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Navy Force Architecture and Ship Acquisition: Selected FY2006 Issues for Congress

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Summary

This report is based on CRS testimony at a March 10, 2005, hearing on Navy force structure and ship acquisition before the Projection Forces Subcommittee of the House Armed Services Committee. Since February 2003, if not earlier, there has been no current, officially approved, unambiguous plan for the future size and structure of the Navy. Ambiguity concerning required numbers of Navy ships may cause business-planning uncertainty for industry and may make it difficult, if not impossible, for Congress to conduct effective oversight by reconciling desired Navy capabilities with planned Navy force structure, and planned Navy force structure with supporting Navy programs and budgets. The undefined aspects of the new sea basing concept for conducting expeditionary operations may be contributing to uncertainty in Navy ship force-structure planning for amphibious ships, maritime prepositioning ships, and naval surface fire support requirements.

A Center for Naval Analyses (CNA) report on fleet platform architectures parallels fairly closely current Navy thinking on the size and composition of the fleet. An Office of Force transformation (OFT) report on the topic challenges current Navy thinking and recommends a radically different fleet architecture involving eight new ship designs. For the six shipyards that build the Navy's major warships, the Navy's proposed FY2006-FY2011 shipbuilding plan would result in relatively low work loads, revenues, and employment levels. Production economies of scale would be limited or poor, and layoffs may occur at some of the yards.

Using incremental funding or advance appropriations could help reduce instability in Navy ship-procurement plans by avoiding or mitigating budget spikes that can occur when traditional full funding is used to procure aircraft carriers and "big deck" amphibious ships. A more fundamental cause of instability in Navy ship-procurement programs, however, may be the absence of a current, officially approved, unambiguous plan for the future size and structure of the Navy. By avoiding or mitigating budget spikes, using incremental funding or advance appropriations could marginally, but not dramatically, increase the number of ships that could be built for a given total amount of funding.

One option for sustaining the ship-construction industrial base in general would be to increase the amount of commercial-ship construction work. An option for sustaining the aircraft carrier construction industrial base would be to restore procurement of CVN-21, the next aircraft carrier, to FY2007. The part of the submarine industrial base that might be in most need of near-term attention is the design and engineering portion. Options for submarine procurement include non-nuclear-powered submarines equipped with air-independent propulsion (AIP) systems and a reduced-cost nuclear-powered submarine based on new "Tango Bravo" technologies being developed by the Navy. There are several options for supporting the surface combatant industrial base between now and about FY2011. Options for FY2011 and beyond include a surface combatant about the same size as today's 9,000-ton Aegis ships, a 6,000-ton frigate, and a low-cost gunfire support ship. This report will not be updated.

Contents

Introduction 1

Selected Issues for Congress 2
- Navy Ship Force-Structure Goals 2
  - Continued Ambiguity 2
  - Capabilities-Based Planning And Ambiguity 2
  - Implications Of This Ambiguity 3
  - Potential Oversight Questions Arising From This Ambiguity 5
- Sea Basing Concept And Navy Ship Force-Structure Goals 6
  - The Sea Basing Concept 6
  - Effect On Navy Ship Force-Structure Goals 7
  - Potential Oversight Questions For Congress 9
- CNA and OFT Reports on Navy Fleet Platform Architectures 10
  - CNA Report 10
  - OFT Report 12
- Industrial-Base Implications Of Reductions and Deferrals 20
  - Overall Ship-Procurement Rate 21
  - Individual Shipbuilding Programs 22
- Alternative Funding Approaches for Navy Ship Procurement 28
  - Introduction 28
  - Full Funding Policy 29
  - Incremental Funding 32
  - Advance Appropriations 35
  - Potential For Reducing Instability In Ship-Procurement Plans 38
  - Potential For Increasing Number Of Ships Procured 40
  - Options for Congress 42
- Options For Sustaining Ship-Construction Industrial Base 46
  - Ship-Construction Industrial Base in General 46
  - Aircraft Carrier Construction Industrial Base 48
  - Submarine Construction Industrial Base 48
  - Surface Combatant Industrial Base 48
- Options For Submarine Procurement 50
  - AIP Submarine 50
  - Lower-Cost (“Tango Bravo”) Nuclear-Powered Submarine 52
- Options for Surface Combatant Procurement 53
  - Roughly 9,000-Ton Surface Combatant (SC[X]) 55
  - Roughly 6,000-Ton Frigate (FFG[X]) 55
  - Low-Cost Gunfire Support Ship 56

Appendix A: Ambiguity in Navy Force Structure Planning 57
- 310-Ship Plan From 2001 QDR 57
- Navy 375-Ship Proposal (2002-2004) 58
- Navy 2005 Testimony On Force Posture Ranges 58

List of Tables

Table 1. CNA-Recommended Force and Navy's 375-Ship Proposal 11
Table 2. Alternative Fleet Structures From OFT Report 16
Table 3. Navy FY2006-FY2011 Ship-Procurement Plan 21
Table 4. Navy Ship Force Structure Plans 61

Navy Force Architecture and Ship Acquisition: Selected FY2006 Issues for Congress

Introduction

Members of Congress who track issues relating to the Navy or the shipbuilding industry have expressed concerns regarding the Administration's plan for the future size and structure of the Navy and for procuring new Navy ships. This report reviews a number of issues relating to these topics. It is based on CRS testimony at a March 10, 2005, hearing before the Projection Forces Subcommittee of the House Armed Services Committee.[1] The Subcommittee asked CRS to testify on the following topics:

- Navy ship force-structure goals;
- the effect of the Navy's sea basing concept for expeditionary operations on Navy ship force-structure goals;
- the recently submitted reports on Navy fleet platform architectures by the Center for Naval Analyses (CNA) and the Department of Defense (DOD) Office of Force Transformation (OFT);
- the industrial-base implications of reductions and funding deferrals in Navy ship procurement programs;
- alternative funding approaches for Navy ship procurement;
- options for sustaining the ship-construction industrial base;
- options for submarine procurement; and
- options for surface combatant procurement.

Each of these issues is addressed below.

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[1] Statement of Ronald O'Rourke, Specialist in National Defense, Congressional Research Service, Before the House Armed Services Committee Subcommittee on Projection Forces Hearing on Navy Force Architecture and Ship Construction, Mar. 10, 2005. 55 pp. The Subcommittee granted CRS permission to convert this testimony into a CRS report.

Selected Issues for Congress

Navy Ship Force-Structure Goals[2]

Continued Ambiguity. Since February 2003, if not earlier, there has been no current, officially approved, unambiguous plan for the future size and structure of the Navy. (For a review of how this situation developed, see Appendix A at the end of this statement.)

The Navy's February 2005 testimony that in future years it may require a total of 260 to 325 ships, or possibly 243 to 302 ships, depending on how much the Navy uses new technologies and the Sea Swap concept for crewing and deploying ships,[3] does little to alter this situation, for three reasons:

- These potential force ranges are fairly broad — the high end in each case is about 25% greater than the low end.
- The Navy's testimony does not make clear whether these planning ranges have been endorsed by the Secretary of Defense as official Department of Defense (DOD) force-structure planning goals.
- The Navy's testimony does not specify the kinds and numbers of ships that comprise the ship totals in these ranges.

Capabilities-Based Planning And Ambiguity. When asked about required numbers of Navy ships and aircraft, Navy and DoD officials have argued that under capabilities-based planning, numbers of ships and aircraft per se are not as important as the total amount of capability represented in the fleet. That may be correct insofar as the policy objective is to have a Navy with a certain desired set of capabilities, and not simply one that happens to include a certain number of ships and aircraft. But that is not the same as saying that a Navy with a desired set of capabilities cannot be translated into a planned force structure that includes certain numbers of ships and aircraft of various types.

Although the Navy is currently working to resolve uncertainties concerning the applicability of new technologies the Sea Swap concept, it arguably should become possible at some point to translate a set of desired Navy capabilities into desired numbers of ships and aircraft. Those numbers might be expressed as focused ranges rather than specific figures (or broad ranges), and these focused ranges may change over time as missions, technologies, and crewing concepts change. But to argue indefinitely that desired naval capabilities cannot be translated into desired numbers

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[2] Material in this section was adapted from CRS Report RL32665, *Potential Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

[3] See Statement of Admiral Vernon Clark, USN, Chief of Naval Operations, before the House Armed Services Committee, February 17, 2005, pp. 19-20 and Statement of Admiral Vernon Clark, USN, Chief of Naval Operations, before the Senate Armed Services Committee, Feb. 10, 2005, pp. 18-19.

of ships and aircraft would be to suggest that the Navy cannot measure and understand the capabilities of its own ships and aircraft. In this sense, the shift to capability-based planning does not in itself constitute a rationale for permanently setting aside the question of the planned size and structure of the fleet.

Implications Of This Ambiguity. Continued ambiguity in Navy force-structure planning has potential implications for the Navy, Congress, and industry.

For the Navy. For the Navy, ambiguity concerning required numbers of Navy ships provides time to resolve uncertainties concerning the applicability of new technologies and the Sea Swap concept to various kinds of Navy ships. Navy (and DOD) officials may also find this ambiguity convenient because it permits them to speak broadly about individual Navy ship-acquisition programs without offering many quantitative details about them — details which they might be held accountable to later, or which, if revealed now, might disappoint Members of Congress or industry officials.

This ambiguity may also, however, make it difficult at some point for Navy officials, in conversations with the Office of the Secretary of Defense (OSD), to defend programs for procuring Navy ships in certain total numbers or at certain annual rates because OSD officials might view alternative total numbers or annual rates as sufficient for maintaining a Navy that falls somewhere within the broad ranges of total numbers of ships that Navy officials have presented in their testimony.

For Congress. Ambiguity concerning required numbers of Navy ships may make it difficult, if not impossible, for Congress to conduct effective oversight by reconciling desired Navy capabilities with planned Navy force structure, and planned Navy force structure with supporting Navy programs and budgets. With the middle element of this oversight chain expressed in only general terms, Congress may find it difficult to understand whether proposed programs and budgets will produce a Navy with DOD's desired capabilities. The defense oversight committees in recent years have criticized the Navy for presenting a confused and changing picture of Navy ship requirements and procurement plans.[4]

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[4] For example, the conference report (H.Rept. 107-772 of Nov. 12, 2002) on the FY2003 defense authorization act (P.L. 107-314/H.R. 4546) stated

> In many instances, the overall Department of Defense ship acquisition message is confused.... The conferees also believe that the DON shares blame for this confusion because it has been inconsistent in its description of force structure requirements. This situation makes it appear as if the Navy has not fully evaluated the long-term implications of its annual budget requests....
>
> The conferees perceive that DOD lacks a commitment to buy the number and type of ships required to carry out the full range of Navy missions without redundancy. The DON has proposed to buy more ships than the stated requirement in some classes, while not requesting sufficient new hulls in other classes that fall short of the stated requirement. Additionally, the conferees believe that the cost of ships will not be reduced by continually changing the

(continued...)

For Industry. Ambiguity concerning required numbers of Navy ships may make it easier for industry officials to pour into broad remarks from the Navy or DOD their own hopes and dreams for individual programs. This could lead to excessive industry optimism about those programs. Ambiguity concerning required numbers of Navy ships can also cause business-planning uncertainty in areas such as production planning, workforce management, facilities investment, company-sponsored research and development, and potential mergers and acquisitions.[5]

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[4] (...continued)

> number of ships in acquisition programs or by frequently changing the configuration and capability of those ships, all frequent attributes of recent DON shipbuilding plans. (Pages 449 and 450)

The House Appropriations Committee, in its report (H.Rept. 108-553 of June 18, 2004) on the FY2005 DOD appropriations bill (H.R. 4613), stated:

> The Committee remains deeply troubled by the lack of stability in the Navy's shipbuilding program. Often both the current year and out year ship construction profile is dramatically altered with the submission of the next budget request. Programs justified to Congress in terms of mission requirements in one year's budget are removed from the next. This continued shifting of the shipbuilding program promotes confusion and frustration throughout both the public and private sectors. Moreover, the Committee is concerned that this continual shifting of priorities within the Navy's shipbuilding account indicates uncertainty with respect to the validity of requirements and budget requests in support of shipbuilding proposals. (Page 164)

[5] In an interview published in the February 2005 issue of Seapower magazine, for example, Michael Petters, the president of Northrop Grumman Newport News, said:

> If there was a clear, stable picture of what the Navy wants, and what sort of infrastructure needs to be in place to support that, the industry would adapt. But what you've had instead are the annual perturbations. That's a challenge for us. We make investments in ships that take eight years to build, then the ship gets delayed because of the way the budget process works.

In the same published interview, Michael W. Toner, the executive vice president of General Dynamics' Marine Systems Group, said:

> Mike [Petters] is dead on. I think Secretary [of the Navy Gordon] England has it right, but it's up to the Navy to establish the stability. What's the plan? Give us a stable plan and then we can make the investments. Industry will do what industry needs to do. But it is a very difficult environment to make investment in, that's for sure.
>
> ("Shipbuilding: An Uncertain Future," *Seapower*, February 2005: 28.)

Similarly, a July 2004 press article stated:

> Philip Dur, chief executive officer of Northrop Grumman's Shipbuilding Systems, argued that the Navy's concept of "capabilities versus numbers" not only would hurt the service's operations, but decimate the industry.

(continued...)

Potential Oversight Questions Arising From This Ambiguity. Potential oversight questions for Congress that arise from ambiguity in Navy ship force-structure planning include the following:

- What are the kinds and numbers of ships that comprise each of the total ship figures (290, 375, 260, 325, 243, and 302 ships) presented in the Navy's February 2005 testimony? What, in other words, is the composition of each of these potential fleets? When does the Navy plan to release these figures?

- Is the lack of information on kinds and numbers of specific categories of ships intended to make it more difficult for Congress to conduct effective oversight of Navy programs and proposed FY2006 budget?

- For each of the three ranges shown in the Navy's 2005 testimony — 290 to 375 ships, 260 to 325 ships, and 243 to 302 ships — what factors explain the difference between the low and high end of the range? Does the Navy anticipate narrowing the difference between the low and high end of each range? If so, when? If not, why not?

- What is the Navy's view regarding the prospective affordability of a Navy of 300 or more ships (i.e., as shown in the high ends of the three ranges from the Navy's 2005 testimony) as opposed to a Navy of roughly 240 to 290 ships (as shown in the low ends of the three ranges)?

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[5] (...continued)

If the Navy decides it cannot afford 300 ships, it should come up with a smaller number and set new ship construction plans based on that number, Dur said.

It also would be helpful, he added, if both the Navy and the Coast Guard jointly planned their long-term shipbuilding buys. "I do not know that either service takes the other service's capabilities into account," he said. If both services set their shipbuilding goals collectively, "then the shipbuilders can lay out an investment plan, a hiring plan [and] a training plan that was predicated on the assumption that we would competing for an X-number of platforms per year on a going-forward basis," Dur said....

If the Department of Defense can frame a requirement for ships and defend it, the industry would make the necessary adjustments to either scale down or ramp up, Dur told reporters during a recent tour of the company's shipyards in Louisiana and Mississippi.

(Roxana Tiron, "Lack of Specificity in Navy Shipbuilding Plans Irks the Industry," *National Defense*, July 2004.)

Sea Basing Concept And Navy Ship Force-Structure Goals[6]

The Sea Basing Concept. The Navy and Marine Corps are developing a new concept of operations for conducting expeditionary operations ashore called enhanced networked sea basing, or sea basing for short. Under the current concept of operations for conducting expeditionary operations ashore, the Navy and Marine Corps would establish a foothold ashore, and then use that foothold as a base from which to conduct operations against the desired ashore objective. Under sea basing, the Navy and Marine Corps would launch, direct, and support expeditionary operations directly from a base at sea, without necessarily establishing an intermediate base ashore.

Many of the details of the sea basing concept have yet to be worked out; Navy and Marine Corps officials are currently working to produce a more refined notion of the concept.[7]

A key rationale for the sea basing concept is that in the future, fixed land bases ashore will become too vulnerable to enemy attack from weapons such as cruise missiles or short-range ballistic missiles, and that launching the operation directly from a base at sea will enhance the survivability of the attacking Navy-Marine Corps force by putting the base out of the range of shorter-range enemy weapons and targeting sensors, and by permitting the sea to be used as a medium of maneuver for evading detection and targeting by longer-range enemy weapons and sensors.

A second rationale for sea basing is that by eliminating the intermediate land base — the logistical "middleman" — sea basing will permit the Marine Corps to initiate and maintain a higher pace of operations against the desired objective, thus enhancing the effectiveness of the operation. A third rationale for sea basing is that it could permit the Marine force, once the operation is completed, to reconstitute and redeploy — that is, get back aboard ship and be ready for conducting another operation somewhere else — more quickly than under the current concept of operations.

The sea base being referred to is not a single ship, but rather a collection of ships. The exact types and numbers of ships involved is now being studied by the Navy and Marine Corps. Although the results of these studies have not yet been announced, general points that have emerged from the public discussion to date include the following:

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[6] Material in this section has been adapted from CRS Report RL32513, *Navy-Marine Corps Amphibious and Maritime Prepositioning Ship Programs: Background and Oversight Issues for Congress*, by Ronald O'Rourke.

[7] For a detailed discussion of the sea basing concept, see *Defense Science Board Task Force on Sea Basing*, op cit, 168 pp. See also Otto Kreisher, "Sea Basing," *Air Force Magazine*, July 2004: 64; Scott C. Truver, "Sea Basing: More Than The Sum Of Its Parts?" *Jane's Navy International*, Mar. 2004: 16-18, 20-21; Art Corbett and Vince Goulding, "Sea Basing: What's New?" *U.S. Naval Institute Proceedings*, Nov. 2002: 34-39.

- The sea base would likely include, among other things, some combination of amphibious and Maritime Prepositioning Force (Future), or MPF(F) ships.[8] The Navy has studied various combinations of amphibious and MPF-type ships.

- Under sea basing, certain functions previously carried out from the intermediate land base, including command and control, fire support, and logistics, would be transferred back to the ships at sea that collectively make up the sea base. Other things held equal, the ships making up the sea base would consequently have to be more capable of carrying out these functions than today's mix of amphibious and MPF ships.

- Due to both the increased capability of ships making up the sea base, as well as the increased cost of MPF(F) ships compared to today's MPF ships, today's three MPF squadrons may be replaced by a set of ships sufficient to form two sea bases.

