGNs)

Fiscal year																					
98	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
1	1	0	1	1	1	1	1	2	4	4	4	4	4	4	4	4	4	4	4	4	4
1	1	0	1	2	3	3	3	3	4	3	3	4	3	3	4	3	3	4	3	3	4
1	1	0	1	2	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4

Potential procurement issues if JCS benchmarks are adopted. Adopting the benchmarks in the JCS study as official force-planning goals would pose at least three potential issues for Congress relating to funding requirements, industrial base, and acquisition strategy.

Funding requirements. At a procurement rate of 1 boat per year, Virginia-class SSNs currently cost about $1.9 billion to $2.0 billion per boat to procure. This cost might come down to roughly $1.8 billion per boat at a procurement rate of 2 boats per year or $1.6 billion to $1.7 billion per boat at a procurement rate of 3 or 4 boats per year. Even with these rate-induced reductions in unit procurement cost, however, achieving and maintaining SSN procurement rates of 2 to 4 SSNs per year would require significantly more funding per year for SSN procurement than is currently programmed in the FYDP. Annual procurement funding requirements could increase from the current $1.9 billion or $2.0 billion to roughly $3.6 billion (2 boats per year), $5.1 billion (3 boats per year), or $6.4 billion (4 boats per year).

Given these potential required funding levels, SSN procurement in coming years could be a major defense issue for the next Administration and Congress. Starting with the Navy=s shipbuilding budget and working outward, achieving such levels of funding for SSN procurement result in an increase in funding pressures on other Navy ship-procurement programs (such as aircraft carriers, surface combatants, amphibious ships, and auxiliary ships), other Navy procurement programs (such as aircraft, missiles, munitions, and C4ISR equipment[25]), other Navy program priorities (such as

[25]C4ISR stands for command, control, communications, computers, intelligence,

research and development or operations and maintenance), program priorities in the other military services, or the overall size of the defense budget.

Industrial base. Increasing SSN procurement from a rate of 1 per year to higher rates (particularly rates of 3 or 4 per year) could pose expansion and adjustment challenges for a submarine-construction industrial base that has maintained an average production rate of less than one boat per year since FY1990. Issues could arise at both the supplier and shipyard level.

At the supplier level, many firms that manufactured submarine components exited that line of business or disappeared entirely during the 1990s as submarine procurement rates fell from the latter-1980s level of about 4 boats per year to an average of less than 1 per year. As a result, some key submarine components are now manufactured by sole sources. These firms may find it difficult to rapidly increase production rates due to limitations on facilities or the ability to rapidly hire and train new workers. And even if a sole source can adequately expand its operations, the Navy, with only one supplier for that component, would not have the option of using direct competition as a means of ensuring best value to the taxpayer in the manufacturing of that component.

Other potential component suppliers may exist, but these firms may find it unattractive to enter (or reenter) the business due to up-front investment requirements, uncertainty over whether the Navy would be able to maintain higher submarine procurement rates over the longer run (and thus ensure an adequate return on investment), regulatory issues involved in doing business with DoD, and the merits of competing non-defense business opportunities. Firms that do choose to reenter the business, moreover, would require time to establish their operations and be certified by the Navy as quality producers.

At the shipyard level, the two submarine-construction yards **B** Electric Boat (EB) and Newport News Shipbuilding (NNS) **B** may face a particular challenge in rapidly hiring and training the thousands of additional workers that would be needed to maintain a production rate of 3 to 4 boats per year, particularly if labor markets remain relatively tight. Problems in rapidly expanding shipyard work forces were a major contributor to the difficulties (and consequent delivery delays and cost overruns) that were experienced in submarine construction in the 1970s and early 1980s. In addition to issues relating to expansion of the work force, policymakers may want to ensure that the two shipyards are not taking or planning to take any steps with regard to reducing their submarine production facilities that would be very difficult or expensive to reverse if needed to support an increased submarine production rate.

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surveillance, and reconnaissance.

