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**STATEMENT OF
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BEFORE THE
SENATE ARMED SERVICES COMMITTEE
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HEARING ON NAVY CAPABILITIES AND FORCE STRUCTURE
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Mr. Chairman, distinguished members of the subcommittee, thank you for the opportunity to appear before you to discuss Navy capabilities and the force structure required to provide them. As requested, my testimony will focus on the following:

- the status of the shipbuilding industrial base (pages 1-6);
- the impact of current Navy shipbuilding plans on the industrial base (pages 6-21); and
- naval capabilities and the recent independent studies on fleet architecture (pages 22-42).

Status Of Shipbuilding Industrial Base

Current Situation

Annual Navy ship procurement declined substantially in the early 1990s, following the end of the Cold War, and today remains substantially below Cold War levels of the 1980s. As a result, among other things:

- current shipyard workloads and employment levels in many cases are below Cold War levels of the 1980s;
- some yards have considerable unused capacity;
- production economies of scale are often limited or poor, putting upward pressure on unit production costs;
- opportunities for the Navy to use periodic (e.g., annual or biannual) competition in the awarding of shipbuilding contracts so as to gain the benefits of competition in production are limited; and
- concerns have increased regarding prospects for Navy shipbuilding supplier firms, many of which are sole sources of what they make for the Navy.

Improved Processes and Methods

The six yards that have built the Navy's major warships in recent years¹ have taken various steps over the last decade or so to improve their ship-design and ship-production processes and methods. These steps have narrowed, but perhaps not closed, the gap in these processes and methods

¹These are the three yards owned by General Dynamics — Bath Iron Works (GD/BIW) of Bath, ME, the Electric Boat Division (GD/EB) of Groton, CT, and Quonset Point, RI, and National Steel and Shipbuilding Company (GD/NASSCO) of San Diego, CA — and the three yards owned by Northrop Grumman — Avondale Shipyards (NG/Avondale) near New Orleans, LA, Ingalls Shipbuilding (NG/Ingalls) of Pascagoula, MS, and Newport News Shipbuilding (NGNN) of Newport News. NG/Avondale and NG/Ingalls, together with a third production facility at Gulfport, MS, form Northrop Grumman Ship Systems (NGSS).

between the six yards and the world's most modern and capable shipyards. A Department of Defense (DOD) report scheduled for completion later this year will address this issue in more detail.²

Rising Material And Component Costs

The six yards have experienced rising costs for materials and components provided to them by supplier firms. These rising costs are a contributor to increasing procurement costs for Navy ships.

Dependence on Navy Work and Opportunities For Other Work

As a group, the six yards are highly dependent on Navy shipbuilding contracts, as they have been for many years. A potentially significant non-Navy source of shipbuilding work in coming years is procurement of large and medium cutters under the Coast Guard Deepwater program, particularly if procurement of these cutters is accelerated and expanded.³

A second potential non-Navy source of shipbuilding work is building warships for export for foreign countries. Although U.S. yards welcome and pursue this work, it tends to be a highly uncertain source of work because it depends on decisions made by foreign governments who in many cases are also considering competing designs offered by foreign yards. In addition, because of the small sizes of most foreign navies, the numbers of ships being contemplated for purchase by these governments tend to be rather small. One current opportunity in this area is the project announced by the Administration in 2001 to provide eight non-nuclear-powered submarines to Taiwan.

A third potential non-Navy source of shipbuilding work is building ocean-going commercial ships, which is an activity that declined substantially in the United States following the end in 1981 of the Construction Differential Subsidy (CDS) that had previously supported such work. Options for increasing the amount of commercial-ship construction work performed in U.S. yards have been discussed or pursued by Congress at various times, particularly since the early 1990s, when the construction rate of large Navy ships declined.

Some of the six yards that have built the Navy's major warships in recent years have explored opportunities for building commercial ships, but with only limited results.⁴ Yards that are configured for building complex combatant ships may face certain challenges in attempting to become competitive builders of commercial ships.⁵ One option that might make it easier for U.S. yards that

²The report being prepared by DOD has been referred to as the Global Shipbuilding Industrial Base Benchmarking Study. For a press article discussing this study, see Christopher J. Castelli, "Patrick: Congress Has Key Role In Examining U.S. Industrial Base," *Inside the Navy*, February 28, 2005.