The Defense Department has expressed some interest in sea basing as a potential joint concept that could involve Army and Air Force forces as well as the Navy and Marine Corps.[9] The Defense Science Board (DSB) in August 2003 issued a report on sea basing which concluded that "sea basing represents *a critical future joint military capability* for the United States."[10]

Effect On Navy Ship Force-Structure Goals. The undefined aspects of the sea basing concept may be contributing to uncertainty in Navy ship force-structure planning in one or more of the following areas:

- **Total number of LPD-17s to be procured.** Although the Navy's proposed FY2006 budget and FY2006-FY2011 Future Years

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[8] A carrier strike group (CSG) would constitute another element of the sea base.

[9] Jason Sherman and David Brown, "Pentagon To Create Multiservice Sea Basing Requirements Office," *Defense News*, December 8, 2003: 30; Catherine MacRae, "Aldridge Wants Top Defense Scientists To Study Future Of Seabasing," *Inside the Pentagon*, Nov. 14, 2002: 1. For articles discussing the potential joint aspects of sea basing, see Otto Kreisher, "Sea Basing," *Air Force Magazine*, July 2004: 64; Ann Roosevelt, "Army, Navy Collaborating On Sea Basing Concept," *Defense Daily*, June 30, 2004: 3; Lisa Troshinsky, "Army Logistics Using Sat Network, Planning For Sea-Based Capability,"*Aerospace Daily & Defense Report*, June 30, 2004: 3-4; Scott C. Truver, "Seabasing: More Than The Sum Of Its Parts?" *Jane's Navy International*, Mar. 2004: 16-18, 20-21; John J. Klein, "Sea Basing Isn't Just About The Sea," *U.S. Naval Institute Proceedings*, Jan. 2004: 32-35;

[10] Defense Science Board. *Defense Science Board Task Force on Sea Basing*. Office of the Under Secretary of Defense For Acquisition, Technology, and Logistics. Washington, 2003. (August 2003) p. xi. Italics as in the original. Similar statements are made in two cover memos included at the front of the report, and on page 87. For press reports about this study, see John T. Bennett, "Marine Corps Commandant, DSB Describe Visions Of Seabasing Concept," *Inside the Pentagon*, Oct. 30, 2004; Jason Ma, "DSB Study, Conference Examine Seabasing Needs and Challenges," *Inside the Navy*, Oct. 27, 2003; Jason Sherman, "Pentagon Group Details Sea Base Concept," *Defense News*, Oct. 27, 2003.

Defense Plan (FYDP) propose reducing planned procurement of San Antonio (LPD-17) amphibious ships to a total of nine ships, it is possible that this number might change as the sea basing concept is refined in more detail.

- **Design and cost of LHA(R).** Although Navy officials currently appear to support a design for LHA(R) — the next "big-deck" amphibious assault ship — that is based on the Wasp (LHD-1) class hull, but with enhanced aviation capabilities and no well deck, it is possible that ongoing study of the sea basing concept, combined with more precise estimates of the cost to build LHA9R) to various designs, could lead to further changes in the design of the ship.

- **Procurement of "big-deck" amphibious ships after LHA®.** Uncertainty over the details of sea basing may be a barrier to forming a clearer plan for procuring "big-deck" amphibious ships following LHA(R).

- **Total number of amphibious ships and 2.5-MEB goal.** Due in part to the emergence of the sea basing concept, Navy officials cannot state with confidence whether the Navy in the future will need a total of 36 amphibious ships or some greater or lesser number. Navy officials have also made few public comments on the issue of whether the longstanding 2.5-Marine Expeditionary Brigade (MEB) lift goal for the amphibious fleet will be retained, modified, or dropped. Navy officials have reportedly suggested that savings realized from reducing the number of Expeditionary Strike Groups (ESGs) may be used to procure new MPF(F) ships.[11]

- **Numbers, designs, and costs for MPF(F) ships.** Until the Navy and Marine Corps develop a more complete understanding of the details of the sea basing concept, it will be difficult for them to present firm plans for these ships in terms of numbers to be procured, designs, and unit procurement costs. Navy officials have acknowledged that their plans for MPF(F) ships need to be more clearly defined.[12]

- **Naval surface fire support requirements.** Until the Navy and Marine Corps develop a more complete understanding of the details of the sea basing concept, it may be difficult for them to arrive at a consensus agreement on naval surface fire support (NSFS) requirements for the fleet. Uncertainty regarding NSFS requirements can in turn contribute to uncertainty regarding

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[11] Christopher J. Castelli, "Navy May Cut Number Of Expeditionary Strike Groups To Fund MPF(F)," *Inside the Navy*, July 12, 2004.

[12] Christopher J. Castelli, "Navy Acquisition Chief Urges Clark To Define Plan For MPF(F) Ships," *Inside the Navy*, June 28, 2004.

requirements for surface combatants, particularly the DD(X) destroyer.[13]

Potential Oversight Questions For Congress. Potential oversight questions for Congress arising from the sea basing concept include the following:

- When does DOD plan to present to Congress a more detailed description of, and a more refined estimate of the potential total cost to fully implement, the sea basing concept? Should Congress direct DOD to present a detailed description and cost estimate by a date certain? How does the current lack of a detailed description and cost estimate affect Congress' ability to conduct effective oversight of programs that might be affected by the concept, including amphibious and maritime prepositioning ship programs and programs relating to naval surface fire support? How does it affect Congress' ability to assess the potential affordability and cost effectiveness of sea basing compared to possible alternatives for conducting future expeditionary operations ashore or programs for meeting other defense priorities?

- What are the potential costs and merits of alternatives to sea basing for conducting future expeditionary operations ashore? How do land bases and sea bases compare in terms of vulnerability to attack and cost to defend against potential attacks of various kinds? What other defense programs might need to be reduced to finance the implementation of sea basing? What are the potential operational risks of not implementing sea basing?

- Should development of the sea basing concept be led by a joint DOD office, or by the Navy and Marine Corps (while still incorporating input from the Army and Air Force)? Does the Pentagon's approach to developing the sea basing concept feature too much, not enough, or about the right amount of interservice coordination and top-level DOD direction? To what degree, if any, does sea basing conflict with any emerging Army or Air Force concepts of operation for conducting future expeditionary operations? If sea basing is developed primarily by the Navy and Marine Corps, and is then subsequently modified by DOD to take Army and Air Force needs into greater account, will this lead to instability in announced plans for procuring amphibious and maritime prepositioning ships?

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[13] A November 2004 Government Accountability Office (GAO) report concluded that

> The Navy and Marine Corps have only recently begun the process to establish validated NSFS requirements that address the overall capabilities needed and the balance between different systems that will be required to provide effective, continuous, and sustaining support fire for forces operating ashore.
>
> (Government Accountability Office, *Information on Options for Naval Surface Fire Support*, GAO-05-39R, Nov. 2004, p. 2.)

CNA and OFT Reports on Navy Fleet Platform Architectures[14]

Section 216 of the conference report (H.Rept. 108-354 of November 7, 2003) on the FY2004 defense authorization bill (H.R. 1588/P.L. 108-136 of November 24, 2003) required the Secretary of Defense to provide for two independently performed studies on potential Navy fleet platform architectures.[15] The two studies were conducted by the Center for Naval Analyses (CNA) and DOD's Office of Force Transformation (OFT) and were recently submitted to the congressional defense committees. Subsection (d) of Section 216 states in part that "The results of each study under this section shall — (1) present the alternative fleet platform architectures considered, with assumptions and possible scenarios identified for each..."

CNA Report.[16] The CNA report presents a fairly traditional approach to naval force planning in which capability requirements for warfighting and for maintaining day-to-day naval forward deployments are calculated and then integrated. The report's discussion of how crew rotation may alter force-level requirements for maintaining day-to-day forward deployments is somewhat detailed and may have been adapted from other work that CNA has done on the topic for the Navy.

The report recommends a Navy force structure of 256 to 380 ships. The high end of this range is about 48% greater than the low end, making it almost twice as broad a range, mathematically, as the ranges presented in the Navy's February testimony. The difference between the low and high ends of the CNA range is that the low end assumes a greater use of crew rotation and overseas homeporting of Navy ships.

Table 1 below compares the CNA-recommended force range to the 375-ship fleet proposal mentioned by Navy officials from early 2002 through early 2004.

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[14] Material in this section was adapted from a Feb. 25, 2005, CRS memorandum to the office of Representative Bartlett and is used here with permission from that office.

[15] H.Rept 108-354, pp.28-29 and 612-613. Section 216 is an amended version of a provision (Section 217) in the House-reported version of H.R. 1588; see pages 255-256 of the House report on H.R. 1588 (H.Rept. 108-106 of May 16, 2003).

[16] Delwyn Gilmore, with contributions by Mark Lewellyn *et al*, *Report to Congress Regarding Naval Force Architecture*. Alexandria (VA), Center for Naval Analyses, 2005. (CRM D0011303.A2/1Rev, Jan. 2005) 60 pp.

Table 1. CNA-Recommended Force and Navy's 375-Ship Proposal

Ship Type	CNA-recommended force	375-ship proposal[a]
Ballistic missile submarines (SSBNs)	14	14
Cruise missile submarines (SSGNs)	4	4
Attack submarines (SSNs)	38 to 62	52
Aircraft carriers	10 to 12	12
Cruisers and destroyers	66 to 112	109
Littoral combat ships (LCSs)	40 to 70	56
Amphibious ships	18 to 30	36
Maritime Prepositioning Force (Future) ships	19 to 21	18
Combat logistics (resupply) ships	25 to 33	33
Other[b]	22	41
Total battle force ships	**256 to 380**	**375**

Notes: a. Composition as shown in CNA report as the program of record for the year 2022. A somewhat different composition is shown in CRS Report RL32665.
b. Includes command ships, support ships (such as salvage ships and submarine tenders), dedicated mine warfare ships, and high-speed sealift ships.

As can be seen in the table, the 380-ship fleet at the high end of the CNA range is similar in size and composition to the Navy's 375-ship fleet proposal. The 256-ship fleet at the low end of the CNA range is a more-or-less scaled-down version of the 380-ship fleet. Its reduced numbers for aircraft carriers, amphibious ships, and attack submarines are similar to figures reported in the defense trade press since early 2004 about possible reductions in planned numbers of those kinds of ships. The 256-ship fleet also includes reduced numbers for ships such as larger surface combatants and combat logistics (resupply) ships.

The CNA range of 256 to 380 ships overlaps with ranges of 290 to 375 ships, 260 to 325 ships, and 243 to 302 ships presented in the Navy's February testimony. An additional comparison is that the mid-point of the CNA-recommended range (318 ships) is similar in terms of total numbers of ships to the 310-ship fleet from the 2001 Quadrennial Defense Review (QDR). Unlike the 2001 QDR fleet, however, the CNA-recommended force includes several dozen Littoral Combat Ships (LCSs) and smaller numbers of other kinds of ships.

The CNA-recommended fleet platform architecture uses essentially the same kinds of ships as those currently in the fleet, under construction, or planned for procurement. It also uses essentially the same kinds of naval formations as those in use today or planned by the Navy. If an alternative fleet platform architecture is defined as one that uses ship types or naval formations that differ in some significant

way from those currently used or planned, then the CNA-recommended force arguably would not qualify as an alternative fleet platform architecture.

In summary, the CNA-recommended force parallels fairly closely current Navy thinking on the size and composition of the fleet. This is perhaps not surprising, given that much of CNA's analytical work is done at the Navy's request.

OFT Report.[17] The OFT report differs significantly (some might say diametrically) from the CNA report. The OFT report "calls into question the viability of the longstanding logic of naval force building"[18] and presents an essentially clean-sheet proposal for a future Navy that would be radically different from the currently planned fleet.

The OFT report was prepared under the direction of retired Navy admiral Arthur Cebrowski, who was the director of OFT from October 29, 2001 until January 31, 2005. The report is generally consistent with Cebrowski's ideas on network-centric warfare and distributed force architectures, which he has developed and articulated since his tenure as President of the Naval War College (from July 24, 1998 to August 22, 2001).

The OFT-recommended fleet would include large numbers of manned ships (about three-quarters of them small, fast surface combatants), about the same number of carrier-based manned aircraft as in the Navy's planned fleet, and large numbers of unmanned systems.

The OFT architecture employs eight new ship designs that differ substantially from the designs of most ships currently in the fleet, under construction, or planned for procurement. Among the eight new ship designs are four types of large surface ships that would be built from a common, relatively inexpensive, merchant-like hull design developed in 2004 for the Navy's Maritime Prepositioning Force (Future) analysis of alternatives. These four types of ships, which would all displace 57,000 tons, include:

- **An aircraft carrier** that would embark a notional air wing of 30 Joint Strike Fighters (JSFs), 6 MV-22 Osprey tilt-rotor aircraft, and 15 unmanned air vehicles (UAVs). The total of 36 manned aircraft is about half as many as in today's carrier air wings, and the OFT architecture envisages substituting two of these new carriers for each of today's carriers. This new carrier would also have support spaces for unmanned underwater vehicles (UUVs), unmanned surface vehicles (USVs), and mission modules for the 1,000-ton surface combatant described below. In displacement terms, this ship would be roughly the same size as a new aircraft carrier design that the United Kingdom plans to procure, and somewhat larger than the

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[17] U.S., Department of Defense, Office of the Secretary of Defense, *Alternative Fleet Architecture Design*. Washington, 2005. (Report for the Congressional Defense Committees, Office of Force Transformation). 101 pp.

[18] Ibid, p. 1

U.S. Navy's 40,000-ton LHA/LHD-type amphibious assault ships. Compared to the U.S. Navy's aircraft carriers, which displace 81,000 to 102,000 tons, this ship could be considered a medium-size carrier.

- **A missile-and-rocket ship** that would be quipped with 360 vertical launch system (VLS) missile tubes and four trainable rocket launchers. Additional spaces on this ship could be used to support UUVs, USVs, and mission modules for the 1,000-ton surface combatant. Alternatively, these spaces could be used to provide limited stowage and working space for the 100-ton surface combatant described below, and mission modules for these 100-ton ships. This ship could be considered similar in some respects to the Navy/DARPA arsenal ship concept of 1996-1997, which would have been a large, relatively simple surface ship equipped with about 500 VLS tubes.[19]

- **An amphibious assault ship** that would embark a notional air wing of either 30 CH-46 equivalents or 6 JSFs, 18 MV-22s, and 3 gyrocopter heavy-lift helicopters. It would also have spaces for Marine Corps equipment, unmanned vehicles, and mission modules for the 1,000-ton surface combatant.

- **A "mother ship" for small combatants** that would contain stowage and support spaces for the 100-ton surface combatant described below.

The four other new-design ships in the OFT architecture are:

- **A 13,500-ton aircraft carrier** based on a conceptual surface effect ship (SES)/catamaran hull design developed in 2001 by a team at the Naval Postgraduate School. This ship would embark a notional air wing of 8 JSFs, 2 MV-22s, and 8 UAVs. The total of 10 manned aircraft is roughly one-eighth as many as in today's carrier air wings, and the OFT architecture envisages substituting eight of these new carriers for each of today's carriers. This new ship would have a maximum speed of 50 to 60 knots. In displacement terms, the ship would be slightly larger than Thailand's aircraft carrier, which was commissioned in 1997, and somewhat smaller than Spain's aircraft carrier, which was based on a U.S. design and was commissioned in 1988. Due to its SES/catamaran hull design, this 13,500-ton ship would be much faster than the Thai and Spanish carriers (or any other aircraft carrier now in operation), and might have a larger

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[19] For more on the arsenal ship, see CRS Report 97-455 F, *Navy/DARPA Arsenal Ship Program: Issues and Options for Congress*, by Ronald O'Rourke. 133 pp.; and CRS Report 97-1044 F, *Navy/DARPA Maritime Fire Support Demonstrator (Arsenal Ship) Program: Issues Arising From Its Termination*, by Ronald O'Rourke. 6 pp. Both reports are out of print and are available directly from the author.

flight deck. This ship could be considered a small, high-speed aircraft carrier.

- **A 1,000-ton surface combatant** with a maximum speed of 40 to 50 knots and standard interfaces for accepting various modular mission packages. These ships would self-deploy to the theater and would be supported in theater by one or more of the 57,000-ton ships described above. This design could be viewed as similar to, but smaller than, the 2,500- to 3,000-ton Littoral Combat Ship (LCS). Compared to the LCS, it would be closer in size to the Streetfighter concept (a precursor to the LCS) that was proposed by retired admiral Cebrowski during his time at the Naval War College.

- **A 100-ton surface combatant** with a maximum speed of 60 knots and standard interfaces for accepting various modular mission packages. These ships would be transported to the theater by the 57,000-ton mother ship and would be supported in theater by that ship and possibly also the 57,000-ton missile-and-rocket ship. Compared to the LCS, this ship, like the 1,000-ton surface combatant, would be closer in size to the Streetfighter concept.

- **A non-nuclear-powered submarine** equipped with an air-independent propulsion (AIP) system.[20] These AIP submarines would be lower-cost supplements to the Navy's nuclear-powered submarines (SSNs) and would be transported from home port to the theater of operations by transport ships. The OFT architecture envisages substituting four of these submarines for the SSN in each carrier strike group.[21]

The 1,000- and 100-ton surface combatants would be built as relatively inexpensive sea frames, like the LCS.

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[20] An AIP system such as a fuel-cell or closed-cycle diesel engine extends the stationary or low-speed submerged endurance of a non-nuclear-powered submarine. A conventional diesel-electric submarine has a stationary or low-speed submerged endurance of a few days, while an AIP-equipped submarine may have a stationary or low-speed submerged endurance of up to two or three weeks. An AIP system does not significantly increase the high-speed submerged endurance of a non-nuclear-powered submarine. A non-nuclear-powered submarine, whether equipped with a conventional diesel-electric propulsion system or an AIP system, has a high-speed submerged endurance of perhaps 1 to 3 hours, a performance limited by the electrical storage capacity of the boat's batteries, which are exhausted quickly at high speed.

[21] The report states that "Alternatives to the SSNs in formations were diesel Air Independent Propulsion (AIP) submarines and unmanned undersea vehicles (UUVs). The AIP submarines were substituted for Virginia class SSNs on a cost basis of roughly four to one. These submarines could be nuclear-powered if they are designed and built based upon a competitive, cost suppressing business model." (Page 60) The strategy of transporting the AIP submarines to the theater using transport ships is not mentioned in the report but was explained at a Feb. 18, 2005 meeting between CRS and analysts who contributed to the OFT report.