These industrial-base issues could be particularly acute if the SSN procurement rate is increased from the current rate of 1 per year to a rate of 3 to 4 boats per year in a relatively short period of time of 1 to 3 years. Although some of the notional procurement profiles in the tables above show such rapid increases in the SSN procurement rate, achieving such a rapid increase could pose significant industrial-base challenges. Although the boats could legally be procured in the profiles shown in the tables, submarines procured during the first few years after the increase in the procurement rate could well take more than six years to build. A few or several years could pass before the industrial base overcomes nearer-term difficulties in expanding the rate of SSN production and the SSN delivery rate catches up with the SSN procurement rate. As a consequence, SSN force levels in the first few years after 2012 would be not quite as high as the projections shown in the graph, which assume a notional 6-year construction time for an SSN. In addition to a significant chance of delayed deliveries, pressures placed on the SSN-construction industrial base could also create a risk of increased SSN procurement costs (due to delays and lower productivity of newer workers) or even reduced product quality (due to pressures to meet cost targets and scheduled delivery dates).

Acquisition strategy. The current Virginia-class acquisition strategy **B** in which boats are produced jointly by EB and NNS, with each yard receiving about 50 percent of the dollar value of the work, and each yard performing final assembly of alternate boats **B** was arrived at in 1997 after 3 years of sometimes contentious debate within Congress and between Congress and the Administration. This teamed-production strategy was designed in large part to respond to Congressional desires to keep both yards involved in submarine construction in the most economical fashion during an expected period of very low rate SSN production (i.e., about 1 boat per year in the near term, increasing later to 1.5 or 2 boats per year).

If it is possible or likely that SSN procurement in the future will increase to a rate of 3 to 4 boats per year, policymakers may wish to consider at least two issues relating to the acquisition strategy for SSNs. The first is whether to maintain the current teamed-production arrangement between EB and NNS, or instead return to the previous arrangement in which each yard built complete submarines.

In assessing this issue, cost would likely be a key criterion. In 1997, the Navy estimated that for the low SSN procurement rates then being contemplated, a teamed-production arrangement in the near term (i.e., for the first several boats in the program) would be roughly $100 million per boat more expensive than a single-yard production strategy at EB, but roughly $150 million per boat less expensive than a two-yard, separate-production strategy at the two yards.

Whether and how these costs differences would change under higher SSN procurement rates of 3 to 4 boats per year is not clear. It is possible, however, that the cost premium associated with the two-yard, separate-production strategy would decrease, since a large part of that premium is due to the fixed overhead costs of maintaining two complete submarine production lines (rather than the current functional arrangement of 1-plus production line divided between the two yards, with some overlap in certain areas). At low rates of SSN procurement, complete SSN production lines at both yards would not be intensively used, and the fixed overhead

costs of maintaining them would fall heavily on each submarine that is produced. At higher rates of procurement, however, complete production lines at both yards would be used more intensively, and the fixed costs of maintaining them would fall less heavily on each submarine that is produced. Returning to a two-yard, separate-production strategy could also reduce or eliminate some component-transportation and inter-yard coordination costs associated with the teamed-production strategy.

Policymakers interested in the possibility of returning to a two-yard, separate-production arrangement for SSNs may wish to ensure that the yards do not take any steps that would make it very difficult or expensive to restart or reestablish the parts of their SSN production lines that may be unused or eliminated during the current period of teamed production.

If policymakers decide that it would be desirable to return to a two-yard, separate-production strategy for cost or other reasons, a second potential question that would arise is whether it would be further desirable and feasible to resume the use of competition in the awarding of SSN construction contracts. Many policymakers believe that competition in defense acquisition can generate benefits in restraining cost, improving product quality, encouraging adherence to scheduled delivery dates, and promoting innovation. In Congressional debates on SSN procurement strategy in the early to mid-1990s, one of the arguments offered by some supporters of keeping both yards involved in submarine construction was that this would maintain a potential for resuming competition in the awarding of SSN construction contracts should the SSN procurement rate ever return to levels high enough to support a competitive approach.