³For more on the Deepwater program, see CRS Report RS21019, *Coast Guard Deepwater Program: Background and Issues for Congress*, by Ronald O'Rourke.

⁴GD/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. The project left NGNN skeptical about the potential for building commercial ships profitably at NGNN. (See Jason Ma, "Newport News Chief Skeptical About Entering Commercial Ship Market," *Inside the Navy*, March 14, 2005.)

⁵Yards that are competitive builders of commercial ships traditionally have been configured somewhat
(continued...)

build complex combatants to compete for commercial-ship construction work would be to make Navy combatant ships more like commercial ships. The Office of Force Transformation (OFT) report on alternative fleet architectures discussed later in this testimony essentially proposes this by using a merchant-like hull as the basis for building four kinds of large surface ships.

Ambiguity And Volatility In Navy Plans

A significant current issue for the shipbuilding industrial base is ambiguity regarding required numbers of Navy ships and year-to-year volatility in the composition of the Navy's six-year shipbuilding plan. 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.

⁵(...continued)

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/EB 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.

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 (Report RS21566, *The Jones Act: An Overview*, by John F. Frittelli), "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."

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, which would qualify them under the Jones Act. (Avondale's web site [<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.")

In addition, ambiguity concerning required numbers of Navy ships, combined with year-to-year volatility in Navy shipbuilding plans, can make it difficult for shipbuilding firms to make business decisions in areas such as production planning, workforce management, facilities investment, company-sponsored research and development, and potential mergers and acquisitions.⁶

Ambiguity concerning required numbers of Navy ships may also 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

⁶In an interview published in the February 2005 issue of *Seapower* magazine, for example, Michael Petters, the president of NGNN, 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.

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 be 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.)

Navy for presenting a confused and changing picture of Navy ship requirements and procurement plans.⁷

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,⁸ and the Navy's March 2005 interim report to Congress on long-range shipbuilding requirements, which details the composition of 260- and 325-ship fleets for FY2035,⁹ together do not resolve the current ambiguity regarding required numbers of Navy ships, for the following reasons:

- Using the 260-ship fleet as a baseline, the range of 260 to 325 ships equates to a 25% range of variability in the potential total number of ships. Although for some ship categories, such as ballistic missile submarines and cruise missile submarines, there is little or no difference in the number of ships included in the 260- and 325-

⁷For example, the conference report (H.Rept. 107-772 of November 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 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)

⁸See, for example, Statement of Admiral Vernon Clark, USN, Chief of Naval Operations, Before the Senate Armed Services Committee, 10 February 2005, pp. 18-19, and Statement of Admiral Vernon Clark, USN, Chief of Naval Operations, Before the House Armed Services Committee, 17 February 2005, pp. 19-20.

⁹U.S., Department of the Navy, *An Interim Report To Congress on Annual Long-Range Plan For The Construction Of Naval Vessels For FY 2006*. Washington, 2005. 5 pp. (This report was delivered to the defense committees of Congress on March 23, 2005. Defense trade publications obtained copies of the report and at least one publication posted the report on its Web site.)

ship fleets, for other ship categories, there are substantial differences. When translated into percentage terms, the difference is 37% for cruisers and destroyers, 30% for littoral combat ships, 41% for amphibious ships, and 43% for maritime prepositioning ships. For the remaining categories of ships — attack submarines, aircraft carriers, combat logistics ships, and other ships — the percentage ranges of variability are 10% or less. In the case of aircraft carriers, however, the one-ship difference under two fleet plans can translate into a substantial difference in Navy funding requirements and shipbuilding work.

- The Navy’s testimony and report do not make clear whether the range of 260 to 325 ships, or the compositions of the 260- and 325-ship fleets, have been endorsed by the Secretary of Defense as official Department of Defense (DOD) force-structure planning goals.
- The March 2005 report does not present a 30-year shipbuilding plan. Instead, it presents a 30-year projection of potential Navy force levels from which potential annual shipbuilding rates can be only partially inferred.

Impact Of Navy Shipbuilding Plans On Industrial Base

Overall Ship-Procurement Rate

The FY2006-FY2011 plan (see **Table 1** on the next page) 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, Littoral Combat Ships (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. 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 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.¹⁰ For the six shipyards that

¹⁰The 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 (continued...)