The OFT architecture is similar in certain ways to a fleet architecture proposed by the Naval Surface Warfare Center (NSWC) between 1989 and 1992. The NSWC architecture, like the OFT architecture, employed a common hull design for a large ship that could be built in several variants for various missions, including aviation, missile launching and fire support, amphibious warfare, logistics support, and mother-ship support of small, fast, surface combatants. The small, fast surface combatants in the NSWC architecture were called scout fighters and were in the same general size range as the 100- and 1,000-ton surface combatants in the OFT architecture.[22]

The OFT report combines the eight above-described types of ships, plus the Navy's currently planned TAOE-class resupply ship, into three alternative force structures that the report calculates would be equal in cost to the equivalent parts of the Navy's proposed 375-ship fleet. The report states that each of these alternative force structures, like the equivalent parts of the Navy's proposed 375-ship fleet, would be organized into 12 carrier strike groups (CSGs), 12 expeditionary strike groups (ESGs), and 9 surface strike groups (SSGs). The three alternative force structures are shown in **Table 2** on the next page.

[22] For more on this proposed fleet architecture, see Norman Polmar, "Carrying Large Objects," *U.S. Naval Institute Proceedings*, Dec. 1990, pp. 121-122; Michael L. Bosworth *et al*, "Multimission Ship Design for an Alternative Fleet Concept," *Naval Engineers Journal*, May 1991, pp. 91-106; Michael L. Bosworth, "Fleet Versatility by Distributed Aviation," *U.S. Naval Institute Proceedings*, Jan. 1992, pp. 99-102; and Victor A. Meyer, "Naval Surface Warfighting Vision 2030," *Naval Engineers Journal*, May 1992, pp. 74-88. See also "USN's '2030' Plan For Future Fleet," *Sea Power*, April 1992, pp. 79, 82; Edward J. Walsh, "'Alternative Battle Force' Stresses Commonality, Capability," *Sea Power*, Feb. 1991,pp. 33-35; Robert Holzer, "Navy Floats Revolutionary Ship Design for Future Fleet," *Defense News*, May 14, 1990, pp. 4, 52; and Anne Rumsey, "Navy Plans Ship Look-A-Likes," *Defense Week*, Mar. 13, 1989, p. 3.

Table 2. Alternative Fleet Structures From OFT Report

Ship Type	Alternative		
	A	B	C
57,000-ton aircraft carrier	24	24	0
57,000-ton missile-and-rocket ship	33	33	33
57,000-ton amphibious assault ship	24	24	24
57,000-ton mother ship	0	24	24
13,500-ton aircraft carrier	0	0	96
1,000-ton surface combatant	417	0	0
100-ton surface combatant	0	609	609
AIP submarine	48	48	48
TAOE-class resupply ship	12	12	12
Subtotal 1,000- and 100-ton ships	*417*	*609*	*609*
Subtotal other ships	*141*	*165*	*237*
Total ships[a]	**558[a]**	**774[a]**	**846[a]**

Source: Table prepared by CRS based on figures in OFT report.
a The totals shown in earlier copies the OFT report are 36 ships lower in each case due to an error in those copies in calculating the numbers of ships in the 12 carrier strike groups.

The totals shown in the table do not include SSNs, cruise missile submarines (SSGNs), and ballistic missile submarines (SSBNs) operating independently of the 12 CSGs, 12 ESGs, and 9 SSGs. The totals also do not include combat logistics ships other than the TAOEs (e.g., oilers, ammunition ships, and general stores ships) and fleet support ships. The Navy's 375-ship proposal, by comparison, includes all these kinds of ships.

As can be seen from the shaded cells in the table, the difference between Alternatives A and B is that the former uses 1,000-ton surface combatants while the latter uses 100-ton surface combatants that are transported into the theater by mother ships, and the difference between Alternatives B and C is that the former uses 57,000-ton aircraft carriers while the latter substitutes 13,500-ton carriers.

As can also be seen in the table, all three fleets are dominated numerically by the small surface combatants. These ships account for about 75% of the ships in Alternative A, about 79% of the ships in Alternative B, and about 72% of the ships in Alternative C. In the Navy's currently planned architecture, by contrast, the LCS might account for roughly 15% to 20% of the total number of ships.

The OFT report contains a fairly detailed discussion of the Navy's budget situation that calls into question, on several grounds, the Navy's prospective ability

to afford its 375-ship proposal. The report concludes that funding for Navy ship-procurement in future years may fall as much as 40% short of what would be needed to achieve the Navy's 375-ship fleet proposal. If the shortfall is 40%, the report estimates, the Navy could maintain a force of 270 to 315 ships, which is comparable in number to today's force of 290 ships, except that the future force would include a substantial number of relatively inexpensive LCSs. If proportionate reductions are applied to the force structures shown in **Table 2**, Alternative A would include 402 to 469 ships, Alternative B would include 557 to 650 ships, and Alternative C would include 609 to 711 ships. Again, these totals would not include certain kinds of ships (independently operating SSNs, etc.) that are included in the total of 270 to 315 ships associated with the Navy's currently planned architecture.

In terms of how the OFT architecture would compare in capability with the currently planned architecture, the report states:

> Alternative fleet formations consisting of small fast and relatively inexpensive craft combining knowledge and attaining flexibility through networking appear superior to the programmed fleet for non-traditional warfare in a variety of settings. This is due to increasing the complexity the enemy faces and increasing U.S. fleet options that in turn reduce enemy options. The speed and complexity of the alternative fleets can provide them with the capability to complicate and possibly defeat the attempts of non-traditional adversaries to elude surveillance. The enemy could have difficulty determining what to expect and how to defeat them all. The superior speed and more numerous participants than in the programmed fleet provide a stronger intelligence base and more numerous platforms from which to conduct strikes and interceptions. This appears to be true even if the smaller craft are *individually* somewhat less capable and less able to sustain a hit than the larger ships in the programmed fleet.
>
> If these circumstances are not achieved, and the enemy can continue to elude and deceive, the programmed fleet often is as good as the alternatives, sometimes even better. It is not necessarily better in cases in which individual ship survivability dominates, a perhaps counterintuitive result until we realize that *fleet* survivability not *individual ship* survivability is what dominates.
>
> An area in which programmed fleets might have an advantage would be when the long loiter time or deep reach of CTOL [conventional takeoff and landing] aircraft on programmed big-deck CVNs [nuclear-powered aircraft carriers] is needed. That said, there need be no great sacrifice. With airborne tanking, the VSTOL [very short takeoff and landing] aircraft in the alternatives could meet the deep strike and long loiter demands. Also, as mentioned earlier, a combination of advances in EMALS [electromagnetic aircraft launch system] and modifications to the JSF will make it possible to launch the JSF with only a marginal range-payload capability penalty. Moreover, trends in technology are providing *unmanned* aircraft greater capability, including greater loiter time and sensor capability.[23]

At other points, the OFT report argues that its recommended fleet architecture would:

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[23] *Alternative Fleet Architecture Design*, op. cit., pp. 75-76. Italics as in the original.

- "provide a quantum leap ahead in capabilities against a spectrum of enemies ranging from large, highly developed competitors to small but determined asymmetric adversaries"[24] and be adaptable, in a dynamic and less-predictable security environment, to changing strategic or operational challenges;

- be capable of both participating in joint expeditionary operations and maintaining "the strategic advantage the Navy has developed in the global commons," avoiding a need to choose between optimizing the fleet for "performance against asymmetric challenges at the expense of its ability to confront a potential adversary capable of traditional high intensity conflict," such as China;[25]

- pose significant challenges to adversaries seeking to counter U.S. naval forces due to the "large numbers of combat entities that the enemy must deal with; a great variety of platforms with which the enemy must contend; speed; different combinations of forces; distribution of forces across large areas; and [adversary] uncertainty as to the mission and capabilities of a given platform;"[26]

- reduce unit shipbuilding costs, and thereby permit an increase in total ship numbers, by shifting the fleet away from complex, highly integrated ship designs that are inherently expensive to build and toward less-complex merchant-like hulls and small sea frames that are inherently less expensive to build;

- increase shipbuilding options for the Navy by shifting the fleet away from complex, highly integrated ship designs that can be built only by a limited number of U.S. shipyards and toward less-complex merchant-like hulls and small sea frames that can be built by a broader array of shipyards;

- make it easier and less expensive to modernize ships over their long lives, and thereby take better advantage of rapid developments in technology, by shifting from highly integrated ship designs to merchant-like hulls and sea frames;

- permit more constant experimentation with new operational concepts, and thereby achieve higher rates of learning about how to evolve the fleet over time; and

- recognize potential future constraints on Navy budgets and make the Navy more smoothly scalable to various potential future resource levels by shifting from a fleet composed of limited numbers of

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[24] Ibid, p. 6.

[25] Ibid, p. 1 and 2.

[26] Ibid, p. i.

> relatively expensive ships to one composed of larger numbers of less expensive ships.

The OFT report does not include a detailed plan for transitioning from today's fleet architecture to its proposed architecture,[27] but such a plan could be developed as a follow-on analysis.

The report poses a significant potential business challenge to the six shipyards that have built the Navy's major warships in recent years. The report's discussion on implementing its proposed architecture states in part:

> The shipbuilding industrial base would also need to start to retool to build different types of ships more rapidly. Smaller shipyards, which presently do little or no work for the Navy could compete to build the smaller ships, thereby broadening the capabilities base of ship design and construction available to the Navy. The change to smaller, lower unit cost ships would also open up overseas markets. With more shipyards able to build the ships and potential for a broader overall market, the U.S. shipbuilding industry would have the chance to expand its competence, innovation and relevance. Taken together this would sharpen the industry's ability to compete and provide alternatives to a ship procurement system that is beset by laws and regulations that frustrate, even pervert, market forces.[28]

The report's concluding section lists five "dangers" that "risk the Navy's 'losing the way.'" One of these, the report states, is "Shielding the shipbuilding industrial base from global competition," which the report states "guarantees high cost, limited innovation, and long cycle times for building ships."[29]

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[27] On the topic of transitioning to the proposed fleet architecture, the report states:

> Implementation of the alternative fleet architecture should start now and should target option generation, short construction time, and technology insertion. The alternative further provides an opportunity to reinvigorate the shipbuilding industrial base. The many smaller ships, manned and unmanned, in the alternative fleet architecture could be built in more shipyards and would be relevant to overseas markets. The potential longevity of the existing fleet will sustain existing shipyards as they move into building smaller ships more rapidly in this broader market and more competitive environment. The shipyards would develop a competence, broad relevance, and operate in an environment driven by market imperatives instead of a framework of laws that frustrates market forces.
>
> As the new ships enter service and the fleet has the opportunity to experiment with new operational concepts (expanded network-centric warfare in particular) existing ships can be retired sooner to capture operations savings. At this point, the sooner the existing fleet is retired, the sooner the benefits of the alternative fleet architecture design will accrue. (Page 3)

Additional general discussion of implementation is found on pages 76-77 of the report.

[28] Ibid, p. 76.

[29] Ibid, p. 80.

The OFT report proposes building ships that are substantially different from those currently in the fleet, under construction, or planned for procurement, and combines these ships into formations which, although similar in name to currently planned formations (i.e., CSGs, ESGs, and SSGs), might be viewed by some observers as substantially different in composition from the currently planned versions of these formations. If an alternative fleet platform architecture is defined as one that uses ship types or naval formations that differ in some significant way from those currently used or planned, then the OFT-recommended force arguably would qualify as an alternative fleet platform architecture.

In summary, the OFT report fundamentally challenges current Navy thinking on the size and composition of the fleet. This is perhaps not surprising, given both OFT's institutional role within DOD as a leading promoter of military transformation and Cebrowski's views on network-centric warfare and distributed force architectures.

Industrial-Base Implications Of Reductions and Deferrals[30]

The Navy's FY2006-FY2011 ship-procurement plan, shown in **Table 3** below, reduces or defers funding for a number of Navy ship-procurement programs. This section discusses the industrial-base implications of these reductions and funding deferrals in terms of the overall ship-procurement rate and individual ship-procurement programs.

[30] Material in this section is adapted from CRS Report RL32665, op. cit.

Table 3. Navy FY2006-FY2011 Ship-Procurement Plan

(Ships fully funded in FY2005 shown for reference)

	FY05	FY06	FY07	FY08	FY09	FY10	FY11	Total FY06-FY11
CVN-21				1				1
SSN-774	1	1	1	1	1	1	1	6
DDG-51	3							0
DD(X)			1	1	1	1	1	5
CG(X)							1	1
LCS	1	1	2	3	5	5	5	21
LPD-17	1	1	1					2
LHA®			1			1		2
TAKE	2	1	1	1				3
TAOE(X)					1	1	2	4
MPF(F)					1	1	2	4
MPF(A)								0
TOTAL	8	4	7	7	9	10	12	49
TOTAL less LCSs	7	3	5	4	4	5	7	28

Source: Department of the Navy, *Highlights of the Department of the Navy FY 2006 Budget*, Chart 14 (p. 5-1).

Overall Ship-Procurement Rate. The FY2006-FY2011 plan would procure a total of 49 ships, or an average of about 8.2 ships per year. Assuming an average Navy ship life of 30 to 35 years, an average procurement rate of about 8.2 ships per year would, over the long run, maintain a fleet of 245 to 286 ships.

As shown in the table, LCSs account for 21 of these 49 ships, or about 43%. LCSs are to be built by yards other than the six yards that have built the Navy's major warships in recent years.[31] Setting aside LCSs so as to focus on larger ships that would likely be built by these six yards, the total number of larger ships is 28, or an average of about 4.7 ships per year. Assuming an average Navy ship life of 30 to

[31] These six yards include Bath Iron Works (BIW) of Bath, ME, the Electric Boat Division of Groton, CT, and Quonset Point, RI, and National Steel and Shipbuilding Company (NASSCO) of San Diego, CA, all of which are owned by General Dynamics Corporation; and Avondale Shipyards near New Orleans, LA, Ingalls Shipbuilding of Pascagoula, MS, and Newport News Shipbuilding of Newport News, VA, all of which are owned by Northrop Grumman Corporation.

35 years, an average procurement rate of about 4.7 ships per year other than LCSs, if maintained over the long run, would maintain a fleet that included 140 to 163 ships other than LCSs.

An average procurement rate of 4.7 ships per year other than LCSs would be about equal to the relatively low rates of Navy ship procurement of the mid- to late 1990s.[32] For the six shipyards that have built the Navy's major warships in recent years, this average ship-procurement rate would result, as a general matter, in relatively low work loads, revenues, and employment levels. Production economies of scale would be limited or poor, putting upward pressure on unit production costs. Layoffs may occur at some of the yards, and the two companies that own these yards may be less inclined to commit to new investments aimed at improving the yards' production facilities.

Individual Shipbuilding Programs.

CVN-21 Aircraft Carrier Program. CVN-21, the next aircraft carrier, is to be built by Northrop Grumman Newport News (NGNN). Compared to the FY2005-FY2009 ship-procurement plan submitted to Congress in February 2004, the FY2006-FY2011 plan would defer the procurement of CVN-21 by a year, to FY2008. This may have been due in part to the need to finance the procurement in FY2007 of other ships, including the lead DD(X) destroyer and the LHA® amphibious assault ship. The FY2006-FY2011 plan would also defer the procurement of the carrier after CVN-21 from FY2011 to a subsequent fiscal year.[33]

The deferral of CVN-21 to FY2008 may increase CVN-21's real (i.e., inflation-adjusted) procurement cost by lengthening the already-considerable production gap at NGNN between CVN-21 and the previous carrier, CVN-77, which was procured in FY2001. Lengthening this gap could reduce the shipyard's ability to efficiently shift workers coming off the CVN-77 production effort onto the CVN-21 effort. As a result, workers coming off the CVN-77 production effort could instead be furloughed, and any new workers hired later to support the start of CVN-21

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[32] The table below shows the number of battle force ships funded by Congress from FY1982 through FY2005.

Battle force ships procured (FY1982-FY2005)

82	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**
17	14	16	19	20	17	15	19	15	11	11	7
94	**95**	**96**	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**
4	4	5	4	5	5	6	6	6	5	7	8

Source: CRS compilation based on examination of defense authorization and appropriation committee and conference reports for each fiscal year. The table excludes non-battle force ships that do not count toward the 310- or 375- ship goal, such as sealift and prepositioning ships operated by the Military Sealift Command and oceanographic ships operated by agencies such as the National Oceanic and Atmospheric Administration (NOAA).

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

construction could require training and be less productive initially than experienced workers.

Under the FY2005 budget and FY2005-FY2009 FYDP submitted to Congress in February 2004, CVN-21's acquisition (i.e., research and development [R&D] plus procurement) cost was estimated at $11.7 billion — $3.1 billion for R&D and $8.6 billion for procurement. Under the new FY2006 budget and FY2006-FY2011 FYDP, the estimate has increased to $13.7 billion — $3.2 billion for R&D and $10.5 billion for procurement. Some portion of the $1.9-billion increase in the ship's estimated procurement cost may be due to the decision to defer CVN-21 to FY2008.

Inefficiencies resulting from lengthening the production gap between CVN-77 and CVN-21 may also increase costs for attack submarine construction work done at NGNN because that work might, for a time, need to bear a somewhat higher share of the shipyard's fixed overhead costs.

SSN-774 Attack Submarine Program. Virginia (SSN-774) class submarines are built jointly by General Dynamics' Electric Boat division (GD/EB) and NGNN. The FY2006-FY2011 plan would maintain the Virginia-class procurement rate at one per year through FY2011. The FY2005-FY2009 plan had called for increasing Virginia-class procurement to two per year starting in FY2009.[34] Keeping Virginia-class procurement at one per year through FY2011 would result in Virginia-class work loads, revenues, and employment levels at GD/EB and NGNN that are about equal to current levels. As a result, production economies of scale for submarines would continue to remain limited or poor.

DDG-51 Destroyer Program. Arleigh Burke (DDG-51) class Aegis destroyers are built by General Dynamics' Bath Iron Works (GD/BIW) and Northrop Grumman's Ship Systems division (NGSS), specifically, Northrop's Ingalls shipyard. The FY2006-FY2011 plan leaves unchanged the previous procurement profile for the DDG-51 program. This profile calls for the three DDG-51s procured in FY2005 to be the last ships in the program. Construction of these three ships is scheduled to finish by the end of 2010.

DD(X) Destroyer Program. DD(X) destroyers are to be built by GD/BIW and/or NG/Ingalls. The FY2005-FY2009 plan had called for procuring a total of eight DD(X)s through FY2009 — one in FY2005, two in FY2007, another two in FY2008, and three in FY2009. The FY2006-FY2011 plan would reduce procurement to one ship per year for the period FY2007-FY2011.