During the early- to mid-1990s debates on SSN procurement, it was suggested that a procurement rate of 2 or even 1.5 boats per year could be sufficient to resume competition in the awarding of SSN construction contracts. (At 1.5 boats per year, it was suggested, a competition could be held once every 2 years for the 3 boats procured during those 2 years. Each yard would be guaranteed 1 of those boats, and the two yards would compete for the third boat.) Others questioned whether rates this low could sustain a meaningful competition (i.e., a competition that generated true bargaining leverage for the government) without putting the two yards into financially risky situations.

At a procurement rate of 3 to 4 boats per year, however, maintaining a competition between the two yards in the awarding of SSN construction contracts would appear more feasible. In the 1980s, when SSNs were last procured at a rate of 3 or 4 boats per year, the Navy held annual competitions between the two yards for the contracts to build the boats procured each year.

In the 1990s, when the reduction in the SSN procurement rate led to a decision to switch to an acquisition strategy that did not employ competition in the awarding of SSN construction contracts, some observers questioned in retrospect whether the annual competitions in the 1980s achieved significant benefits for the government. They argued that these were competitions in form only because the uncertainty over the government=s contract-award decisions was tightly bounded by the production capacity at each yard combined with the knowledge of how the Navy had divided the previous year=s SSN construction contracts. Others argued that the competitions did

in fact generate significant bargaining leverage for the government, these factors notwithstanding.

If policymakers decide that returning to the use of competition in the awarding of SSN procurement contracts would be desirable, the other question to address is whether it would be feasible in the wake of the teamed-production arrangement. In implementing this strategy, EB and NNS shared many of their submarine-production trade secrets with one another, so as to ensure that each part of the submarine would benefit from the combined production know-how of both yards. Such production trade secrets **B** for example, ways of manufacturing or assembling certain parts of the submarine, or of managing certain phases of the construction process **B** can be critical in gaining a bidding advantage over a rival shipyard in a competition for construction contracts. Having revealed these trade secrets to one another, one or both of the two yards might object strongly to the idea of the government resuming competition in the awarding of SSN construction contracts, since such a competition might result in a yard=s own production trade secrets being used against it in the bidding process by the rival yard. A yard that believed it shared more valuable trade secrets than it received from the other yard would likely view a resumption of competition as fundamentally unfair.

Others, however, could argue that the divulging of these trade secrets was an unavoidable feature of an acquisition strategy that was implemented in part to preserve a potential for resuming competition at some point in the future. They might also argue that the potential unfairness of having one=s trade secrets used by the other yard will diminish over time as the design of the Virginia class evolves (due to insertion of new technologies) and thereby creates opportunities for developing new production trade secrets for building these modified parts of the boat. One possible approach would be to let a few or several years pass between the return to a two-yard, separate-production strategy and the resumption of competition between the yards, so as to give the yards time to develop new production processes and practices that can generate bidding advantages in a subsequent competition.

Aircraft carriers. Accommodating the funding needs of aircraft carrier procurement in the DoN budget has been an issue for many years. This is due to three factors **B** the high unit procurement cost of aircraft carriers relative to other Navy ships (and all other DoD platforms and weapons); the relatively infrequent appearance of aircraft carriers in the budget as a procurement item (their steady-state replacement rate is about 1 ship every 4 years); and a DoD budgeting rule known as the full funding policy, which requires the full procurement cost of any item funded through the procurement title of the DoD appropriation act to be provided in the year in which the item is procured.[26] Together, these three factors can create a situation in which funding the procurement of an aircraft carrier can crowd out funding for other Navy program priorities unless the Navy budget is allowed a one-year increase above its

[26]For a discussion of the full-funding policy and its application to procurement of Navy ships in particular, see 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. 7-8.

prevailing level B a so-called budget Aspike@ B to accommodate at least some of the carrier=s procurement cost.