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.

Table 1. 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(R) | | | 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).

Individual Shipbuilding Programs

CVN-21 Aircraft Carrier Program. CVN-21, the next aircraft carrier, is to be built by 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. Navy officials state this was due to the need to finance the procurement in FY2007 of other ships, including the lead DD(X) destroyer and the LHA(R) amphibious assault ship. The FY2006-

¹⁰(...continued)

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).

FY2011 plan would also defer the procurement of the carrier after CVN-21 from FY2011 to FY2012.¹¹

Navy officials state that the deferral of CVN-21 to FY2008 increased CVN-21's procurement cost by about \$400 million. The deferral lengthened the already-considerable production gap at NGNN between CVN-21 and the previous carrier, CVN-77, which was procured in FY2001. Lengthening this gap reduced 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 construction could require training and be less productive initially than experienced workers.

The lengthened 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 GD/EB and NGNN. The FY2006-FY2011 plan would maintain Virginia-class procurement at one per year through FY2011. The FY2005-FY2009 plan had called for increasing Virginia-class procurement to two per year starting in FY2009.¹² 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.

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

Some Navy and industry officials are concerned that unless a major submarine-design project is begun soon, the submarine design and engineering base will begin to atrophy through the departure of experienced personnel. Rebuilding an atrophied submarine design and engineering base, these Navy and industry officials believe, could add substantial time and cost to the next submarine-design effort, whenever it might begin. Concern about this possibility among some Navy and industry officials has been strengthened by the UK's recent difficulties in designing its new Astute-class SSN. The UK submarine design and engineering base atrophied for lack of submarine design work, and the subsequent Astute-class design effort has experienced considerable delays and cost overruns.

¹¹For 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.

¹²For 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.

Submarine designers and engineers from GD/EB were assigned to the Astute-class project to help the UK overcome these problems.¹³

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-FY2011.¹⁴

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.¹⁵

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

¹³See, for example, Andrew Chuter, “U.K. Spending Mounts For U.S. Help On Sub,” *Defense News*, September 13, 2005: 4; Richard Scott, “Electric Boat Provides Project Director For Astute Class,” *Jane’s Navy International*, May 2004: 33; Richard Scott, “Astute Sets Out On The Long Road To Recovery,” *Jane’s Navy International*, December 2003: 28-30; Richard Scott, “Recovery Plan Shapes Up For Astute Submarines,” *Jane’s Defence Weekly*, November 19, 2003: 26.

¹⁴For more on the DD(X) program, see CRS Report RS21059, *Navy DD(X) and CG(X) Programs: Background and Issues for Congress*, by Ronald O’Rourke, and CRS Report RL32109, *Navy DD(X), CG(X), and LCS Ship Acquisition Programs: Oversight Issues and Options for Congress*, by Ronald O’Rourke.

¹⁵The Navy’s FY2005-FY2009 plan proposed funding the construction of 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. 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 be 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 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 sixth DD(X) might be procured in FY2012. If so, then the total procurement quantity for the DD(X) program would be six ships.¹⁶ The FY2006-FY2011 FYDP, however, contains no advance procurement funding in FY2011 to support the procurement of a sixth DD(X) in FY2012.

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 proportional to light-ship displacement, then building a DD(X) might generate about 75% more shipyard work than building a DDG-51, 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 NG/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).¹⁷ 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

¹⁶For 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.

¹⁷GD/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.

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.

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 (WMEC-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 1980s¹⁸ — or establishing it at a yard that has not previously built larger, complex surface combatants, but could be made capable of doing so.

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 FY2010.¹⁹ 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(R) Amphibious Ship Program. The LHA(R) amphibious assault ship would be built by NGSS, primarily NG/Ingalls. Compared to the FY2005-FY2009 plan, the FY2006-FY2011 plan would accelerate the procurement of LHA(R) by one year, to FY2007. The FY2004-FY2009

¹⁸The 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.