A comparison of the FY2006-FY2011 plan to the FY2005-FY2009 plan suggests at first that the FY2006-FY2011 plan has deferred the procurement of the lead DD(X) destroyer by two years, to FY2007. The actual effect of the FY2006-FY2011 plan on the schedule for building this ship, however, appears to be less dramatic. The Navy's FY2005-FY2009 plan proposed funding the construction of

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[34] For more on the SSN-774 program, see CRS Report RL32418, *Navy Attack Submarine Force-Level Goal and Procurement Rate: Background and Issues for Congress*, by Ronald O'Rourke.

the lead DD(X) in the Navy's research and development account through a stream of annual funding increments stretching out to FY2011 — an approach commonly known as incremental funding. Under this proposed scheme, the Navy had some flexibility to choose which year to record as the nominal year of procurement for the lead DD(X). The Navy chose FY2005, the year of the first scheduled increment, even though the amount of funding requested for the FY2005 increment equated to only about 8% of the ship's total cost, leaving the remaining 92% of the ship's cost to be provided in future years.

Congress, in acting on the Navy's proposed FY2005 budget, approved the Navy's FY2005 funding request for the lead DD(X) but directed that the ship be procured the traditional way, through the Navy's shipbuilding account (known formally as the Shipbuilding and Conversion, Navy, or SCN, account), and that it be funded the traditional way, in accordance with the full funding policy, which requires that items acquired through the procurement title of the DOD appropriation act be fully funded in the year they are procured.[35] Consistent with this direction, the FY2005 funding increment was designated as advance procurement (AP) funding for a lead DD(X) to be procured in some future fiscal year.

Abiding by this direction required the Navy to alter its funding profile for the lead DD(X) to one that fully funds the ship in a particular year. The FY2006-FY2011 plan suggests that the Navy, after examining its options, selected FY2007 as the year in which the ship would be fully funded. The actual schedule for building the lead ship, however, may delayed by about a year rather than two years. Consequently, although the nominal year of procurement for the lead DD(X) appears to have been deferred two years, the actual amount of change in the schedule for the lead ship may be less.

The FY2006-FY2011 Navy plan, however, defers the procurement of the second DD(X) by a year, to FY2008, and as mentioned earlier, reduces DD(X) procurement to one per year for the five-year period FY2007-FY2011.

The Navy has recently testified that it requires a total of eight to 12 DD(X)s. Under previous plans, however, the Navy envisioned stopping DD(X) procurement at about the time that it started CG(X) procurement. If the lead CG(X) is procured in FY2011, as shown in the FY2006-FY2011 plan, and there is a gap year in FY2012 between the procurement of the lead CG(X) and follow-on CG(X)s starting in FY2013, then a final DD(X) might be procured in FY2012. If so, then the total procurement quantity for the DD(X) program would be six ships.[36]

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[35] For more on the full funding policy, see CRS Report RL31404, *Defense Procurement: Full Funding Policy — Background, Issues, and Options for Congress*, by Ronald O'Rourke and Stephen Daggett.

[36] For more on the DD(X) program, see CRS Report RS21059, *Navy DD(X) Destroyer Program: Background and Issues for Congress*, by Ronald O'Rourke; and CRS Report RL32109, *Navy DD(X) and LCS Ship Acquisition Programs: Oversight Issues and Options for Congress*, by Ronald O'Rourke.

Supporters of the surface combatant industrial base expressed concern last year about the gap between the end of DDG-51 procurement and the start of DD(X) procurement. This gap, supporters argued, would make it difficult for the industrial base to manage the transition from DDG-51 production to DD(X) production. The FY2006-FY2011 plan appears to increase the length of this gap, which would likely intensify these concerns.

The light-ship displacement of the DD(X) design (about 12,135 tons) is about 75% greater than that of the DDG-51 design (about 6,950 tons). If shipyard construction work is roughly proportionate to light-ship displacement, then building a DD(X) might generate about 75% more shipyard work than building a DD(X), and building one DD(X) per year would be equivalent to building 1.75 DDG-51s per year.

Supporters of GD/BIW and NG/Ingalls have argued in previous years that three DDG-51s per year, in conjunction with other work being performed at the two yards (particularly Ingalls), is the minimum rate needed to maintain the financial health of the two yards. Navy officials in recent years have questioned whether this figure is still valid. Building the equivalent of 1.75 DDG-51s per year equates to about 58% of this rate. If the minimum rate of three DDG-51 equivalents per year is valid, then the one-per-year procurement rate for the DD(X) program may raise questions about the potential future financial health of these yards.

Until recently, the DD(X) acquisition strategy called for the first DD(X) to be built by NG/Ingalls and the second by GD/BIW, and for the construction contracts for the first six DD(X)s to be divided evenly between the two yards. As a result of the reduction in the planned DD(X) procurement rate, however, the Navy is considering holding a competition between the two yards for the right to become the sole builder of the DD(X).

If the Navy holds such a competition, then the consequences for the yard that loses the competition could be very serious. GD/BIW is involved as a shipbuilder in no shipbuilding programs other than the DDG-51 and DD(X).[37] Consequently, if GD/BIW loses the DD(X) competition and does not receive other new ship-construction work, then GD/BIW could experience a significant reduction in workloads, revenues, and employment levels by the end of the decade. Theoretical scenarios for the yard under such circumstances could include closure and liquidation of the yard, the "mothballing" of the yard or some portion of it, or reorienting the yard into one that focuses on other kinds of work, such as building commercial ships, overhauling and modernizing Navy or commercial ships, or fabricating components of Navy or commercial ships that are being built by other yards. Reorienting the yard into one that focuses on other kinds of work, if feasible, would likely result in workloads, revenues, and employment levels that are significantly reduced from today's.

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[37] GD/BIW is also the prime contractor for the GD version of the LCS, but the GD version is to be built by the Austal USA shipyard, of Mobile, AL.

If NGSS loses the DD(X) competition and other work being done at NG/Ingalls (particularly construction of amphibious ships) does not increase, then NG/Ingalls could similarly experience a reduction in workloads, revenues, and employment levels. The continuation of amphibious-ship construction at NG/Ingalls could make the scenarios of closure and liquidation or mothballing less likely for NG/Ingalls than for GD/BIW, but workloads, revenues, and employment levels could still be reduced from current levels, and the cost of amphibious-ship construction and other work done at NG/Ingalls could increase due to reduced spreading of shipyard fixed overhead costs.

If surface-combatant construction work at GD/BIW or NG/Ingalls ceases, the Navy would be left with one yard actively building larger, complex surface combatants. If the Navy at some point wanted to reestablish a second source for building these ships, its options would include reconstituting surface combatant construction at the yard where the work had ceased, reconstituting it at some other yard with past experience building larger surface combatants — such as NGNN, which built nuclear-powered cruisers in the 1970s, NG/Avondale, which built Knox (FF-1052) class frigates in the 1970s and Hamilton (WHEC-715) class Coast Guard cutters in the 1960s and 1970s, or perhaps Todd Pacific Shipyards of Seattle, WA, which built Oliver Hazard Perry (FFG-7) class frigates in the 1980s[38] — or establishing it at a yard that has not previously built larger, complex surface combatants, but could be made capable of doing so.

CG(X) Cruiser Program. The FY2006-FY2011 plan would accelerate the procurement of the first CG(X) cruiser to FY2011. The long-range shipbuilding plan that the Navy submitted to Congress in 2003 showed the first CG(X) cruiser being procured in FY2018.[39] A December 2004 DOD document called *Program Budget Decision 753 (PBD 753*), stated that a DD(X) procurement rate of one per year would "maintain the bridge to the CG(X)."[40]

Littoral Combat Ship (LCS) Program. The FY2006-FY2011 plan would defer procurement of the third LCS by a year, to FY2007. This is consistent with Congress' direction, in acting on the Navy's FY2005 budget request, to fully fund a lead LCS in FY2005 but require a gap year between the procurement of a lead LCS and any follow-on LCSs built to that same design. The Navy plans to procure two lead LCSs to different designs developed by two competing industry teams. Under the FY2006-FY2011 plan, the single ship now planned for FY2006 would presumably be the second lead LCS, and the two LCSs now planned for FY2007 would presumably be follow-on ships built to the same design as the lead LCS procured in FY2005. The FY2006-FY2011 plan would also reduce the number of

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[38] The Navy's FFG-7s were built at GD/BIW, Todd Pacific Shipyards, and Todd Shipyards of San Pedro, CA. The San Pedro yard is now part of Southwest Marine, Inc., which in turn is part of United States Marine Repair, a group of shipyards that focuses on repairing, modernizing, converting, and overhauling non-nuclear-powered ships.

[39] For more on the CG(X) program, see CRS Report RL32109, *Navy DD(X) and LCS Ship Acquisition Programs: Oversight Issues and Options for Congress*, by Ronald O'Rourke.

[40] U.S. Department of Defense, *Program Budget Decision [PBD] 753*, Washington, 2004. p. 6.

LCSs procured in FY2009 from six ships to five. This can be viewed as consistent with the Navy's longer-range projection for the LCS program, which has envisioned a sustaining procurement rate of five ships per year through the end of the program, as shown by the figures for FY2010 and FY2011.[41]

LPD-17 Amphibious Ship Program. San Antonio (LPD-17) class amphibious ships are built by NGSS, particularly NG/Avondale. The FY2006-FY2011 plan would end procurement of LPD-17s after procuring the ninth ship in the class in FY2007. Previous plans had generally called for building a total of 12 LPD-17s through FY2010.[42] Under the FY2006-FY2011 plan, workloads, revenues, and employment levels associated with building LPD-17s would wind down about three years earlier than under previous plans. NG/Avondale might be able to compensate for this by beginning to build TAOE(X) resupply ships or MPF(F) ships, but procurement of these ships is not scheduled to start until FY2009, suggesting that NG/Avondale might experience a dip in workloads, revenues, and employment levels between the winding down of LPD-17 production and the scaling up of TAOE(X) or MPF(F) production. It is not certain, moreover, whether NG/Avondale will participate in building either of these ships.

LHA® Amphibious Ship Program. The LHA® amphibious assault ship would be built by NGNN, primarily NG/Ingalls. Compared to the FY2005-FY2009 plan, the FY2006-FY2011 plan would accelerate the procurement of LHA® by one year, to FY2007. The FY2004-FY2009 shipbuilding plan that the Navy submitted to Congress in February 2003 showed LHA® in FY2007. Accelerating procurement of LHA® to FY2007 can thus be viewed as restoring the year of procurement shown in the plan submitted to Congress in 2003.[43] The acceleration of LHA® to FY2007 would improve NG/Ingalls' ability to shift workers from the previous amphibious assault ship, LHD-8, to LHA®, and perhaps help NG/Ingalls somewhat in managing the potential consequences of the Navy's decisions regarding the DD(X) program.

TAKE Auxiliary Cargo Ship Program. Lewis and Clark (TAKE-1) class auxiliary cargo ships are built by GD/National Steel and Shipbuilding Company (GD/NASSCO). Under the FY2005-FY2009 plan, the final three ships in the program were to be procured in FY2006 (two ships) and FY2007 (one ship). The FY2006-FY2011 plan would instead procure these ships at a rate of one per year during the three-year period FY2006-FY2008. As a consequence, employment at the yard associated with building these ships may start to decline around FY2006 rather

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[41] For more on the LCS program, see CRS Report RS21305, *Navy Littoral Combat Ship (LCS): Background and Issues for Congress*, by Ronald O'Rourke; and CRS Report RL32109, *Navy DD(X) and LCS Ship Acquisition Programs: Oversight Issues and Options for Congress*, by Ronald O'Rourke.

[42] For more on the LPD-17 program, see CRS Report RL32513, *Navy-Marine Corps Amphibious and Maritime Prepositioning Ship Programs: Background and Oversight Issues for Congress*, by Ronald O'Rourke.

[43] For more on the LHA(R) program, see CRS Report RL32513, *Navy-Marine Corps Amphibious and Maritime Prepositioning Ship Programs: Background and Oversight Issues for Congress*, by Ronald O'Rourke.

than FY2007, but construction work on these ships would continue for an additional year into the future before ceasing.

TAOE(X) Replenishment Ship Program. The FY2005-FY2009 plan called for procuring the first two TAOE(X) ships in FY2009. The FY2006-FY2011 plan reduces the FY2009 procurement to one ship. This would appear to reduce the potential of the TAOE(X) program to serve as a new source of work in FY2009 for yards that may be attempting to compensate for the winding down of other shipbuilding programs.

MPF(F)/MPF(A) Maritime Prepositioning Ship Program. The FY2005-FY2009 plan included three MPF-type ships in FY2009 — two MPF(F)s and one MPF(A) (an aviation variant of the MPF(F) design). The FY2006-FY2011 plan would reduce MPF-type procurement to one ship in FY2009.[44] This would similarly appear to reduce the potential of the MPF program to serve as a new source of work in FY2009 for yards that may be attempting to compensate for the winding down of other shipbuilding programs.

Alternative Funding Approaches for Navy Ship Procurement[45]

Introduction. Some observers, including the Chief of Naval Operations and shipbuilding industry officials, have recently proposed procuring Navy ships using funding approaches other than the traditional full funding approach that has been used to procure most Navy ships since the 1950s.[46] These alternative funding approaches include incremental funding, which has been used to fund a few Navy ships in recent years, and advance appropriations, which has not been used for Navy ship procurement. Supporters of these alternative funding approaches believe they could increase stability in Navy shipbuilding plans and perhaps increase the number

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[44] For more on the MPF(F) program, see CRS Report RL32513, op. cit.

[45] Material in this section is adapted from CRS Report RL32776, *Navy Ship Procurement: Alternative Funding Approaches — Background and Options for Congress*, by Ronald O'Rourke. See also CRS Report RL31404, *Defense Procurement: Full Funding Policy — Background, Issues, and Options for Congress*, by Ronald O'Rourke and Stephen Daggett.

[46] For the Chief of Naval Operations, see Statement of Admiral Vernon Clark, USN, Chief of Naval Operations, Before The House Armed Services Committee, Feb. 17, 2005, p. 20, and Statement of Admiral Vernon Clark, USN, Chief of Naval Operations, Before The Senate Armed Services Committee, Feb. 10, 2005, p. 20. See also Andrew Scutro, "Clark Seeks Hearings On Shipbuilding Process," *NavyTimes.com*, Feb. 18, 2005; Dave Ahearn, "Clark Urges Ships Funding Reforms, But Defends Shipbuilding Cuts," *Defense Today*, Febr. 18, 2005; and Geoff Fein, "Federal Acquisition Regulations Should Be Examined, CNO Says," *Defense Daily*, Feb. 18, 2005.

For industry officials, see Dave Ahearn, "Northrop Chief Says Payment Due For Aircraft Carrier Delay," *Defense Today*, Feb. 16, 2005; Nathan Hodge, "Despite Setbacks, Northrop Grumman Chief Confident On Missile Defense, Budget," Feb. 16, 2005; William Matthews, "Northrop Pitches Novel Ship Financing, Again," *Defense News*, Dec. 6, 2004, p. 24; Christopher P. Cavas, "Northrop Chief Urges Spreading Ship Payments," *Defense News*, Nov. 22, 2004; Christopher J. Castelli, "Shipbuilder Northrop Pitches Financing Strategy For Ships To Navy," *Inside the Navy*, Nov. 1, 2004, p. 1.

of Navy ships that could be built for a given total amount of ship-procurement funding.

Congress may maintain current practices for funding Navy ship procurement or change them by, for example, increasing the use of incremental funding or starting to use advance appropriations. Congress' decision on this issue could be significant because the full funding policy relates to Congress' power of the purse and its responsibility for conducting oversight of Department of Defense (DOD) programs. Consequently, the issue can be alternately expressed as how to procure Navy ships economically while maintaining key congressional prerogatives. Congress' decision on ship funding approaches could also affect future Navy capabilities, annual Navy funding requirements, and the shipbuilding industrial base.

Full Funding Policy.

General Description. Most (but not all) Navy ships procured since the late 1950s have been funded in accordance with the full funding policy. Before then, many Navy ships were procured with incremental funding, which is discussed below.

For DOD procurement programs, the full funding policy requires the entire procurement cost of a usable end item (such as a Navy ship) to be funded in the year in which the item is procured. The policy applies not just to Navy ships, but to all weapons and equipment that DOD procures through the procurement title of the annual DOD appropriations act.

In general, the full funding policy means that DOD cannot contract for the construction of a new weapon or piece of equipment until funding for the entire cost of that item has been approved by Congress. Sufficient funding must be available for a complete, usable end item before a contract can be let for the construction of that item. Under traditional full funding, no portion of a usable end item's procurement cost is funded in a year after the year in which the item is procured.

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 control DOD spending and carry out its oversight of DOD activities. Understanding total costs and how previously appropriated funds are used are key components of Congress' oversight capability.

The full funding policy is consistent with two basic laws regarding government expenditures — the Antideficiency Act of 1870, as amended, and the Adequacy of Appropriations Act of 1861. Regulations governing the full funding policy are found in Office of Management and Budget (OMB) Circular A-11 and DOD Directive 7000.14-R, which provide guidelines on budget formulation. OMB Circular A-11 states, among other things, that

> Good budgeting requires that appropriations for the full costs of asset acquisition be enacted in advance to help ensure that all costs and benefits are fully taken into account at the time decisions are made to provide resources. Full funding

> with regular appropriations in the budget year also leads to tradeoffs within the budget year with spending for other capital assets and with spending for purposes other than capital assets. Full funding increases the opportunity to use performance-based fixed price contracts, allows for more efficient work planning and management of the capital project (or investment), and increases the accountability for the achievement of the baseline goals.
>
> When full funding is not followed and capital projects (or investments) or useful segments are funded in increments, without certainty if or when future funding will be available, the result is sometimes poor planning, acquisition of assets not fully justified, higher acquisition costs, cancellation of major investments, the loss of sunk costs, or inadequate funding to maintain and operate the assets.[47]

Support for the full funding policy has been periodically reaffirmed over the years by Congress, the Government Accountability Office (GAO), and DOD.[48]

Advance Procurement (AP) Payments Under Full Funding. The executive branch regulations that implement the full funding policy for DOD procurement programs permit two circumstances under which advance procurement (AP) "down payments" on a usable end item can be provided in one or more years prior to the item's year of procurement:[49]

- AP funding may be used to pay for "long-lead items" — components of a usable end item that have long manufacturing lead times — if needed to ensure that these items will be ready for installation into the end item at the appropriate point in the end item's construction process.

- AP funding may also be used to pay for "economic order quantity" (EOQ) procurement of a set of long-lead items for a set of weapons being acquired under a multiyear procurement (MYP) arrangement.

Each of these is discussed below.

AP Payments For Long-Lead Items. Long-lead items are often manufactured not at the end item's final assembly facility (such as a shipyard) but at separate supplier firms. In Navy shipbuilding, AP payments have most commonly been used to pay for nuclear-propulsion components of nuclear-powered aircraft carriers and submarines.