As shown in the table below, there is a mixed history in recent years regarding the use of a DoN budget spike to facilitate aircraft carrier procurement. The procurement of aircraft carriers in FY1983 and FY1988 coincided with apparent DoN budget spikes for those years that are equivalent to most of the cost of these carriers, while procurement of carriers in FY1980 and FY1995 do not coincide with such spikes. (Indeed, overall DoN budget totals suggest, if anything, a negative budget spike in FY1995.)

Under the Administration=s amended FYDP, the planned procurement in FY2001 of the next aircraft carrier, CVN-77, coincides with an apparent DoN budget spike. As a percentage of the cost of the CVN being procured, this spike is smaller than the FY1983 and FY1988 spikes. As a percentage of the cost of the DoN budget, this spike at first appears smaller than the FY1983 and FY1988 spikes, but is actually somewhat larger than the FY1988 spike when the number of carriers procured (2 in FY1988, as opposed to 1 in FY2001) is taken into account.

Table 7. Aircraft carrier (CVN) procurement and apparent DoN budget spikes, FY1980-FY2001 (cost figures in billions, rounded to nearest tenth)

FY	No. CVNs pro-cured	Procurement cost of CVN(s)		Rough apparent size of DoN budget spike		Size of spike expressed as percent of		
		Then-year $	Con-stant FY01 $	Then-year $	Con-stant FY01 $	Proc. cost of CVN(s)	DoN budget	
							Total	Per CVN
80	1	$2.5	$4.7	no spike		---	---	---
83	2	$6.9	$10.7	$6.0	$9.0	87	7.4	3.7
88	2	$6.2	$8.2	$4.7	$6.1	75	4.7	2.3
95	1	$4.3	$4.6	no spike		---	---	---
01	1	$4.9	$4.9	$2.4	$2.4	48	2.6	2.6

Source: Prepared by CRS based on DoD budget data. Percentages calculated using precise (rather than rounded) then-year dollar figures. The rough apparent size of the DoN budget spikes for FY1983, FY1988 and FY2001 is based on a comparison of DoN funding levels for the time period in question, particularly the funding levels for the years just prior and after the year in question.

This history of DoN budget levels and aircraft carrier procurement funding poses at least three potential policy questions for Congress:

- Is the apparent planned size of the FY2001 DoN funding spike about right, too low, or too high in terms of the resulting funding pressure, if any, that is placed on other FY2001 DoN funding priorities?

- What other DoN program priorities, if any, had their funding reduced in FY2001 as a result of the need to fund CVN-77, and how were these programs affected by these funding reductions?

- Is there a way to fund procurement of an aircraft carrier without use of a DoN funding spike that avoids generating a potentially significant one-year impact on funding for other DoN program priorities?

With regard to the third question, one alternative to the use of a funding spike would be to relax the application of the full funding policy to procurement of aircraft carriers, so that the procurement cost of a carrier can be spread more evenly over a period of several years leading up to the year in which funding of the ship is completed and the ship is procured. Such a funding profile is sometimes referred to as incremental funding. In recent years, as discussed in CRS testimony last year, some observers have proposed relaxing the application of the full funding policy to Navy ships (particularly aircraft carriers and amphibious assault ships), and several ships (including aircraft carriers) have been procured with funding profiles that depart in various ways from adherence to the full funding policy.[27]

Surface combatants. Compared to last year=s plan, the Administration=s new amended FYDP delays the procurement of the first DD-21 class land attack destroyer by 1 year (to FY2005), increases by 1 ship the number of DDG-51s to be procured in the FYDP, and stretches out the procurement of the final DDG-51s by two years, to FY2005, in large part to compensate for delaying the start of DD-21 procurement. The 1-year delay in the start of DD-21 procurement is intended to provide additional time for developing the new technologies, including electric-drive propulsion technology, that will be incorporated into the DD-21 design.

The Administration=s restructured plan for procuring surface combatants raises potential issues for Congress regarding force-structure, the industrial base, and the multiyear procurement arrangement for DDG-51.