¹⁹For 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.

shipbuilding plan that the Navy submitted to Congress in February 2003 showed LHA(R) in FY2007. Accelerating procurement of LHA(R) to FY2007 can thus be viewed as restoring the year of procurement shown in the plan submitted to Congress in 2003.²⁰ The acceleration of LHA(R) to FY2007 would improve NG/Ingalls' ability to shift workers from the previous amphibious assault ship, LHD-8, to LHA(R), and perhaps help NG/Ingalls somewhat in managing the potential consequences of decisions regarding the DD(X) program.

TAKE Auxiliary Cargo Ship Program. Lewis and Clark (TAKE-1) class auxiliary cargo ships are built by 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 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 at that time for the winding down of other shipbuilding programs.

MPF(F)/MPF(A) Maritime Positioning 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 FY2009.²¹ 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 at that time for the winding down of other shipbuilding programs.

Options For Supporting Shipbuilding Industrial Base

Aircraft Carrier Industrial Base. One option for supporting the aircraft carrier 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 detailed design and non-recurring engineering (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(R) or the lead DD(X).²²

²⁰For more on the LHA(R) program, see CRS Report RL32513, *Navy-Marine Corps Amphibious and Maritime Positioning Ship Programs: Background and Oversight Issues for Congress*, by Ronald O'Rourke.

²¹For more on the MPF(F) program, see CRS Report RL32513, op cit.

²²For more on the potential use of incremental funding or advance appropriations in Navy ship procurement, (continued...)

Submarine Industrial Base. One option for supporting the design and engineering portion of the submarine industrial base would be to design a new type of submarine. In recent months, two options have emerged for designing and procuring a new type of attack submarine. One option involves designing a non-nuclear-powered submarine equipped with an air-independent propulsion (AIP) system that could be procured in tandem with Virginia-class SSNs. The other option involves designing a reduced-cost SSN using new “Tango Bravo” technologies being developed by the Navy that would be procured as a successor to the Virginia-class design. Some or all of \$600-million fund included in the FY2006-FY2011 FYDP for “a future undersea superiority system” could be used to help finance either option.

AIP-Equipped Non-Nuclear-Powered Submarine. The OFT report on potential fleet platform architectures that is discussed later in this testimony proposed a future Navy consisting of several new kinds of ships, including AIP-equipped non-nuclear-powered submarines.²³ AIP-equipped submarines are currently being acquired by certain foreign navies.

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.

In contrast, a nuclear-powered submarine’s submerged endurance, at any speed, tends to be limited by the amount of food that it can carry. In practice, this means that a nuclear-powered submarine can remain submerged for weeks or months at a time, operating at high speeds whenever needed.

AIP submarines could be procured in tandem with Virginia-class boats. One possibility, for example, would be to procure one Virginia-class boat plus one or more AIP submarines each year.

Reduced-Cost “Tango Bravo” SSN. 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

²²(...continued)

see CRS Report RL32776, *Navy Ship Procurement: Alternative Funding Approaches — Background and Options for Congress*, by Ronald O’Rourke.

²³See also Christopher J. Castelli, “Defense Department Nudges Navy Toward Developing Diesel Subs,” *Inside the Navy*, March 7, 2005; Dave Ahearn, “Lawmakers Assail Navy Budget, But Eye Non-Nuke Subs,” *Defense Today*, March 3, 2005.

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, (c) 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.²⁴

Some 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.

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 no more than 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 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 earlier than FY2011; conversely, some Navy officials believe the lead ship might not be ready for procurement until after FY2011.) If the lead ship 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.

Factors To Consider In Assessing Options. In weighing these options against one another, and against the option of simply continuing to procure Virginia-class SSNs, potential factors

²⁴Navy information paper on advanced submarine system development provided to CRS by Navy Office of Legislative Affairs, Jan. 21, 2005. For additional discussion of the Tango Bravo program, see Aarti Shah, “Tango Bravo Technology Contract Awards Expected This Spring,” *Inside the Navy*, March 14, 2005; Andrew Koch, “US Navy In Bid To Overhaul Undersea Combat,” *Jane’s Defence Weekly*, March 9, 2005: 11; Lolita C. Baldor, “Smaller Subs Could Ride Waves Of The Future,” *NavyTimes.com*, February 4, 2005; Robert A. Hamilton, “Navy, DARPA Seek Smaller Submarines,” *Seapower*, February 2005: 22, 24-25.

for Congress to consider include cost, capability, technical risk, and effect on the industrial base. Each of these is discussed below.