Congress in recent years has occasionally approved AP funding for conventionally powered Navy ships, such as destroyers and amphibious ships, for which the Navy did not request any AP funding for long-lead items. Congress in

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[47] OMB Circular A-11 (July 2003), Appendix J, Section C, Principle 1 (of four principles for financing capital assets).

[48] For a detailed discussion of the origins, rationale, and governing regulations of the full funding policy, as well as examples of where Congress, GAO, and DOD have affirmed their support for the policy, see Appendix A of CRS Report RL31404, op. cit.

[49] Note that the funding discussed here is advance *procurement* funding, which is not to be confused with the alternate funding approach called advance *appropriations*, discussed later.

recent years has also occasionally approved AP funding for "advance construction" work on certain ships, which apparently refers to early shipyard activities for building the basic structure of a ship, as opposed to manufacturing long-lead components to be installed into the ship. The use of AP funding for shipyard advance construction activities is not recognized in executive branch budget regulations on the full funding policy, at least not in the same way as these regulations recognize the use of AP funding for long-lead components.

Congressional decisions to approve AP funding for ships for which the Navy did not request such funding, or for shipyard advance construction activities, could be aimed at one or more of the following goals:

- generating shipyard construction work (and thus shipyard revenues and jobs) on a particular ship in a year prior to that ship's year of procurement;
- creating an early financial commitment to procuring a ship that is planned for procurement in a future year, which can enhance job security for construction workers at the yard that would build the ship;
- reducing the total construction cost of a ship through improved sequencing or year-to-year balancing of shipyard construction work; and
- reducing the portion of a ship's cost to be funded in the year of procurement.

AP Payments For EOQ Under Multiyear Procurement. Most DOD procurement programs use annual contracting, under which DOD lets one or more contracts for each year's worth of procurement of a given item. Multiyear procurement is a special contracting authority, approved by Congress on a program-by-program basis, that permits DOD to use a single contract to procure a set of end items that are scheduled to be procured across a series of up to five fiscal years (i.e., the budget year in question, plus up to four future years). An MYP arrangement approved for the Navy's F/A-18E/F strike-fighter program, for example, permitted the Navy to procure, under a single contract, a total of 198 to 224 F/A-18E/Fs during the five-year period FY2000-FY2004. Congress over the years has granted MYP authority for a relatively small number of procurement programs.

The law governing MYP arrangements is set forth in 10 USC 2306b. This provision permits AP funding to be used to finance, at the outset of an MYP arrangement, the procurement of long-lead components for all of the end items to be procured under the MYP arrangement. The MYP arrangement to procure a total of five Virginia (SSN-774) class nuclear-powered attack submarines over the five-year period FY2004-FY2008, for example permits the Navy to procure, in the first years of the arrangement, five sets of long-lead nuclear-propulsion components. This up-front procurement of long-lead items is called an "economic order quantity" (EOQ)

because it procures (i.e., places an order for) these items in the form of a group that can be manufactured in an efficient (i.e., economic) manner.[50]

"One Decision For One Pot Of Money". When Congress approves AP funding for an item, it does so through a funding decision for that year that is separate from the decision that Congress subsequently makes, in the item's year of procurement, to fund the remainder of the item's procurement cost. Items procured with AP funding thus involve two or more funding decisions from Congress — one or more decisions to approve AP funding in one or more years prior to the year of procurement, plus a final decision, in the item's year of procurement, to fund the remainder of the item's procurement cost. A decision by Congress to approve AP funding for an item does not create an obligation on the part of Congress to approve the remainder of the item's procurement cost in some future year, but it usually indicates that Congress anticipates doing so.

Although some DOD weapons and equipment are procured with AP funding, most DOD procurement items are funded through a single decision by Congress to provide the entire cost of the item in the item's year of procurement. For this reason, the full funding policy for DOD procurement programs can be described in simplified terms as "one decision for one pot of money."

Incremental Funding.

General Description. In spite of the existence of the full funding policy, a few Navy and DOD ships have been procured in recent years (or are currently being procured) with incremental funding. Examples include DOD sealift ships, the attack submarine SSN-23, the amphibious assault ships LHD-6 and LHD-8, and the aircraft carrier CVN-21. The DOD sealift ships were procured through the National Defense Sealift Fund (NDSF), a DOD revolving and management fund that is outside the procurement title of the DOD appropriations act and therefore not subject to the full funding policy in the same way as DOD procurement programs funded through the procurement title. LHD-8 is currently being incrementally funded by explicit legislative direction. SSN-23, LHD-6 and CVN-21 amount to cases of *de facto* incremental funding. These ships constitute recent exceptions to the use of full funding in the procurement of Navy ships. Prior to the imposition of the full funding policy in the 1950s, however, much of DOD weapon procurement was accomplished through incremental funding.

Under incremental funding, a weapon's cost is divided into two or more annual portions, or increments, that can reflect the need to make annual progress payments to the contractor as the weapon is built. Congress then approves each year's increment as part of its action on that year's budget. Under incremental funding,

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[50] 10 USC 2306b(i)(4)(B) states: "The Secretary of Defense may obligate funds appropriated for any fiscal year for advance procurement under a contract for the purchase of property only for the procurement of those long-lead items necessary in order to meet a planned delivery schedule for complete major end items that are programmed under the contract to be acquired with funds appropriated for a subsequent fiscal year (including an economic order quantity of such long-lead items when authorized by law)."

DOD can contract for the construction of a weapon after Congress approves only the initial increment of its cost, and completion of the weapon is dependent on the approval of the remaining increments in future years by that Congress or future Congresses. A key feature of incremental funding is that a portion of the ship's cost is provided in one or more years beyond the item's year of procurement.

One form of incremental funding, called split funding, involves dividing a weapon's procurement cost into two portions, one of which is funded in the item's year of procurement, the other the following year. Split funding, in other words, is a two-year form of incremental funding.

Advantages and Disadvantages.

Potential Advantages. Supporters of incremental funding could argue that, compared to full funding, using incremental funding in DOD procurement can be advantageous because it can do one or more of the following:

- permit very expensive items, such as large Navy ships, to be procured in a given year while avoiding or mitigating budget "spikes" (also called lumps) that could require displacing other programs from that year's budget, which can increase the costs of the displaced programs due to uneconomic program-disruption start-up and stop costs;

- avoid a potential bias against the procurement of very expensive items that might result from use of full funding due to the item's large up-front procurement cost (which appears in the budget) overshadowing the item's long-term benefits (which do not appear in the budget) or its lower life cycle operation and support (O&S) costs compared to alternatives with lower up-front procurement costs;

- permit construction to start on a larger number of items in a given year within that year's amount of funding, so as to achieve better production economies of that item than would have been possible under full funding;

- recognize that certain DOD procurement programs, particularly those incorporating significant amounts of advanced technology, bear some resemblance to research and development activities (which can be funded in increments), even though they are intended to produce usable end items;

- reduce the amount of unobligated balances associated with DOD procurement programs;[51]

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[51] For an explanation and discussion of unobligated balances, see CRS Report RL30002, *A Defense Budget Primer*, by Mary T. Tyszkiewicz and Stephen Daggett.

- implicitly recognize potential limits on DOD's ability to accurately predict the total procurement cost of items, such as ships, that take several years to build; and

- preserve flexibility for future Congresses to stop "throwing good money after bad" by halting funding for the procurement of an item under construction that has become unnecessary or inappropriate due to unanticipated shifts in U.S. strategy or the international security environment.

Potential Disadvantages. In spite of its potential advantages, Congress replaced incremental funding with the full funding policy in the 1950s, and has periodically reaffirmed the full funding policy since then, on the grounds that incremental funding did (or could do) one or more of the following:

- make the total procurement costs of weapons and equipment less visible to Congress and more difficult for Congress to understand and track;

- permit one Congress to "tie the hands" of one or more future Congresses — a kind of action that Congress traditionally tries to avoid — by providing initial procurement funding for a weapon whose cost would have to be largely funded by one or more future Congresses;

- create a potential for DOD to start procurement of an item without necessarily understanding its total cost, stating that total cost to Congress, or providing fully for that total cost in future DOD budgets — the so-called "camel's-nose-under-the-tent" issue; and

- increase weapon procurement costs by exposing weapons under construction to potential uneconomic start-up and stop costs that can occur when budget reductions or other unexpected developments cause one or more of the planned increments to be reduced or deferred.

Navy Proposal For Funding Lead Ships. As part of its proposed FY2005 budget and FY2005-FY2009 Future Years Defense Plan (FYDP), the Navy in 2004 proposed funding the procurement of the lead DD(X) destroyer and the lead Littoral Combat Ship (LCS) program in the Navy's research and development (R&D) account rather than the Navy's ship-procurement account, which is known formally as the Shipbuilding and Conversion, Navy (SCN) account. Funding the procurement of lead ships through the R&D account would permit them to be incrementally funded without violating the full funding policy.

Congress, in acting on the Navy's proposed FY2005 defense budget, rejected the Navy's proposal to procure the lead DD(X) through the Navy's research and development account, directed the Navy to fully fund the lead DD(X) in the Navy's ship-procurement account, and fully funded the lead LCS in the Navy's research and development account.

Although Congress in 2004 rejected the Navy's proposal to incrementally fund the lead DD(X) and lead LCS, Navy officials testifying in early 2005 in support of the Navy's proposed FY2006 defense budget and FY2006-FY2011 FYDP have again expressed support for the concept of funding the procurement of lead ships in the R&D account, which would permit them to be funded incrementally.

"Multiple Decisions For Multiple Pots Of Money". Since incremental funding divides the procurement cost of an end item into two or more annual increments, and since Congress typically approves one of these increments each year, incremental funding can be described in simplified terms as "multiple decisions for multiple pots of money."

Advance Appropriations.

General Description. Advance appropriations have not been used in Navy ship procurement, but have been used by other executive branch agencies to fund various programs.[52]

Advance appropriations is an alternate form of full funding that is permitted under executive branch budget regulations. As a funding approach, it can be viewed as lying somewhere between traditional full funding and incremental funding.[53] Under advance appropriations, as under traditional full funding, Congress makes a one-time decision to fund the entire procurement cost of an end item. That cost, however, can then be divided into two or more annual increments, as under incremental funding, that are assigned to (in budget terminology, "scored in") two or more fiscal years.[54]

In contrast to incremental funding, under which Congress must take a positive action each year to approve each year's funding increment, under advance appropriations, Congress, following its initial decision to fund the item, would need to take a positive action to cancel or modify an annual funding increment in a future-

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[52] Use of advance appropriations in the federal budget is summarized in the appendix volume of each year's U.S. government budget. For the FY2006 version, see U.S. Executive Office of the President. Office of Management and Budget. *Appendix [to the] Fiscal Year 2006 Budget of the U.S. Government*. (Washington: GPO, 2005), pp. 1241-1242.

[53] As discussed in an earlier footnote, advance appropriations is not to be confused with advance *procurement* (AP) funding that can occur under traditional full funding.

[54] Advance appropriations can also be used to fund the entire cost of an item and have that entire cost assigned to a single future fiscal year.

OMB Circular A-11 defines advance appropriations as appropriations that are:

- — Enacted normally in the current year;
- — Scored after the budget year (e.g., in each of one, two, or more later years, depending on the language); and
- — Available for obligation in the year scored and subsequent years if specified in the language.

(OMB Circular A-11 (July 2003 version), Appendix J (Principles Of Budgeting For Capital Asset Acquisitions), Section E (Glossary).)

year budget. In this sense, advance appropriations can be thought of as a legislatively locked in form of incremental funding: the future-year funding increments will occur unless Congress takes action to stop them.

OMB Circular A-11 allows for the use of advance appropriations to help finance capital assets under certain circumstances:

> Regular appropriations for the full funding of a capital project or a useful segment (or investment) of a capital project in the budget year are preferred. If this results in spikes that, in the judgment of OMB, cannot be accommodated by the agency or the Congress, a combination of regular and advance appropriations that together provide full funding for a capital project or a useful segment or an investment should be proposed in the budget.
>
> *Explanation*: Principle 1 (Full Funding) is met as long as a combination of regular and advance appropriations provide budget authority sufficient to complete the capital project or useful segment or investment. Full funding in the budget year with regular appropriations alone is preferred because it leads to tradeoffs within the budget year with spending for other capital assets and with spending for purposes other than capital assets. In contrast, full funding for a capital project (investment) over several years with regular appropriations for the first year and advance appropriations for subsequent years may bias tradeoffs in the budget year in favor of the proposed asset because with advance appropriations the full cost of the asset is not included in the budget year. Advance appropriations, because they are scored in the year they become available for obligation, may constrain the budget authority and outlays available for regular appropriations of that year.
>
> If, however, the lumpiness caused by regular appropriations cannot be accommodated within an agency or Appropriations Subcommittee, advance appropriations can ameliorate that problem while still providing that all of the budget authority is enacted in advance for the capital project (investment) or useful segment. The latter helps ensure that agencies develop appropriate plans and budgets and that all costs and benefits are identified prior to providing resources. In addition, amounts of advance appropriations can be matched to funding requirements for completing natural components of the useful segment. Advance appropriations have the same benefits as regular appropriations for improved planning, management, and accountability of the project (investment).[55]

Advantages and Disadvantages. Supporters of advance appropriations could argue that it offers many of the potential advantages of incremental funding outlined earlier — including avoiding or mitigating budget spikes — while avoiding some of its potential disadvantages, such as the risk of increasing weapon procurement costs created by uneconomic start-up and stop costs that can occur when budget reductions or other unexpected developments cause planned increments to be reduced or deferred.

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[55] OMB Circular A-11 (July 2003), Appendix J, Section C, Principle 2 (of four principles for financing capital assets). Italics as in the original.

Opponents of advance appropriations could argue that it retains (or even expands) one of the key potential disadvantages of incremental finding — that of tying the hands of future Congresses — by committing a portion of one or more future-year budgets to the financing of an item procured in a prior year and requiring a positive action from future Congresses to undo those commitments. Opponents could also argue that compared to full funding, advance appropriations under certain circumstances could increase ship-construction costs by causing work on a ship to stop and then be restarted. Specifically, they could argue, if a given increment of construction work on the ship is completed before the end of a fiscal year and that year's funding increment is entirely expended, the Navy might have to halt work on the ship and wait until the start of the next fiscal year to access the next increment of funding and resume work. Under full funding, in contrast, the Navy would have access to funding for the ship's entire construction cost and consequently would not have to halt work until the start of the next fiscal year, avoiding the additional costs of halting and then resuming work.

Navy Advocacy In 2001. In 2001, some Navy officials advocated the use of advance appropriations for Navy ship procurement, noting at that time that this funding approach is used by several federal agencies other than DOD.[56]

Although use of advance appropriations for Navy ship procurement was supported by some Navy officials and some Members of Congress,[57] the Navy in

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[56] Source: Slides for May 3, 2001 Navy briefing to CRS, *Advance Appropriations for Navy Shipbuilding*, pp. 16, 19-21. The Navy also argued that current law, contrary to some assertions, does not prohibit the use of advance appropriations. Specifically, the Navy argued that:

- 31 USC 1341, [the] "Anti-Deficiency Act," prohibits writing a contract which "involves the government in a contract or obligation for the payment of money before an appropriation is made *unless authorized by law*."
- 10 USC 2306b [the provision covering multi-year procurement contracts] allows [DOD and certain other federal agencies] to enter into multi-year contracts for the purchase of weapon systems, as long as [there is] "a reasonable expectation that throughout the contemplated contract period the head of the agency will request funding for the contract at the level required to avoid contract cancellation."
- 31 USC 1105 [a provision relating to the contents of the federal budget and its submission to Congress] requires that [the executive branch] identify in advance of need future appropriations that will have to be approved in order to complete the contract. These advance appropriations have to be specifically approved by Congress to allow [the executive branch] to obligate the government in advance of receipt of funds.

[57] Christian Bohmfalk, "O'Keefe: Advance Appropriations, If Used Correctly, Could Help Navy," *Inside the Navy*, Nov. 26, 2001; Christian Bohmfalk, "Stevens Promotes Advance Appropriations To Boost Ship Production," *Inside the Navy*, Sept. 10, 2001; Mike McCarthy, "CNO Advocates Advance Funding of Ships," *Defense Week*, July 16, 2001, p. 2; Christian Bohmfalk, "Senior Navy Leaders Describe Benefits of Advance Appropriations," *Inside the Navy*, Apr. 16, 2001; Christopher J. Castelli, "Congress Weighs (continued...)

2001 apparently did not receive approval from the Office of Management and Budget (OMB) to use the approach for ship procurement, and did not officially propose its use as part of its FY2002 budget submission to Congress.[58] Congress in 2001 did not adopt advance appropriations as a mechanism for funding Navy ships.

The House Appropriations Committee, in its report (H.Rept. 107-298 of November 19, 2001) on the FY2002 defense appropriations bill (H.R. 3338), stated that it was

> dismayed that the Navy continues to advocate the use of alternative financing mechanisms to artificially increase shipbuilding rates, such as advanced appropriations, or incremental funding of ships, which only serve to decrease cost visibility and accountability on these important programs. In attempting to establish advanced appropriations as a legitimate budgeting technique, those Navy advocates of such practices would actually decrease the flexibility of future Administrations and Congresses to make rational capital budgeting decisions with regard to shipbuilding programs. Accordingly, the Committee bill includes a new general provision (section 8150) which prohibits the Defense Department from budgeting for shipbuilding programs on the basis of advanced appropriations.[59]

The provision mentioned above (Section 8150) was not included in the final version of the bill that was passed by Congress and signed into law (H.R. 3338/P.L. 107-117 of January 10, 2002).

"One Decision For Multiple Pots of Money". Because advance appropriations involves a one-time decision by Congress to approve the entire procurement cost of the end item, which can then be divided into two or more increments that are assigned to two or more fiscal years, advance appropriations can be described in simplified terms as "one decision for multiple pots of money."

Potential For Reducing Instability In Ship-Procurement Plans.

Could using incremental funding or advance appropriations reduce instability in Navy ship-procurement plans?

Using incremental funding or advance appropriations could help reduce instability in Navy ship-procurement plans by avoiding or mitigating budget spikes that can occur when traditional full funding is used to procure ships that are very expensive and are procured once every few years. The ships that best fit this

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[57] (...continued)
Using 'Advance Appropriations' For Shipbuilding," *Inside the Navy*, Apr. 9, 2001; Dale Eisman, "Plan Would Boost Navy Shipbuilding," *Norfolk Virginian-Pilot*, Apr. 5, 2001.