Force structure. The amended FYDP would procure a total of 14 surface combatants in the 6-year period FY2000-FY2005, as opposed to 16 surface combatants under last year=s plan. This 2-ship reduction in planned procurement of surface combatants is the reason why the amended FYDP would procure a total of 45 ships as opposed to 47 ships under last year=s FYDP.

[27] Ibid, p. 8-13.

The average rate of procurement under the amended FYDP **B** 2.33 ships per year **B** is equal to about 69 percent of the steady-state procurement rate shown in Table 1 (3.38 ships per year) for the planned force of 116 surface combatants, and about 58 percent of the steady-state procurement rate (4.02 ships per year) that would be needed to maintain the 138-ship surface combatant force (of the same proportionate mix of cruisers/destroyers and frigates shown in Table 1) reportedly called for by the surface combatant community=s new force-level study.

If surface combatants were procured at the steady-state rate of 3.38 ships per year through the 6 years of the FYDP, a total of about 20 surface combatants would be procured, as opposed to the 14 in the amended FYDP. In this sense, the amended FYDP, if implemented, would create a 6-ship backlog in surface combatant procurement for this period.

If maintained over a building period of about 34.3 years (the implied weighted average service life for a 116-ship force with a steady-state procurement rate of 3.38 ships per year), a procurement rate of 2.33 ships per year would over the long run reduce the surface combatant force to about 80 ships.

Industrial base. The Administration=s new plan would procure surface combatants at a rate of 2 ships per year in the final four years of the FYDP (FY2002-FY2005). For several years, the two yards that build surface combatants **B** Bath Iron Works (BIW) and Ingalls Shipbuilding **B** have maintained that a procurement rate of 3 ships per year is at or near the minimum economic rate for producing surface combatants at both yards. In large part for this reason, both DoN and Congress have worked for the past several years to stabilize the surface combatant procurement rate at 3 ships per year.

The last time that DoD and others seriously discussed reducing the surface combatant procurement rate to something less than 3 ships per year was in 1993-1994. In response to this discussion, CRS in 1994 prepared a report on the DDG-51 procurement rate that included a discussion of the potential industrial-base implications of procurement rates of less than 3 ships per year.[28] The report stated the following:

> A Navy study of the DDG-51 industrial base suggests that while a procurement rate of 3 ships per year is a low rate with minimum flexibility for sustaining DDG-51 production at two yards, it is not necessarily a rock-bottom rate. With a substantial amount of additional, non-DDG 51 work, the Navy study suggests that a procurement rate of 2.5 ships per year (i.e., 2 ships one year, 3 the next, and so on) would be sufficient to sustain two yards, with some risk. With a very substantial amount of additional, non-DDG-51 work, the Navy study suggests that a procurement rate of 2 ships per year might sustain two yards, but at a higher level of risk to the survival of the shipyards.... The study suggests that the DDG-51 supplier and engineering base can be sustained with a procurement rate as low as 2

[28]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) 67 p.

ships per year, though not without loss of some suppliers, supplier disruption, and restructuring of supplier operations.[29]

The CRS report also included the following summary table:[30]

[29]Ibid, p. 7.

[30]Ibid, p. 62.

Table 8. [DDG-51] procurement rate and industrial base

Policy objective	Procurement rate: number of ships per year						
	3	2.5	2	1.5	1	0.5	0
Maintain 2 DDG-51 shipyards	Yes[a]	Yes, with some risk[b]	Possi-ble, but high risk[c]	No			
Maintain 1 DDG-51 shipyard	Yes[d]			Yes, with some risk[e]		No	
Maintain supplier/ engineering base	Yes	Yes, but supplier loss, disruption, restructuring		Difficult or problematic due to loss of key suppliers, engineers		No	

a Would require some additional, non-DDG 51 work.
b Would require a fairly substantial amount of additional, non-DDG 51 work.
c Would require a very substantial amount of additional, non-DDG 51 work, and risk to survival of one or both yards could be high.
d Might require some additional, non-DDG 51 work, particularly at 2 ships per year.
e Would require some (possibly a fairly substantial) amount of additional, non-DDG-51 work at 1.5 ships per year. Would require a fairly substantial or very substantial amount of additional, non-DDG 51 work at 1 ship per year, and risk to survival of yard could be high.