Cost. The Virginia-class program has a projected total development cost of roughly \$4 billion. An AIP submarine or Tango Bravo SSN could similarly require billions of dollars in up-front costs to develop.

The OFT report recommended substituting four AIP-submarines for one Virginia-class submarine in each carrier strike group, suggesting that four AIP submarines might be procured for the same cost (\$2.4 billion to \$3.0 billion in the FY2006-FY2011 FYDP) as one Virginia-class submarine. This suggests 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 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. If so, then the annual cost of procuring one Virginia-class SSN plus one, two, or perhaps three AIP submarines could be equal to or less than that of procuring two Virginia-class boats per year.

If the procurement cost of a Tango Bravo SSN were no more than 67% that of a Virginia-class boat, then the annual procurement cost of two Tango Bravo SSNs could be equal to no more than 1.33 Virginia-class SSNs.

Capability. 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.

With regard to the first of the three points above, the OFT report proposes transporting the AIP submarines into the overseas theater of operations aboard a transport ship.²⁵ 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.

²⁵The 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.

With regard to the second and third points above, the effectiveness of an AIP submarine would depend on what kinds of operations the submarine might need to perform on a day-to-day basis or in conflict situations while operating as part of a forward-deployed carrier strike group.

One 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.

One risk of a plan to shift to procurement of Tango Bravo SSNs is that financial pressures in future years could lead to a decision to limit procurement of Tango Bravo SSNs to one per year. If the Tango Bravo SSN were equivalent in capability to the Virginia-class, however, this would produce a U.S. SSN force no less capable than would have resulted if Virginia-class procurement were continued at one per year.

Technical Risk. Developing and designing an AIP submarine would entail a certain amount of technical risk, particularly since a non-nuclear-powered combat submarine has not been designed and procured for the U.S. Navy since the 1950s.

Developing and designing a Tango Bravo SSN would similarly entail a certain amount of technical risk, particularly with regard to maturing the Tango Bravo technologies and incorporating them into an integrated SSN design. The earlier the target date for procuring the first Tango Bravo SSN, the higher the technical risk might be.

In contrast to either of these options, simply continuing to procure Virginia-class SSNs would likely entail substantially less technical risk, unless an attempt were made to incorporate very substantial changes into the Virginia-class design, in which case the difference in technical risk compared to the two new-design options might not be as great.

Effect On Industrial Base. Starting design work now on a new submarine could provide near-term support to the submarine design and engineering portion of the submarine industrial base and thereby help maintain that base.

An AIP submarine could be designed at either GD/EB, NGNN, or a yard that currently does not design submarines for the U.S. Navy, such as NG/Ingalls. NG/Ingalls has been associated with proposals in recent years for building non-nuclear-powered submarines for export to foreign countries such as Taiwan. If design work for an AIP submarine were to be done at GD/EB, NGNN, or both, it would help maintain certain submarine design and engineering skills at one or both of those yards. It would not, however, maintain certain skills at those yards related to the design and engineering of submarine nuclear propulsion plants. If the design were to be done at NG/Ingalls or some other yard, it might not directly support the maintenance of any submarine design and engineering skills at GD/EB or NGNN.

A Tango Bravo SSN could be designed by GD/EB, NGNN, or both, so the potential effect of a Tango Bravo SSN program on the submarine design and engineering base would depend in part on the acquisition strategy pursued for the program. At the yard or yards doing the design work, it would help to maintain various skills related to the design of nuclear-powered submarines, including skills related to the design and engineering of submarine nuclear propulsion plants.

After completing the design of an AIP submarine or Tango Bravo SSN, the submarine 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 back to designing a follow-on attack submarine that would take advantage of technologies even more advanced than those available today. This sequence of three successive submarine design projects could help maintain the submarine design and engineering base for the next 15 or so years.

The potential effect of an AIP submarine procurement program on the construction portion of the submarine industrial base would depend in part on where the submarines would be built. AIP submarines could be built at either GD/EB, NGNN, or a yard that currently does not build submarines, such as NG/Ingalls. If financial pressures in future years lead to a decision to increase procurement of AIP submarines while reducing procurement of Virginia-class submarines to something less than one per year, this would benefit the yard building the AIP submarines but reduce Virginia-class construction work at GD/EB and NGNN below levels that might have occurred under the option of simply continuing with Virginia-class procurement.