[58] Dale Eisman, "White House Rejects Proposal To Stretch Shipbuilding Funds," *Norfolk Virginian-Pilot*, Sept. 6, 2001; Christian Bohmfalk, "Advance Appropriations, Not Part of FY-02 Request, May Resurface," *Inside the Navy*, July 16, 2001.

[59] H.Rept. 107-298, p. 119.

description are aircraft carriers and "big-deck" amphibious assault ships.[60] Accommodating budget spikes for such ships within an overall ship-procurement or Department of the Navy budget for a given fiscal year can require the Navy to move to other fiscal years other ships that the Navy would have preferred to procure in the spike year, or, conversely, require the Navy to move the carrier or amphibious assault ship from a preferred year of procurement to a less-preferred year that happens to have fewer other Navy ships in it. Such movements of planned ship procurements can be a source of instability in Navy ship-procurement planning.

The FY2006-FY2011 Navy ship-procurement plan submitted to Congress in February 2005 contains at least two potential examples of such ship movements:

- The Navy, as part of its proposed FY2005 budget and FY2005-FY2009 FYDP submitted to Congress in February 2004, had proposed funding the lead DD(X) destroyer through the Navy's research and development account, which would have permitted the ship to be funded through a stream of incremental payments during the seven-year period FY2005-FY2011. Congress, in acting on the FY2005 budget request, directed the Navy to instead procure the lead DD(X) through the Navy's ship-procurement account and to use full funding. In testifying on the Navy's proposed FY2006 budget and FY2006-FY2011 FYDP, Navy officials have suggested that due in part to an inability to fully fund the lead DD(X) in FY2006 while still meeting other FY2006 spending needs, the Navy decided in its FY2006-FY2011 budget submission to fund DD(X) in FY2007.

- The Navy, as part of its proposed FY2005 budget and FY2005-FY2009 FYDP, had planned to procure CVN-21 in FY2007. Doing so, however, might have required the Navy to displace one or more other ships from FY2007 to a later year. Perhaps due in part to this consideration, the Navy decided in its FY2006-FY2011 budget submission to defer the procurement of CVN-21 by a year, to FY2008, which is a year that might more easily accommodate CVN-21 in budgetary terms but from a production standpoint might be a less-preferred year for procuring CVN-21 than FY2007 because it lengthens an already-substantial gap in the aircraft carrier production line between CVN-21 and the previous carrier, CVN-77, which was procured in FY2001.

Although use of full funding can contribute to instability in Navy ship-procurement plans by causing budget spikes that lead to the movement of planned ship procurements from one year to another, a more fundamental cause of instability in Navy ship-procurement programs in recent years may be the absence of a current,

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[60] "Big-deck" amphibious assault ships, which carry the designations LHA or LHD, are large amphibious ships that are designed to embark and operate a total of about two dozen Marine Corps helicopters and VSTOL (vertical-short takeoff and landing) airplanes. They have a flight deck that runs the entire length of the ship and consequently look like medium-sized aircraft carriers.

officially approved, consensus plan for the future size and structure of the Navy. This in turn may reflect evolution and uncertainty in Navy and DOD thinking about desired Navy capabilities and the metrics for translating those desired capabilities into required types and numbers of ships.[61] If so, then the primary means for improving stability in Navy ship-procurement programs would be to encourage the Navy and DOD to better define their thinking regarding desired Navy capabilities and the metrics for translating those desired capabilities into ship requirements.

Potential For Increasing Number Of Ships Procured.

Could using incremental funding or advance appropriations increase the number of Navy ships that can be built for a given total amount of ship-procurement funding?

Using incremental funding or advance appropriations could, under some circumstances, marginally increase the number of ships that could be built for a given total amount of ship-procurement funding (or, conversely, marginally reduce the total cost to procure a given number of ships). By avoiding or mitigating budget spikes that could cause ships to be moved from one year to another in ship-procurement plans, using incremental funding or advance appropriations might avoid perturbations in ship production schedules. Such perturbations could increase construction costs, reducing at the margin the total number of ships that could be procured for a given total amount of ship-procurement funding.

In addition, if a situation arises in which annual funding for ship procurement limits ship-procurement in the near term to low rates with poor production economies of sale, but is expected to rise in future years to levels that would be more than adequate to support higher, economic rates of ship procurement, then using incremental funding or advance appropriations could permit construction to begin on additional ships in the near term, improving near-term production economies of scale, while still permitting the Navy to procure ships in future years at economic rates of production. Improving near-term production economies of scale while preserving acceptable production economies of scale in later years might result in marginally higher average economies of scale for the entire period in question and thereby reduce, at the margin, the collective cost of all the ships procured in the near term and the later years.

This scenario, however, is dependent on realizing the expected increase in ship-procurement funding in the later years. If this increase is not realized, then using incremental funding or advance appropriations could simply trade poor production economies of scale in the near term for poor production economies of scale in future years. Put another way, it would simply trade an inability to afford something now for an inability to afford something later.

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[61] For more discussion of this point, see CRS Report RL32665, *Potential Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

In discussing the potential effects of using incremental funding or advance appropriations, it is possible to construct presentations showing how a decision today to begin using incremental funding or advance appropriations could increase, perhaps dramatically, the number of ships on which construction can be started in the near term. This is simply because using incremental funding or advance appropriations would defer much of the procurement cost of the ships in question to future years. In those future years, the remainder of the cost of these ships would still have to be paid. As a result, other things held equal, the number of new ships that could be procured in those future years for a given amount of ship-procurement funding will be reduced because portions of those future-year budgets would now be needed to pay for the ships on which construction had started in prior years.

Presentations that show a dramatic near-term increase in the number of ships on which construction could begin by starting to use incremental funding or advance appropriations — if not tempered by cautions that this could also reduce the number of new ships that could be procured in future years for a given amount of shipbuilding funding — can mislead audiences into concluding that using incremental funding or advance appropriations can dramatically increase the total number of ships that can be procured over the long run for a given total amount of ship-procurement funding. Incremental funding or advance appropriations, by avoiding perturbations in ship production schedules or improving average production economies of scale over a period of several years, might marginally reduce ship-procurement costs and thereby marginally (rather than dramatically) increase the total number of ships that can be procured over the long run for a given amount of ship-procurement funding. The reduction in ship-procurement costs might be sufficient, for example, to increase from 20 to 21 the total number of ships that could be fully paid for with a certain total amount of funding.

Under certain other circumstances, using incremental funding or advance appropriations could increase rather than reduce ship-procurement costs. As discussed earlier, using incremental funding could increase the procurement cost of a ship if one of more of the ship's funding increments is reduced or deferred and the ship's production schedule is consequently disrupted. In addition, if budget circumstances require reducing the ship-procurement budget for a given year and some portion of that year's budget is already devoted to paying for ships started in prior years with incremental funding or advance appropriations, then preserving that portion of the budget so as to avoid disrupting the production schedule of those prior-year ships would mean that the budget reduction would fall more heavily on the remaining part of the ship-procurement budget. This could increase the chance that the reduction would lead to a decision to defer to a future year the procurement of a new ship planned for that year, which could increase the procurement cost of that ship.

Lastly, if Congress decides to make more use of incremental funding or to start using advance appropriations, and then decides at a later point to return to a more exclusive reliance on full funding, it could temporarily reduce the number of new ships that could be procured because the full costs of new ships being procured and portions of the costs of ships started in prior years under incremental funding or advance appropriations would need to be funded at the same time.

Options for Congress. Options for Congress that arise out of proposals to make greater use of incremental funding or begin using advance appropriations for procuring Navy ships include (but are not limited to) the following:

- maintain current ship-procurement funding practices;
- strengthen adherence to the full funding policy in ship procurement;
- increase the use of incremental funding in ship procurement;
- begin using advance appropriations in ship procurement; and
- shift lead-ship detailed design/nonrecurring engineering (DD/NRE) costs to the Navy's research and development (R&D account).

Each of these is discussed below.

Maintain Current Funding Practices. Current ship-procurement funding practices can be summarized as procuring almost all ships with full funding, procuring a small number with *de facto* or explicit incremental funding, and approving, for some ships being fully funded, advance procurement (AP) funding that the Navy did not request, or for purposes of shipyard advance construction activities rather than long-lead components.

Supporters of this option could argue that current funding practices give DOD and the Congress the flexibility to use incremental funding on a limited basis for aircraft carriers and selected amphibious assault ships while not formally abandoning the full funding policy. They could similarly argue that current funding practices provide Congress with flexibility for using AP funding for purposes other than funding long-lead items requested by DOD. Such flexibility, they can argue, is important for meeting policy goals such as preserving the shipbuilding industrial base within available funding.

Opponents of this option could argue that current practices weaken adherence to the full funding policy by making even limited use of incremental funding and by using AP funding for purposes other than funding long-lead items requested by DOD. Such practices, they could argue, increase the chance that supporters of other kinds of procurement items, such as aircraft, could seek to have them funded using incremental funding, and that such proposals have already been made.[62]

Other opponents of this option could argue that current funding practices provide DOD with insufficient formal authority to use incremental funding or

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[62] Opponents of this option could note that DOD, as part of its FY2003, FY2004, and FY2005 defense budgets and its FY2003-FY2007, FY2004-FY2009, and FY2005-FY2009 FYDPs, proposed procuring 60 C-17 airlift aircraft under a follow-on multiyear procurement (MYP) arrangement approved by Congress in FY2002 that would procure at least some of the aircraft with funding profiles that resembled incremental funding rather than full funding. Under this approach, the Air Force requested Congress to appropriate enough money in a given year to make progress payments on the MYP contract rather than to fully fund a specific number of aircraft. See CRS Report RL31404, op. cit., pp. 7-8.

advance appropriations so as to avoid or mitigate funding spikes associated with procurement of ships like aircraft carriers and big-deck amphibious assault ships. Giving DOD formal authority to budget for ships using these mechanisms, they could argue, would permit DOD to structure its budget submission to Congress so as to take optimum advantage of these mechanisms.

Strengthen Adherence To Full Funding Policy. This option would involve reducing or eliminating the use of incremental funding in Navy ship procurement and reducing or eliminating the use, in ships being fully funded, of AP funding for purposes other than funding the procurement of long-lead items requested by DOD.

Supporters could argue that this option, by strengthening adherence to the full funding policy, would reduce the chance that supporters of other kinds of DOD procurement items, such as aircraft, would seek to have them funded using incremental funding. Budget spikes associated with procuring aircraft carriers or big-deck amphibious assault ships, they could argue, can be anticipated years in advance, permitting their effects to be carefully managed. They could argue that stability in Navy ship-procurement plans can be increased by encouraging the Navy and DOD to better define their thinking regarding Navy requirements, and that ship-procurement costs can be reduced through measures other than incremental funding or advance appropriations, such as multiyear procurement, contracts that are structured to provide incentives to shipbuilders to control costs, and investment in improved shipyard production capabilities.

Opponents of this policy could argue that it would deprive Congress of the flexibility it has under current funding practices to use incremental funding on a limited basis when absolutely necessary and to use AP funding for purposes other than funding long-lead items requested by DOD. Congress, they could argue, should not deprive itself of tools that might help improve stability in Navy shipbuilding plans, reduce ship-procurement costs, and preserve the shipbuilding industrial base within available funding. Congress, they could argue, has recently taken steps to discourage the spread of incremental funding to DOD procurement items other than ships, and can continue doing this while preserving some flexibility for itself in funding ship procurement.

Increase Use of Incremental Funding. This option could involve explicitly (rather than tacitly) using incremental funding for aircraft carriers, using incremental funding to procure all (not just some) big-deck amphibious assault ships, or both. It could also involve funding the procurement of the lead ships of each new class of Navy ships in the Navy's research and development account rather than the ship-procurement account, as the Navy has proposed.

Supporters of this option could argue that it would take maximum advantage of opportunities for avoiding or mitigating budget spikes associated with the procurement of these ships. They could also argue that it could strengthen the full funding policy by making it clear to observers that only certain ships, and no other DOD procurement items, may be procured with incremental funding. They could argue that current funding practices — under which aircraft carriers can be funded with *de facto* (rather than explicit) incremental funding and some (but not all)

amphibious ships are funded with incremental funding (either *de facto* or explicit) — can send confusing signals regarding adherence to the full funding policy, and that a clear, explicit policy of using incremental funding only for certain ships would send a clear signal that these ships represent special exceptions to an otherwise strict practice of adhering to the full funding policy.

Opponents of this option could argue that any use of incremental funding weakens the full funding policy, increasing the likelihood of proposals to use it for funding other DOD procurement items. Incremental funding, they could argue, should be used to avoid or mitigate budget spikes only when doing so is necessary to avoid disruptions in ship-procurement programs that would substantially increase procurement costs. Depending on the composition of the ship-procurement plan, they could argue, the budget spike associated with a carrier or big-deck amphibious assault ship might or might not lead to a disruption that substantially increased procurement costs, and that such increases in any event would have to be weighed against the risk of an increase in cost of an incrementally funded ship due to a decision in a future year to reduce or delay a funding increment.

Begin Using Advance Appropriations. This option could involve starting to use advance appropriations for ships such as aircraft carriers or big-deck amphibious assault ships.

Supporters could argue that this option, like the previous one, would take maximum advantage of opportunities for avoiding or mitigating budget spikes associated with the procurement of these ships. Since advance appropriations is a form of full funding, they could argue that this option would not weaken the full funding policy. They could also argue that compared to the previous option, this option would create less risk of an increase in the cost of an aircraft carrier or big-deck amphibious assault ship due to a decision to reduce or defer a funding increment because, under advance appropriations, funding increments occur automatically unless Congress takes a positive actions to stop them.

Opponents of this option could argue that even though advance appropriations is a form of full funding, introducing its use into Navy ship procurement would still amount to a relaxation of the application of the full funding concept to DOD procurement that could serve as a precedent for subsequent proposals to relax its application still further. This option, they could argue, is unnecessary because mitigating a budget spike associated with the procurement of an aircraft carrier or big-deck amphibious assault ship can be accomplished through the currently accepted practice of occasionally using incremental funding. Starting to use advance appropriations for aircraft carriers or big-deck amphibious assault ships, they could argue, creates a risk of increasing the procurement cost of other ships as a result of concentrating potential reductions in future-year ship-procurement budgets on those ships.[63]

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[63] For additional discussion of the options of using incremental funding or advance appropriations for procuring aircraft carriers or other Navy ships, see Irv Blickstein and Giles Smith, *A Preliminary Analysis of Advance Appropriations as a Budgeting Method for* (continued...)

Transfer Lead-Ship DD/NRE Costs To R&D Account. In Navy ship-procurement programs, the detailed design and nonrecurring engineering (DD/NRE) costs for each class of ship — the cost to create the detailed plans for building the class — are included in the procurement cost of the lead ship in the class. Since the DD/NRE costs for a complex combatant can be significant, including them in the procurement cost of the lead ship can make that ship significantly more expensive to procure than the second and subsequent ships in the class.

In the case of the DD(X) destroyer program, for example, the lead ship's total procurement cost of roughly $2.8 billion includes about $1 billion in DD/NRE costs for the class. The remaining $1.8 billion or so is the actual hands-on construction cost for the lead ship. Including $1 billion of DD/NRE costs in the procurement cost of the lead DD(X) increased the ship's procurement cost by roughly 56% and may have contributed to a Navy decision that it could not afford to fully fund the ship in FY2006 while meeting other FY2006 funding needs.

Including DD/NRE costs in the procurement cost of the lead unit is a practice that is not followed by other DOD procurement programs, such as programs for procuring aircraft, ground vehicles, and missiles. If it were, the lead units of these other types of procurement programs would be significantly more expensive to procure.

One response to the challenge of paying for lead ships whose procurement cost includes significant DD/NRE costs would be to fund the procurement of lead ships through the Navy's research and development (R&D) account rather than the Navy's ship-procurement account, as the Navy has proposed in 2004 and 2005. This approach, which would permit both DD/NRE costs and the hands-on construction costs of lead ships to be funded incrementally while not violating the full funding policy, can be viewed as an example of the previously-discussed option of increasing the use of incremental funding.

As discussed earlier, Congress, in acting on the Navy's proposed FY2005 defense budget, rejected the Navy's proposal to procure the lead DD(X) through the Navy's research and development account, directed the Navy to fully fund the lead DD(X) in the Navy's ship-procurement account, and fully funded the lead LCS in the Navy's research and development account.

An alternative approach to the challenge of paying for lead ships whose procurement cost includes significant DD/NRE costs would be to treat DD/NRE work as the final stage of the R&D process and transfer DD/NRE costs to the Navy's R&D account. Under this option, the DD/NRE costs for a ship class could be

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[63] (...continued)
Navy Ship Procurements, (RAND: Santa Monica (CA), 2002), MR-1527-Navy; and John Birkler, et al., *Options for Funding Aircraft Carriers*, (RAND, MR-1526-Navy). The second report also discusses a third option for funding aircraft carriers called capital account funding. The report describes this as an approach "in which Congress commits to a specific level of annual funding (adjustable from time to time) sufficient to support all carrier-construction activities over the long term. The account could serve as a source of either incremental funding or full funding." (p. xi)

incrementally funded without violating the full funding policy, while the actual hands-on construction cost of the lead ship would be fully funded, in conformance with the full funding policy.

This option can be viewed as an intermediate approach that is between the current practice of fully funding both DD/NRE costs and the lead ship's hands-on construction costs, and incrementally funding both these costs in the R&D account, as would occur under the Navy's proposal.

In the case of the DD(X) program, this intermediate approach would permit the Navy to incrementally fund roughly $1 billion in DD/NRE costs, potentially increasing the Navy's ability to fund the lead DD(X) in FY2006 while meeting other FY2006 funding needs.

Supporters of this option could argue that DD/NRE work is best viewed as the final stage of research and development and should be treated as such in the budget, and that shifting these costs to the R&D account would make Navy ship-procurement programs look more like DOD procurement programs for things such as aircraft, ground vehicles, and missiles.

Opponents could argue that NN/NRE work is more closely related to production than to research, and that the current practice of including DD/NRE costs in the procurement cost of the lead ship makes these costs more visible to Congress, which is important because detailed design costs for certain past Navy ships have experienced significant cost growth.

Options For Sustaining Ship-Construction Industrial Base

Options for sustaining the ship-construction industrial base are discussed below in terms of how they might sustain the following:

- the Navy ship-construction industrial base in general;
- the aircraft carrier construction industrial base;
- the submarine construction industrial base; and
- the surface combatant construction industrial base.

Ship-Construction Industrial Base in General. Aside from procuring larger numbers of Navy ships, one option for sustaining the ship-construction industrial base in general would be to increase the amount of commercial-ship construction work. This option has been discussed or pursued by Congress at various times, particularly since the early 1990s, when the construction rate of large Navy ships declined as a result of the end of the Cold War and associated reductions in the planned size of the Navy.