Although 6 years have passed since this report was issued, the basic thrust of the quote and table taken from the 1994 CRS report would appear to remain broadly true: Reducing the DDG-51 procurement rate to 2 ships per year could place the two yards under financial pressure, unless substantial amounts of non-DDG-51 work were added to the work loads of the two yards.

In recent years, the Navy has followed a policy of dividing DDG-51s more or less equally between the two yards. Reducing the DDG-51 procurement rate from 3 ships per year to 2 ships per year would thus reduce the average number of new DDG-51s awarded to each yard from 1.5 per year to 1 per year. Of a DDG-51's total procurement cost of about $900-plus million (when procured at a rate of 3 ships per year), roughly $350 million goes to the shipyard that builds the ship (the remainder goes to firms that build components for the ship). On this basis, reducing the DDG-51 procurement rate to 2 ships per year could reduce average revenues at each yard by an average of roughly $175 million per year.

BIW is now a part of the marine systems group at General Dynamics (along with Electric Boat and National Steel and Shipbuilding Co. [NASSCO]), and can thus benefit from the financial resources of its new parent firm. BIW is also now participating in the construction of LPD-17 class amphibious ships, along with Avondale Shipbuilding. Under the Avondale-BIW teaming arrangement, BIW will build every third ship. Ingalls remains a part of Litton Industries (which also now includes Avondale), and has had some success in winning non-Navy ship-construction work, including a contract to build 2 new cruise ships.

The addition of the LPD-17 construction work would help BIW weather a 4-year period during which it might receive only 1 DDG-51 per year. If BIW receives every third LPD-17, and if 2 LPD-17s are procured each year, as currently planned, then BIW would receive, on average, two-thirds of an LPD-17 each year. LPD-17s have a total procurement cost of roughly $750 million per ship, of which about $450 million to $500 million might go to BIW.[31] On this basis, an average of two-thirds of an LPD-17 per year would amount to about $300 million to $330 in additional annual revenue at BIW, or almost twice the average annual revenue that BIW might lose due to a reduction in the DDG-51 procurement to 2 ships per year.

Building LPD-17s, however, may not involve as much outfitting work as building DDG-51s. (Outfitting is the installation into the ship=s basic structure of the ship=s many different kinds of mechanical and electrical systems.) As a consequence, LPD-17 work may not by itself be adequate to preserve a skill mix at BIW that contains a sufficient number of skilled outfitters for building DD-21s in the future at a rate of 3 ships per year.

Similarly, although the amount of non-Navy ship construction added to Ingalls= work load in recent years might partially or fully compensate Ingalls for reduced DDG-51-related revenues, it is not clear whether this work is of a kind that will be sufficient to preserve adequate numbers of workers with the kinds of skills needed for future surface combatant construction.

Multiyear procurement arrangement. Congress may wish to explore how the restructured DDG-51 procurement profile will affect the multiyear procurement (MYP) arrangement that has been approved for the DDG-51 program. At a minimum, Congress may need to modify the terms of the MYP authority granted for the program so as to capture DDG-51s that are now planned for procurement in FY2004 and FY2005.

Large-deck amphibious ships. For FY2001, there are two potential issues for Congress regarding procurement of large-deck amphibious ships, also known as

[31] Avondale was recently awarded a $492 million contract for the shipyard-portion of LPD-19 (the third LPD-17 class ship), which will be built at BIW. Litton Gets $492-Million Navy Contract. *Los Angeles Times*, February 17, 2000: C2.

amphibious assault ships. One of these issues concerns the funding profile for the procurement of LHD-8, the next amphibious assault ship; the other concerns the more general issue of the procurement schedule for the replacement ships for 5 older amphibious assault ships. Each of these issues is discussed below.