A Tango Bravo SSN could be built at either GD/EB, NGNN, or both, so the potential effect of a Tango Bravo SSN program on the submarine construction industrial base would depend in part on the acquisition strategy pursued for the program. If Tango Bravo SSNs were procured at a rate of two per year, this could result in a greater total volume of SSN construction work than might have occurred under the option of simply continuing with Virginia-class procurement. Conversely, if financial pressures in future years lead to a decision to limit procurement of Tango Bravo SSNs to one per year, this could result in a lower total volume of SSN construction work than might have occurred under the option of simply continuing with Virginia-class procurement.

Surface Combatant Industrial Base. Options for supporting the surface combatant industrial base can be divided into options for supporting the base between now and about FY2011, and options for supporting the base in FY2011 and beyond.

Options for FY2006-FY2011. Options for supporting the surface combatant industrial base between now and 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(R) 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,²⁶ 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 FY2006-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 31 to 33 large and medium cutters (six to eight large cutters and 25 medium cutters) over a period of many years at low annual production rates. Some analysts believe that more than 31 to 33 of these cutters will be needed to fully meet the Coast Guard's expanded post-9/11 mission requirements. The RAND Corporation published a report in 2003 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.²⁷ Members of Congress and others have expressed interest in accelerating procurement of these cutters and in expanding the total number of cutters to be procured.

In terms of light-ship displacement, four or five large or medium Deepwater cutters would be roughly equivalent to one DD(X). Procuring four or five of these cutters per year might therefore

²⁶The Navy for several years stated that it planned to build a total of 57 DDG-51s. A total of 62 were procured.

²⁷John Birkler, et al., *The U.S. Coast Guard's Deepwater Force Modernization Plan: Can It Be Accelerated? Will It Meet Changing Security Needs?*, RAND, National Security Research Division, MR-3128.0-USCG, Sept. 2003.

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 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.²⁸

Options For FY2011 and Beyond. 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.

The prospect of a one-per-year rate might also raise questions about the potential cost effectiveness of the DD(X)/CG(X) effort when measured in terms of average unit acquisition cost, which is the average cost to develop and procure each ship. Given the \$10 billion dollars in research and development funding programmed for the DD(X) program, if DD(X)s or CG(X)s are procured at a rate of one per year for 20 or fewer years and the combined number of DD(X)s and CG(X)s is consequently 20 or less, then the average acquisition cost for the DD(X)/CG(X) effort could be more than \$3 billion per ship.

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

²⁸For additional discussion of the Deepwater program, see CRS Report RS21019, *Coast Guard Deepwater Program: Background and Issues for Congress*, by Ronald O'Rourke.

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 might maintain the cruiser-destroyer force at a level closer to what the Navy may be planning. A rate of two ships per year might 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;
- 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 February 2005 report on options for the FY2006 federal budget.²⁹ 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 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 needed.

²⁹U.S. Congressional Budget Office, *Transforming the Navy's Surface Combatant Force*, Mar. 2003, pp. 27-28, 63; and U.S. Congressional Budget Office, *Budget Options*, Feb. 2005, pp. 18-19.

Independent Studies on Fleet Architecture³⁰

Origin of Studies

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 future fleet platform architectures (i.e., potential force structure plans) for the Navy. Subsection (d) of Section 216 stated 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....”³¹

The two studies required by Section 216 were conducted by the Center for Naval Analyses (CNA) and the Office of Force Transformation (OFT) and were submitted to the congressional defense committees in February 2005.

A third independent study on potential future fleet platform architectures was conducted by the Center for Strategic and Budgetary Assessments (CSBA). CSBA conducted this study on its own initiative and made it available to congressional and other audiences in March 2005 as an alternative to the CNA and OFT studies.

Force Structure Recommendations

CNA Report.³² The CNA report uses essentially the same kinds of ships and naval formations as those planned by the Navy. The report recommends a Navy force structure range of 256 to 380 ships. The low end of the range assumes a greater use of crew rotation and overseas homeporting of Navy ships than the high end. **Table 2** below compares the CNA-recommended force range to the Navy’s 375-ship fleet proposal of 2002-2004 and the notional 260- and 325-ship fleets for FY2035 presented in the Navy’s March 2005 interim report to Congress.