Yards that are competitive builders of commercial ships traditionally have been configured somewhat differently from yards that focus on building complex combatant ships. Commercial ships typically require less outfitting of their interiors than complex combatant ships, so yards that are competitive builders of commercial ships traditionally have had work forces with a fairly high percentage of basic steel workers (who build the shell of the ship) and lower numbers of outfitters, while yards

that focus on building complex combatant ships traditionally have had work forces that have included larger numbers of outfitters. In addition, yards that focus on building complex combatant ships have equipment for assembling, integrating, and testing complex ship combat systems and (in the case of GD/Electric Boat and NGNN) equipment for assembling, installing, and testing nuclear-propulsion equipment.

The additional costs associated with maintaining larger numbers of outfitters and equipment related to complex combat systems and nuclear propulsion can pose challenges to complex combatant yards seeking to enter the commercial-ship construction market. Some of today's complex-combatant yards explored the option in the 1990s. GD/BIW, for example, examined the option during the 1990s but ultimately decided against attempting to enter the market. As another example, NGNN in the 1990s started a program to build double-hulled tankers, but lost money on the project and stopped it after building a few ships.

Among the six yards that currently build the Navy's larger warships, the yards for which the option of increasing commercial-ship construction work currently might be most suitable are GD/NASSCO and NG/Avondale. GD/NASSCO builds auxiliary and sealift ships for the Navy and DOD. Since these ships are similar in design and complexity to commercial ships, GD/NASSCO is similar to purely commercial shipbuilding yards in terms of numbers of outfitters and lack of equipment related to complex combat systems and nuclear propulsion. GD/NASSCO pursues commercial-ship construction work, and its workload is often a mix of commercial ships and Navy/DOD auxiliaries and sealift ships. The yard is currently building 185,000 DWT oil tankers for BP Oil Shipping Company USA. A total of four of these ships are to be delivered by 2006. The ships are to be used for transporting crude oil from Valdez, Alaska, to oil refineries on the U.S. West Coast, meaning that these ships fall under the Jones Act (Section 27 of the Merchant Marine Act of 1920 [46 USC. 883]), which, as discussed in a CRS report, "requires that all waterborne shipping between points within the United States be carried by vessels built in the United States, owned by U.S. citizens (at least 75%), and manned with U.S. citizen crews. The act essentially bars foreign built and operated vessels from engaging in U.S. domestic commerce."[64]

NG/Avondale has also built auxiliary and sealift ships for the Navy and DOD, but its current workload includes construction of LPD-17 amphibious ships, which are somewhat complex in terms of their outfitting requirements and combat systems. Recent commercial-ship construction work at NG/Avondale includes 125,000 DWT oil tankers built for Polar Tankers, Inc. The first of five such ships was delivered in 2001. These ships also appear intended for transporting crude oil from Alaska to the U.S. West Coast,[65] which would qualify them under the Jones Act.

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[64] CRS Report RS21566, *The Jones Act: An Overview*, by John F. Frittelli.

[65] Avondale's website [http://www.ss.northropgrumman.com/company/avondale.cfm] states: "These 895-foot-long, 125,000 DWT ships are capable of carrying more than one million barrels of crude oil along the treacherous trade route from Alaska to the U.S. West Coast."

One option that might make it easier for U.S. yards that build complex combatants to compete for commercial-ship construction work would be to make Navy combatant ships more like commercial ships. The OFT report on alternative fleet architectures discussed earlier essentially proposes this by using a merchant-like hull as the basis for building four kinds of large surface ships.

Aircraft Carrier Construction Industrial Base. One option for sustaining the aircraft carrier construction industrial base would be to restore FY2007 as the year of procurement for CVN-21, which would shorten the gap in production between CVN-77 and CVN-21 and thereby reduce the cost of CVN-21 (and possibly also costs for submarine construction work at NGNN). Restoring FY2007 as CVN-21's year of procurement might be facilitated by making greater use of incremental funding for CVN-21 than currently planned, by using advance appropriations for CVN-21, by transferring CVN-21's DD/NRE costs to the Navy's research and development account, where they could be incrementally funded, or by using incremental funding or advance appropriations to fund other ships currently planned for FY2007, such as LHA® or the lead DD(X).

Submarine Construction Industrial Base. The part of the submarine industrial base that might be in most need of near-term attention is not the construction portion, which would continue to be supported at roughly current levels by the plan to continue procuring Virginia-class submarines at one per year through FY2011, but the design and engineering portion. According to Navy and industry officials, the submarine design and engineering base is facing the near-term prospect, for the first time in about 50 years, of having no new submarine design to work on. The Navy believes that this design and engineering workforce, if not maintained through significant new submarine design work, might atrophy and be very difficult to reconstitute. As discussed below in the section on submarine procurement options, one option for addressing this situation would be to begin work now on a new-design, lower-cost submarine that might be ready for lead-ship procurement around FY2011.

Surface Combatant Industrial Base.

Options for FY2006-FY2011. As discussed earlier, the Navy's FY2006-FY2011 plan for procuring DD(X) destroyers may put considerable pressure on the two yards — GD/BIW and NG/Ingalls — that currently build larger surface combatants for the Navy. Options for supporting the surface combatant industrial base between now and about FY2011, many of which could be combined, include the following:

- accelerating procurement of the first one or two DD(X)s by a year;
- procuring additional DD(X)s;
- procuring additional DDG-51s;
- procuring additional LPD-17 or LHA® amphibious ships;
- transferring construction of LCSs to these yards;
- modernizing Ticonderoga (CG-47) class Aegis cruisers;
- modernizing Arleigh Burke (DDG-51) class Aegis destroyers, perhaps more extensively than currently planned by the Navy; and

- accelerating and expanding procurement of large and medium Deepwater cutters for the Coast Guard.

Accelerating procurement of the first one or two DD(X)s might be facilitated by transferring DD(X) DD/NRE costs to the Navy's research and development account, where they could be incrementally funded, or by using incremental funding or advance appropriations for these ships.

The Navy has no requirement for additional DDG-51s, but the last five DDG-51s were arguably procured in part for industrial-base purposes,[66] and if additional DDG-51s were procured, the Navy would find ways to make good use of them.

Procuring additional LHA(R)s during the period FY206-FY2011 period might be facilitated by using incremental funding or advance appropriations.

Transferring construction of LCSs to GD/BIW or NG/Ingalls would likely increase the cost of these ships due to the higher overhead costs of these yards compared to the smaller yards where these ships are currently planned to be built. It might also, however, reduce the cost of other work being done at GD/BIW or NG/Ingalls by spreading the fixed overhead costs of these over a broader workload. It might also avoid the risk of the LCS program creating one or more new yards that are highly dependent on Navy shipbuilding work, which could make more complex the task of managing the shipbuilding industrial base.

Options for modernizing DDG-51s more extensively than currently planned by the Navy include making changes to reduce crewing requirements to about 200 people per ship, and lengthening the ships with a plug that would permit an increased payload.

The current Coast Guard Deepwater acquisition program of record calls for procuring 33 large and medium cutters (eight large cutters and 25 medium cutters) over a period of many years at low annual production rates. The total planned procurement quantity of 33 ships was established prior to 9/11. Many analysts believe that more than 33 of these cutters will be needed to fully meet the Coast Guard's expanded post-9/11 mission requirements. The RAND Corporation has published a report stating that the Coast Guard might need as many as 90 of these ships (44 large cutters and 46 medium cutters) to fully meet its post-9/11 mission requirements. Members of Congress and others have expressed interest in accelerating procurement of these cutters so as to achieve more economic production rates, and in expanding the total number of cutters to be procured.

In terms of light-ship displacement, four or five large and medium Deepwater cutters would be roughly equivalent to one DD(X). Procuring four or five of these cutters per year might therefore generate about as much shipyard construction work as one DD(X) per year, and procuring eight or 10 per year might generate about as much shipyard construction work as two DD(X)s per year. Although the skill mix

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[66] The Navy for several years stated that it planned to build a total of 57 DDG-51s. A total of 62 were procured.

for building Deepwater cutters is somewhat different than the skill mix for building DD(X)s, accelerating and expanding procurement of Deepwater cutters could:

- reduce the Coast Guard's unit procurement costs for these ships by procuring them at more economic annual rates;
- increase Coast Guard capabilities toward post-9/11 requirements more quickly;
- permit the Coast Guard to retire its aging cutters more quickly, thereby eliminating more quickly the high operation and support costs of these cutters; and
- help sustain the Navy's surface combatant industrial base through a program funded in the budget of the Department of Homeland Security (DHS), the Coast Guard's parent department, rather than the Navy or DOD budget.[67]

Options For FY2011 and Beyond. As discussed below in the section on surface combatant procurement options, one option for supporting the surface combatant industrial base in FY2021011 and beyond would be to begin work now on a new-design, lower-cost surface combatant that might be ready for lead-ship procurement around FY2011.[68]

Options For Submarine Procurement

Two new options for submarine procurement have recently emerged. One would supplement procurement of Virginia-class submarines with procurement of non-nuclear-powered submarines that are equipped with air-independent propulsion (AIP) systems. The other would be to design a new, lower-cost nuclear-powered submarine and shift from procurement of Virginia-class submarines to procurement of these new submarines perhaps around FY2011.

AIP Submarine. The OFT report on alternative fleet platform architectures recommended substituting four AIP-submarines for one Virginia-class submarine in each carrier strike group, suggesting that four AIP submarines could be procured for the same cost ($2.4 billion to $3.0 billion in the FY2006-FY2011 FYDP) as one Virginia-class submarine. This implies an average unit procurement cost for an AIP submarine of roughly $600 million to $750 million each when procured at a rate of four per year. Although AIP submarines being built by other countries might cost this much to procure, a U.S. Navy AIP submarine might be built to higher capability

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[67] For additional discussion of the Deepwater program, see CRS Report RS21019, *Coast Guard Deepwater Program: Background and Issues for Congress*, by Ronald O'Rourke.

[68] For additional discussion of options for supporting the surface combatant industrial base, see CRS Report RL32109, *Navy DD(X) and LCS Ship Acquisition Programs: Oversight Issues and Options for Congress*, by Ronald O'Rourke.

standards and consequently cost more to procure, possibly reducing the equal-cost ratio of substitution to three to one or possibly something closer two to one.

As noted in an earlier footnote, an AIP system such as a fuel-cell or closed-cycle diesel engine extends the stationary or low-speed submerged endurance of a non-nuclear-powered submarine. A conventional diesel-electric submarine has a stationary or low-speed submerged endurance of a few days, while an AIP-equipped submarine may have a stationary or low-speed submerged endurance of up to two or three weeks. An AIP system does not, however, significantly increase the high-speed submerged endurance of a non-nuclear-powered submarine. A non-nuclear-powered submarine, whether equipped with a conventional diesel-electric propulsion system or an AIP system, has a high-speed submerged endurance of perhaps 1 to 3 hours, a performance limited by the electrical storage capacity of the submarine's batteries, which are exhausted quickly at high speed.

As a consequence of their very limited high-speed submerged endurance, non-nuclear-powered submarines, even those equipped with AIP systems, are not well suited for submarine missions that require:

- long, completely stealthy transits from home port to the theater of operation,
- submerged periods in the theater of operation lasting more than two or three weeks, or
- submerged periods in the theater of operation lasting more than a few hours or days that involve moving the submarine at something more than low speed.

Recognizing that AIP submarines are not well suited for making long, completely stealthy transits, the OFT report proposes transporting the AIP submarines into theater aboard a transport ship. In doing so, the OFT report accepts that the presence of a certain number of U.S. AIP submarines in the theater of operations will become known to others. A potential force-multiplying attribute of having an SSN in a carrier strike group, in contrast, is that the SSN can be detached from the strike group, and redirected to a different theater to perform some other mission, without alerting others to this fact. Opposing forces in the strike group's theater of operations could not be sure that the SSN was not in their own area, and could therefore continue to devote resources to detecting and countering it. This would permit the SSN to achieve military effects in two theaters of operation at the same time — the strike group's theater of operations, and the other theater to which it is sent.

A significant risk of a plan to begin procuring AIP submarines while continuing to procure Virginia-class submarines at one per year is that financial pressures in future years could lead to a decision to increase procurement of AIP submarines while reducing procurement of Virginia-class submarines to something less than one per year. Such a decision would result in a total submarine force with more AIP submarines and fewer SSNs than planned, and consequently with potentially insufficient capability to meet all submarine mission requirements. This possibility

is a principal reason why supporters of the U.S. nuclear-powered submarine fleet traditionally have strongly resisted the idea of initiating construction of non-nuclear-powered submarines in this country.

Lower-Cost ("Tango Bravo") Nuclear-Powered Submarine. The Virginia class was designed in the early to mid-1990s, using technologies that were available at the time. New technologies that have emerged since that time may now permit the design of a new SSN that is substantially less expensive than the Virginia-class design, but equivalent in capability. The Navy and the Defense Advanced Research Projects Agency (DARPA) are now pursuing the development of these technologies under a program called Tango Bravo, a name derived from the initial letters of the term "technology barriers." As described by the Navy,

> TANGO BRAVO will execute a technology demonstration program to enable design options for a reduced-size submarine with equivalent capability as the VIRGINIA Class design. Implicit in this focus is the goal to reduce platform infrastructure and, ultimately, the cost of future design and production. Additionally, reduced platform infrastructure provides the opportunity for greater payload volume.
>
> The intent of this collaborative effort is to overcome selected technology barriers that are judged to have a significant impact on submarine platform infrastructure cost. Specifically, DARPA and the Navy will jointly formulate technical objectives for critical technology demonstrations in (a) shaftless propulsion, (b) external weapons, © conformal alternatives to the existing spherical array, (d) technologies that eliminate or substantially simplify existing submarine systems, and (e) automation to reduce crew workload for standard tasks.[69]

Navy and industry officials believe that if these technologies are developed, it would be possible to design a new submarine equivalent in capability to the Virginia class, but with a procurement cost of perhaps no more than 67% of the Virginia class, and possibly less. Such a submarine could more easily be procured within available resources at a rate of two per year, which is a rate that the Navy would need to start in FY2012 or FY2013, and sustain for a period of about 12 years, to avoid having the SSN force drop below 40 boats.[70]

Consequently, as an alternative to the option of procuring AIP submarines, another option would be to start design work now on a new "Tango Bravo" SSN. The goal of such an effort could be to produce an SSN design with capability equivalent to that of Virginia-class and a procurement cost that is 50% to 67% that of the Virginia class. The idea of designing a submarine with these features has been discussed by Navy and industry officials. Under this option, Virginia-class procurement could continue at one per year until the Tango Bravo submarine was

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[69] Navy information paper on advanced submarine system development provided to CRS by Navy Office of Legislative Affairs, Jan. 21, 2005.

[70] For a discussion of future submarine force levels and associated procurement rates, see CRS Report RL342418, *Navy Attack Submarine Force-Level Goal and Procurement Rate: Background and Issues for Congress*, by Ronald O'Rourke, particularly the 40-boat column in **Table 5**, entitled "Notional Procurement Profiles for Various Force Sizes."

ready for procurement, at which point Virginia-class procurement would end, and procurement of the Tango Bravo submarine would begin.

If design work on a Tango Bravo submarine is begun now and pursued in a concerted manner, the first Tango Bravo submarine might be ready for procurement by FY2011. (Some industry officials believe that under ideal program conditions, the lead ship could be procured even earlier.) If the lead ship of such a submarine is procured in FY2011, then the procurement rate could be increased to two per year starting in FY2012 or FY2013, meeting the time line needed to avoid falling below 40 boats.

Starting design work now on a Tango Bravo submarine would provide near-term support to the submarine design and engineering base and thereby help maintain that base, addressing an issue discussed earlier. After completing the design of the Tango Bravo SSN, the design and engineering base could turn to designing the next-generation ballistic missile submarine (SSBN), the lead ship of which might need to be procured around FY2020. After designing this new SSBN, the design and engineering base could turn to designing a follow-on SSN that would take advantage of technologies even more advanced than those in the Tango Bravo submarine. This sequence of three successive submarine design projects could help maintain the submarine design and engineering base for the next 15 or so years.

Some or all of the $600 million programmed in the FY2006-FY2011 FYDP for a new undersea superiority system could be used to help finance a concerted effort to design a Tango Bravo submarine that would be ready for procurement by FY2011.

Options for Surface Combatant Procurement

The decision to reduce DD(X) procurement to one ship per year in FY2007-FY2011, which appears to have been driven in large part by affordability considerations, suggests that, unless budget conditions change, the Navy may never be able to afford to procure more than one DD(X) or CG(X) per year.

A procurement rate of one DD(X) or CG(X) per year, if sustained for a period of many years, might not be enough to maintain the cruiser-destroyer force at desired levels. If maintained over the long run (i.e., for a period of 35 years), such a procurement rate would eventually reduce the cruiser-destroyer force to about 35 ships.

A prospective procurement rate of one DD(X) or CG(X) per year may also raise concerns about the potential cost effectiveness of the DD(X)/CG(X) effort, particularly when measured in terms of average unit acquisition cost, which is the average cost to develop and procure each ship. A total of roughly $10 billion in research and development funding has been programmed for the DD(X), and additional research and development funding would be required to modify the DD(X) design into a CG(X) design, making for a total of more than $10 billion in research and development costs for the combined DD(X)/CG(X) effort. Under the long-term shipbuilding plan that the Navy submitted to Congress in 2003, this total research and development cost would have been amortized over a production run of 48 ships (24

DD[X]s and 24 CG[X]s), equating to an average of more than $208 million in research and development costs for each ship. If, however, a total of fewer than 48 DD(X)s and CG(X)s are built, the average research and development cost per ship would increase. If, for example, a total of 18 DD(X)s and CG(X)s are built (e.g., six DD(X)s plus 12 CG(X)s built at a rate of one per year for 12 years), then the per-ship research and development cost would increase to more than $555 million per ship. This figure, combined with an average unit procurement cost of $2 billion or more for each DD(X) and CG(X), would result in a DD(X)/CG(X) average unit acquisition cost of more than $2.5 billion, and possibly something closer to $3 billion.

Dissatisfaction with a one-per-year procurement rate due to its potential effects on force structure or average unit acquisition cost could lead to a decision at some point to terminate the DD(X)/CG(X) program. If such a decision were made in the near term, the total number of ships that might be built under the program could be as low as one or two. Under this scenario, a single DD(X) might be procured as a technology demonstrator, while a second DD(X) might be procured to give the other shipyard experience in building the design.