LHD-8 funding profile. Congress provided $45 million in FY1999 advanced procurement funding (since adjusted to $44 million) for LHD-8, the eighth Wasp (LHD-1) class amphibious assault ship **C** a ship the Administration had not requested for procurement in its then-current FY1998-FY2003 FYDP. The Administration responded to this action the following year by including LHD-8 in the final year of its new FY2000-FY2005 FYDP submitted to Congress in February 1999, with advanced procurement funding for the ship programmed in FY2004.

For FY2000, Congress provided an additional $375 million in advanced procurement funding for LHD-8 (since adjusted to $356 million) and included language in the FY2000 defense appropriations act stating that Athe Secretary of the Navy is hereby granted the authority to enter into a contract for an LHD-1 Amphibious Assault Ship which shall be funded on an incremental basis.@[32] The Administration has responded to these actions this year by retaining LHD-8 in the final year of its amended FY2000-FY2005 FYDP and eliminating the advanced procurement funding it had previously programmed for the ship in FY2004.

By implication, the Administration=s current position appears to be either that LHD-8 already qualifies as an incrementally funded ship by virtue of the FY1999 and FY2000 increments of advanced procurement funding provided by Congress, or that the language in the appropriation act is a statement by Congress of its own intended method for funding the ship, but not a requirement that the Administration propose a funding profile showing additional advanced procurement funding for the ship during the period FY2001-FY2004.

Potential FY2001 issues for Congress regarding procurement of LHD-8 are whether to provide a third increment of advanced procurement funding for the ship in FY2001, and whether to include new legislative language making more explicit whether Congress expects future DoD budget submissions to include additional programmed increments of advanced procurement funding for LHD-8 in FY2002-FY2004.

Replacement schedule for 5 older large-deck ships. A more general issue, and one which has not received much attention, concerns the schedule for procuring new amphibious assault ships as replacements for the 5 older Tarawa (LHA-1) class amphibious assault ships procured in FY1969-FY1971. These 5 ships entered service at a 1-per-year rate in the period 1976-1980 and will reach the end of their nominal

[32] See page 13 of the conference report (H.Rept. 106-371) on the FY2000 defense appropriations bill (H.R. 2561).

35-year service lives in 2011-2015. LHA-8 is intended as the replacement for LHA-1, the first of these 5 older LHAs, but there has been less discussion of when additional ships should be procured to replace the other 4 LHAs.

CRS understands that DoN has recently completed (but as of this writing has not yet released) a study that examines 3 options for responding to the approaching end of the 35-year service lives of the older LHAs. These options are putting the 5 LHAs through a Service Life Extension Program (SLEP) to permit them to remain in service beyond age 35; procuring modified LHD-1 class ships as replacements; or developing and procuring a new-design large-deck amphibious ship (known as the LHX) as replacements. Marine Corps officials have indicated that, from an operational standpoint, they would prefer a new-procurement option to the SLEP option because the LHAs have certain built-in capability limitations which a service-life-extension program could not eliminate, and which could become operationally significant after 2011. Other observers have argued that the SLEP option, though less expensive on a per-ship basis than procuring a new ship, could be less cost-effective because it would extend the life of the ships by about 15 years (less than 50 percent of the life of a new ship) but could cost about $1 billion per ship (more than 50 percent of the cost of a new ship).

The LHX, as an all-new design, could be designed to be more capable than a modified LHD-1. An LHX could also be cost-effective, given the opportunity to design the ship from a clean sheet of paper and thus take maximum advantage of technologies (such as those permitting large reductions in crew size) that could reduce the life-cycle cost of the ship below that of a modified LHD-1. Developing the LHX design, however, could easily cost more than a billion dollars (particularly if it were to incorporate a large number of new technologies) and require several years of design and engineering work. If LHD-8 replaces the first LHA, then this $1 billion (or more) in research and development costs would be amortized over an LHX production run of 4 ships, increasing the LHX=s total unit acquisition cost (as opposed to unit procurement cost) by $250 million (or more) per ship. In addition, since these 4 ships would be the first built to the new design, they would all have early positions on the shipyard production learning curve for that design, which (other things held equal) would elevate their price further relative to the LHD-1 design, which is further down its learning curve. These cost factors could make the LHX option less attractive in terms of development and procurement costs compared to the modified-LHD option.

If new ships are to be procured to replace all 5 LHAs on a timely basis (i.e., without requiring any of the LHAs to operate beyond age 35), then the schedule for procuring the replacement ships is becoming a potentially urgent issue. Given that LHA-1 reaches age 35 in 2011, and assuming that it takes 5 years to build a large-deck amphibious ship, then the replacement ship for LHA-1 can be procured in FY2006. On this basis, it appears that the scheduled FY2005 procurement of LHD-8 is, if anything, one year earlier than it needs to be.

If all 5 LHAs are to be replaced on a timely basis, however, procuring LHD-8 in FY2005 would then require the procurement of the remaining 4 replacement ships in the subsequent 5-year period FY2006-FY2010. Given the procurement cost of a

large-deck amphibious ship (about $1.75 billion for LHD-8, if procured in FY2005), procuring 5 large-deck amphibious ships in the 6-year period FY2005-FY2010 might cause an unacceptable amount of reductions or displacements in other Navy shipbuilding programs during those years. Procuring LHA replacements at a rate of one every 2 or 3 years might be easier to accomplish because the budgetary impact on other Navy programs would be spread out over a larger number of years. (A procurement rate of one ship every three years would also be about equal to the steady-state replacement rate for large-deck amphibious ships shown in Table 1.)

If the fifth replacement ship is procured in FY2010, then procuring the 5 replacement ships at a rate of one every 3 years would have required the procurement of the first replacement ship (LHD-8) in FY1998, and the second replacement ship in FY2001. In this sense, the opportunity has already passed for replacing all 5 LHAs on a timely basis using a procurement schedule for the replacement ships of 1 ship every 3 years.

The table below shows alternative profiles for procuring the five replacement ships starting in either FY2001 (the earliest year now possible) or FY2005. As can be seen in the table, if procurement of the 5 replacement ships is started in FY2001, and ships are procured at a rate of 1 ship every 2 or 3 years, then most or all of the 5 LHAs can be replaced before age 35. If, on the other hand, procurement is started in FY2005, as currently planned, and the ships are procured at a rate of 1 ship every 2 or 3 years, then most of the LHAs will be replaced after age 35, though in almost all most cases at or before age 40.

Table 9. Alternative schedules for procuring LHA replacements and resulting age of LHAs at replacement

Alternative profiles for procuring LHA replacements	**Resulting age at which LHAs are replaced**				
	LHA-1	**LHA-2**	**LHA-3**	**LHA-4**	**LHA-5**
LHD-8 procured in FY2001, subsequent ships at rate of:					
1 every 3 years	30	32	34	36	38
1 every 2 years	30	31	32	33	34
1 per year	30	30	30	30	30
LHD-8 procured in FY2005, subsequent ships at rate of:					
1 every 3 years	34	36	38	40	42
1 every 2 years	34	35	36	37	38
1 per year	34	34	34	34	34

Another factor to consider is the effect of the schedule for procuring LHD-8 on the production line at Ingalls Shipbuilding, the shipyard that builds LHDs. Since the

previous large-deck amphibious ship, LHD-7, was procured in FY1996, procuring LHA-8 in FY2001 would result in a 5-year gap in procurement between LHA-7 and LHA-8. This is somewhat longer than the optimum gap between ship procurements from the standpoint of maintaining heel-to-toe production of LHDs at Ingalls, but it is short enough to avoid a complete break in the LHD production line. Procuring LHD-8 in 2005, in contrast, would create a 9-year gap in procurement between LHD-7 and LHD-8. This would likely cause a break in the production line at Ingalls and a consequent increase in the procurement cost of LHD-8 due to the costs associated with restarting the LHD production line.

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