Another scenario is that a total of five DD(X)s are procured through FY2011, as currently planned, but that the CG(X) program is terminated due to concerns about its procurement cost (which may be greater than that of the DD[X]) and questions about the role of the CG(X) in the missile-defense mission. Although the DD(X) has been described by DOD and others as a bridge to CG(X), there is a possibility (some observers say a probability) that industry may cross that bridge only to discover that the CG(X) is no longer waiting at the other end.

If the DD(X)/CG(X) effort is terminated at some point and an alternative large surface combatant design is not ready to be put into procurement, it could place pressures on the surface combatant industrial base that are significantly higher than those it currently faces under the Navy's FY2006-FY2011 plan for procuring DD(X)s, with consequences that could be more severe.

One option for addressing this situation would be to begin design work now on a new surface combatant that is substantially less expensive to procure than the DD(X)/CG(X). Such a surface combatant could be more easily procured within available resources at a rate of two ships per year, which would maintain the cruiser-destroyer force at a level closer to what the Navy may be planning. A rate of two ships per year could also be easier to divide between two shipyards while still constraining production costs. This option could aim at having the new design ready for procurement in FY2011, which is when CG(X) procurement is currently scheduled to begin.

Notional options for a less-expensive surface combatant include:

- A roughly 9,000-ton surface combatant;
- A roughly 6,000-ton frigate; and
- A low-cost gunfire support ship.

Each of these is discussed below. An additional option to consider, even though it might not be less expensive in terms of unit procurement cost, is the 57,000-ton

missile-and-rocket ship proposed in the OFT report on alternative fleet platform architectures.

Roughly 9,000-Ton Surface Combatant (SC[X]). One option for a smaller, less expensive, new-design ship would be a new-technology surface combatant about equal in size to the Navy's current 9,000-ton Aegis cruisers and destroyers. Such a ship, which might be called the SC(X) (meaning surface combatant, in development) could:

- be intended as a replacement for either the CG(X) program or both the DD(X) and CG(X) programs;
- incorporate many of the same technologies now being developed for the DD(X) and CG(X), including, for example, technologies permitting a reduced-sized crew and integrated electric-drive propulsion;
- cost substantially less to procure than a DD(X) or CG(X), and perhaps about as much to procure as a DDG-51 destroyer (i.e., perhaps about $1,300 million per ship when procured at a rate of two per year);
- be similar to the DD(X) and CG(X) in terms of using a reduced-size crew to achieve annual operation and support costs that are considerably less than those of the current DDG-51 design;
- carry a payload — a combination of sensors, weapon launchers, weapons, and aircraft — that is smaller than that of the DD(X) or CG(X), but comparable to that of current DDG-51s or Aegis cruisers.

A land-attack oriented version of the SC(X) might be able to carry one Advanced Gun System (AGS), as opposed to the two on the DD(X). An air- and missile-defense version of the SC(X) might have fewer missile tubes than CG(X), but still a fairly substantial number.

Roughly 6,000-Ton Frigate (FFG[X]). A second option for a smaller, less expensive, new-design ship would be a frigate intended as a replacement for both the DD(X)/CG(X) effort and the LCS program. The option for a new-design frigate was outlined in a March 2003 Congressional Budget Office (CBO) report on surface combatants and CBO's recent report on options for the federal budget.[71] CBO estimates that such a ship, which it called the FFG(X), might displace about 6,000 tons and have a unit procurement cost of about $800 million.

A 6,000-ton FFG(X) would likely be too small to be equipped with the AGS and therefore likely could not provide the additional naval gunfire capability that would

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[71] Congressional Budget Office (CBO), *Transforming the Navy's Surface Combatant Force*, Mar. 2003, pp. 27-28, 63; and CBO, *Budget Options*, Feb. 2005, pp. 18-19.

be provided by the DD(X). A 6,000-ton FFG(X) might, however, be capable of performing the non-gunfire missions that would be performed by both the DD(X) and the LCS. A 6,000-ton FFG(X) would could be viewed as a replacement in the surface combatant force structure for the Navy's Oliver Hazard Perry (FFG-7) class frigates and Spruance (DD-963) class destroyers. Since a 6,000-ton FFG(X) would be roughly midway in size between the 4,000-ton FFG-7 design and the 9,000-ton DD-963 design, it might be suitable for carrying more modern versions of the mission equipment currently carried by the FFG-7s and DD-963s.

Low-Cost Gunfire Support Ship. A third option for a smaller, less expensive, new-design ship would be a low-cost gunfire support ship — a relatively simple ship equipped with one or two AGSs and only such other equipment that is needed for basic ship operation. Other than the AGSs and perhaps some advanced technologies for reducing crew size and thus total life-cycle cost, such a ship could use existing rather than advanced technologies so as to minimize development time, development cost, and technical risk. Some of these ships might be forward-stationed at sites such as Guam or Diego Garcia, so as to be available for rapid crewing and movement to potential contingencies in the Western Pacific or Indian Ocean/Persian Gulf regions. The goal would be to procure specialized AGS-armed ships as a niche capability for the Navy, and then forward-station some of that capability so as to maximize the odds of being able to bring a desired number of AGSs to an overseas theater of operation in a timely manner on those occasions when it is needed.

Appendix A: Ambiguity in Navy Force Structure Planning [72]

310-Ship Plan From 2001 QDR

The last unambiguous ship force structure plan for the Navy that was officially approved and published by the Office of the Secretary of Defense (OSD) appeared in the report on the 2001 Quadrennial Defense Review (QDR). This plan, like the one approved in the 1997 QDR, included 12 aircraft carriers, 116 surface combatants, 55 nuclear-powered attack submarines (SSNs),[73] and 36 amphibious ships organized into 12 amphibious ready groups (ARGs) with a combined capability to lift the assault echelons of 2.5 Marine Expeditionary Brigades (MEBs).[74] Although the 2001 QDR report did not mention a total number of ships, this fleet was generally understood to include a total of about 310 battle force ships.[75] The 2001 QDR report also stated that as DOD's "transformation effort matures — and as it produces significantly higher output of military value from each element of the force — DOD will explore additional opportunities to restructure and reorganize the Armed Forces."[76]

Following the publication of the 2001 QDR report, the Navy took steps which had the effect of calling into question the status of the 310-ship plan. In November 2001, the Navy announced a plan for procuring a new kind of small surface combatant, called the Littoral Combat Ship (LCS), that the Navy had not previously planned to procure, and which was not mentioned in the 2001 QDR report.[77] And in

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[72] Material in this appendix was adapted from CRS Report RL32665, *Potential Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

[73] The plan approved in the 1997 QDR originally included 50 SSNs but was subsequently amended to include 55 SSNs.

[74] U.S. Department of Defense, *Quadrennial Defense Review Report*, 2001, p. 22.

[75] Since the beginning of the Reagan Administration, the total number of ships in the Navy has been calculated using the battle force method of counting ships. Battle force ships are ships that are readily deployable and which contribute directly or indirectly to the deployed combat capability of the Navy. Battle force ships include active-duty Navy ships, Naval Reserve Force ships, and ships operated by the Military Sealift Command that meet this standard. The total number of battle force ships includes not only combat ships but also auxiliary and support ships — such as oilers, ammunition ships, and general stores ships — that transport supplies to deployed Navy ships operating at sea. The total number of battle force ships does not include ships in reduced readiness status that are not readily deployable, ships and craft that are not generally intended for making distant deployments, oceanographic ships operated by the National Oceanic and Atmospheric Administration (NOAA), and DoD sealift and prepositioning ships that transport equipment and supplies (usually for the benefit of the Army or Air Force) from one land mass to another.

[76] *Quadrennial Defense Review Report*, op. cit., p. 23.

[77] For more on the LCS program, see CRS Report RS21305, *Navy Littoral Combat Ship (LCS): Background and Issues for Congress*, by Ronald O'Rourke; and CRS Report (continued...)

February 2003, in submitting its proposed FY2004-FY2009 Future Years Defense Plan (FYDP) to Congress, DOD announced that it had initiated studies on undersea warfare requirements and forcible entry options for the U.S. military. These studies could affect, among the other things, the required numbers of SSNs and amphibious ships. The 310-ship plan is now rarely mentioned by Navy and DOD officials.

Navy 375-Ship Proposal (2002-2004)

Navy leaders in early 2002 began to mention an alternative proposal for a 375-ship Navy that included several dozen LCSs not included in the 310-ship plan. The 375-ship proposal included 12 aircraft carriers, 55 SSNs, 4 converted Trident cruise-missile-carrying submarines (SSGNs), 160 surface combatants (including 104 cruisers, destroyers, frigates, and 56 LCSs), 37 amphibious ships, and additional mine warfare and support ships.

Although Navy leaders routinely referred to the 375-ship proposal from about February 2002 through about February 2004, Secretary of Defense Donald Rumsfeld, at a February 5, 2003 hearing before the House Armed Services Committee, explicitly declined to endorse it as an official DOD goal, leaving it a Navy proposal only.

In April 2004, Navy leaders began to back away from the 375-ship proposal, stating that 375 was an approximate figure, that the ships making up the total of 375 were subject to change, and perhaps most important, that the 375-ship figure reflected traditional concepts for crewing and deploying Navy ships, rather than new concepts — such as Sea Swap — that could significantly reduce future requirements for Navy ships.

Navy 2005 Testimony On Force Posture Ranges

At a February 10, 2005, hearing before the Senate Armed Services Committee on the proposed FY2006 DOD budget and FY2006-FY2011 FYDP, Admiral Vernon Clark, the Chief of Naval Operations, testified that the Navy in future years may require a total of 260 to 325 ships, or possibly 243 to 302 ships, depending on how much the Navy uses new technologies and Sea Swap. Specifically, Clark stated:

> As we evolve advanced concepts for employment of forces, we will also refine analyses and requirements, to include the appropriate number of ships, aircraft, and submarines....
>
> In a sensor-rich construct, the numbers of platforms are no longer a meaningful measure of combat capability. And just as the number of people is no longer the primary yardstick by which we measure the strength or productivity of an organization in an age of increasing capital-for-labor substitutions, the number of ships is no longer adequate to gauge the health or combat capability of the

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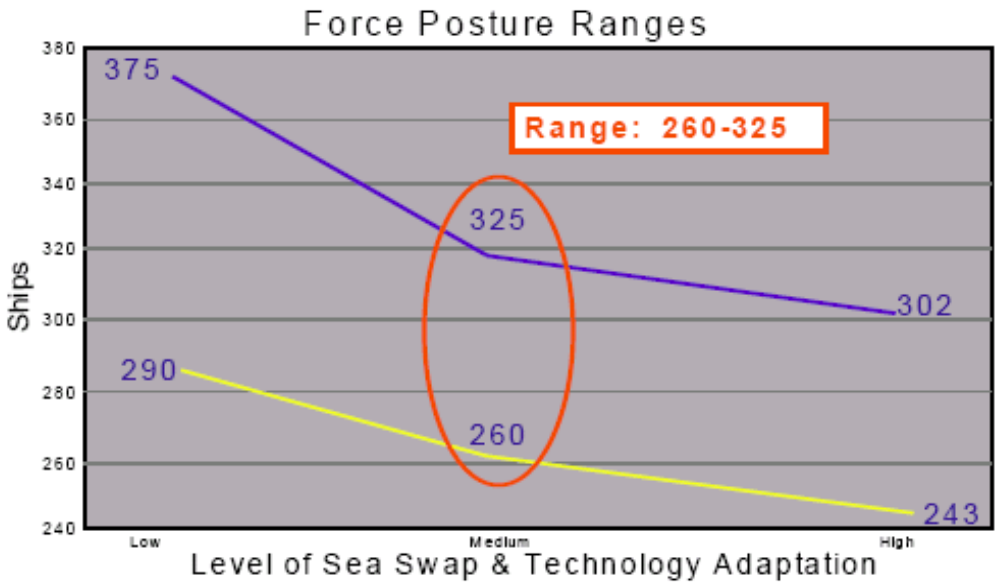
[77] (...continued)
RL32109, *Navy DD(X) and LCS Ship Acquisition Programs: Oversight Issues and Options for Congress*, by Ronald O'Rourke.



Navy. The capabilities posture of the Fleet is what is most important. In fact, your Navy can deliver much more combat power, more quickly now than we could twenty years ago when we had twice as many ships and half again as many people....

Further, I believe that the current low rate of ship construction and the resultant escalation of platform cost will constrain the future size of the Fleet. As I have previously testified, I don't believe that it's all about numbers; numbers have a quality all their own, there's no question about that. But, it is more important that we buy the right kinds of capabilities in the ships that we're procuring in the future, and that we properly posture our force to provide the speed and agility for seizing and retaining the initiative in any fight.

The ultimate requirement for shipbuilding, however, will be shaped by the potential of emerging technologies, the amount of forward basing, and innovative manning concepts such as Sea Swap. Additional variables range from operational availability and force posture to survivability and war plan timelines.

The notional diagram [above] illustrates how manning concepts and anticipated technological adaptation will modify the number of ships required. The [upper and lower] lines represent levels of combat capability and the ships required to achieve that capability. For example, the left side of the diagram shows our current number of ships (290) and the current projection of ships required to fully meet Global War on Terror requirements (375) in the future. The right side of the diagram shows a projection that provides the same combat capability but fully leverages technological advances with maximum use of Sea Swap. It is a range of numbers because the degree of technological adaptation is a variable, as is the degree to which we can implement Sea Swap. The middle portion of the curve [in the ellipse] shows a projected range that assumes a less extensive projection of technological adaptation and use of Sea Swap. Although simplified, this diagram shows how the application of transformational new technologies coupled with new manning concepts will enable us to attain the

> desired future combat capability with a force posture between 260 and 325 ships.[78]

Admiral Clark's testimony does not make clear whether any of these potential ship totals have been endorsed by the Secretary of Defense as official DOD force-structure planning goals.

Admiral Clark's testimony also does not specify the kinds and numbers of ships that comprise the various ship totals shown in the diagram above.

Table 4 on the next page compares the 310-ship plan from the 2001 QDR, the Navy's 375-ship proposal of 2002-2004, notional 250- and 330-ship plans developed by CRS prior to Admiral Clark's testimony, and the total ship numbers from Admiral Clark's testimony. The notional 250- and 330-ship plans were developed for informational purposes using press accounts on potential force-structure changes being considered by the Navy.

[78] Statement of Admiral Vernon Clark, USN, Chief of Naval Operations, Senate Armed Services Committee, Feb. 2005, pp. 17-19.

Table 4. Navy Ship Force Structure Plans

Ship Type	310-ship plan from 2001 QDR	Navy 375-ship proposal (2002-2004)	Notional 250- and 330-ship plans based on 2004 reports on Navy studies		2005 Navy testimony on force posture ranges, depending on level of application of Sea Swap and new technologies					
					Low level		Medium level		High level	
			About 250	About 330	Low	High	Low	High	Low	High
Ballistic missile submarines (SSBNs)	14	14	14	14	n/a	n/a	n/a	n/a	n/a	n/a
Cruise missile submarines (SSGNs)	2 or 4[a]	4	4	4	n/a	n/a	n/a	n/a	n/a	n/a
Attack submarines (SSNs)	55	55	37	50	n/a	n/a	n/a	n/a	n/a	n/a
Aircraft carriers	12	12	9	12	n/a	n/a	n/a	n/a	n/a	n/a
Cruisers, destroyers, frigates	116	104	70[b]	84[c]	n/a	n/a	n/a	n/a	n/a	n/a
Littoral Combat Ships (LCSs)	0	56	30[d]	45[e]	n/a	n/a	n/a	n/a	n/a	n/a
Amphibious ships	36	37	24	36	n/a	n/a	n/a	n/a	n/a	n/a
Maritime prepositioning ships	0[f]	0[f]	10[f]	18[f]	n/a	n/a	n/a	n/a	n/a	n/a
Combat logistics (resupply) ships	34	42	30	34	n/a	n/a	n/a	n/a	n/a	n/a
Command and support ships	25	25	20	25	n/a	n/a	n/a	n/a	n/a	n/a
Dedicated mine warfare ships	16	26[g]	0[h]	8[h]	n/a	n/a	n/a	n/a	n/a	n/a
TOTAL battle force ships	**310 or 312**	**375**	**248**	**330**	**290**	**375**	**260**	**325**	**243**	**302**

Source: Navy data and (for notional 250- and 330-ship plans) press reports, except as otherwise noted in footnotes below.
Notes: n/a = not available.
a. The report on the 2001 QDR did not mention a specific figure for SSGNs. The Administration's proposed FY2001 DOD budget requested funding to support the conversion of two available Trident SSBNs into SSGNs, and the retirement of two other Trident SSBNs. Congress, in marking up this request, supported a plan to convert all four available SSBNs into SSGNs.
b. The two-per-year procurement rate for DD(X) destroyers and CG(X) cruisers shown in the Navy long-range shipbuilding plan delivered to Congress in 2003 would, if maintained over the long run, eventually result in a force of 70 larger surface combatants.
c. Replacing the 62 DDG-51 class Aegis destroyers procured through FY2005 and the final 22 CG-47 class Aegis cruisers on a one-for-one basis (while retiring the first 5 Aegis cruisers, as planned by the Navy) would maintain a force of 84 larger combatants.
d. This is the lower end of the range of about 30 to 60 ships that Navy officials have sometimes mentioned as the potential total procurement quantity for the LCS program.
e. This is half-way between the lower and higher ends of the range of about 30 to 60 ships that Navy officials have sometimes mentioned as the potential total procurement quantity for the LCS program. The higher end was associated with the Navy's 375-ship proposal.
f. Today's 16 Maritime Prepositioning Force (MPF) ships are intended primarily to support Marine Corps operations ashore, rather than Navy combat operations, and thus are not counted as Navy battle force ships. The Navy's planned MPF(Future) ships, however, may be capable of contributing to Navy combat capabilities (for example, by supporting Navy aircraft operations). For this reason, the 10 to 16 MPF(F) ships that may be built in coming years are counted here as battle force ships.
g. The figure of 26 dedicated mine warfare ships appears to include 10 ships maintained in a reduced mobilization status called Mobilization Category B. Ships in this status are not readily deployable and thus do not count as battle force ships. The 375-ship proposal thus implied transferring these 10 ships to a higher readiness status.
h. The figure of 0 dedicated mine warfare ships assumes that mine warfare duties are completely taken over by the 30 LCSs (for whom mine warfare is one of three primary stated missions) and by other ships (such as six DDG-51 destroyers) equipped with so-called organic (i.e., built-in) mine warfare systems. The figure of 8 mine warfare ships (which is half-way between 0 and the 16 in the 310-ship plan) assumes that, even with 45 LCSs and some other ships equipped with organic mine warfare capability, a few dedicated mine warfare ships are determined to be needed.