³⁰This section includes some material adapted with permission from a March 18, 2005 memorandum to the office of Representative Roscoe Bartlett.

³¹Section 216 is an amended version of a provision (Section 217) in the House-reported version of H.R. 1588. See pages 28-29 and 612-613 of H.Rept. 108-354, and pages 255-256 of the House report (H.Rept. 108-106 of May 16, 2003) on H.R. 1588.

³²Delwyn 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. (Hereafter CNA report.)

Table 2. CNA-Recommended Force and Other Proposals

| Ship type | CNA force range | Navy 375-ship proposal of 2002-2004 ^a | Notional Navy fleets for FY2035 | |
|--|-------------------|--|---------------------------------|------------|
| | | | 260 ships | 325 ships |
| Ballistic missile submarines (SSBNs) | 14 | 14 | 14 | 14 |
| Cruise missile submarines (SSGNs) | 4 | 4 | 4 | 4 |
| Attack submarines (SSNs) | 38 to 62 | 52 | 37 | 41 |
| Aircraft carriers | 10 to 12 | 12 | 10 | 11 |
| Cruisers and destroyers | 66 to 112 | 109 | 67 | 92 |
| Littoral combat ships (LCSs) | 40 to 70 | 56 | 63 | 82 |
| Amphibious ships | 18 to 30 | 36 | 17 | 24 |
| Maritime Prepositioning Force (Future) ships | 19 to 21 | 18 | 14 | 20 |
| Combat logistics (resupply) ships | 25 to 33 | 33 | 24 | 26 |
| Other ^b | 22 | 41 | 10 | 11 |
| Total battle force ships | 256 to 380 | 375 | 260 | 325 |

Source: Table prepared by CRS based on CNA report and March 2005 Navy report.

a Composition as shown in CNA report as the program of record for 2022. An earlier and 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 sea basing connector ships.

OFT Report.³³ The OFT report 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

³³U.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. (Hereafter OFT report.)

unmanned underwater vehicles (UUVs), unmanned surface vehicles (USVs), and mission modules for the 1,000-ton surface combatant described below.

- **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.
- **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.
- **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.
- **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.
- **A non-nuclear-powered submarine** equipped with an air-independent propulsion (AIP) system. 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.³⁴

³⁴The 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 (continued...)

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

The OFT report combines these eight types of ships, plus the Navy’s currently planned TAOE-class resupply ship, into a fleet that would include a much larger total number of ships than planned by the Navy, about the same number of carrier-based aircraft as planned by the Navy, and large numbers of unmanned systems. The OFT report presents three alternative versions of this fleet, which the report calls Alternatives A, B, and C. The report calculates that each of these alternatives would be equal in cost to the equivalent parts of the Navy’s 375-ship proposal. Each of these alternative force structures, like the equivalent parts of the Navy’s 375-ship proposal, 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 3** below.

Table 3. 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 |
| <i>Subtotal 1,000- and 100-ton ships</i> | <i>417</i> | <i>609</i> | <i>609</i> |
| <i>Subtotal other ships</i> | <i>141</i> | <i>165</i> | <i>237</i> |
| 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 early copies of 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.

³⁴(...continued)

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 February 18, 2005 meeting between CRS and analysts who contributed to the OFT report.

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.

CSBA Report.³⁵ The CSBA report uses many of the same ship designs currently planned by the Navy, but also proposes some new ship designs. The CSBA report also proposes ship formations that in some cases are different than those planned by the Navy. **Table 4** below compares the CSBA-recommended force structure to CNA's recommended force range, the Navy's 375-ship fleet proposal of 2002-2004, and the notional 260- and 325-ship fleets for FY2035 presented in the Navy's March 2005 interim report to Congress.

³⁵Robert O. Work, *Winning the Race: A Naval Fleet Platform Architecture for Enduring Maritime Supremacy*. Washington, Center for Strategic and Budgetary Assessments, 2005. (Version as of March 1, 2005, which is in the form of a slide briefing with 322 slides. Hereafter CSBA report.)

Table 4. CSBA-Recommended Force and Other Proposals

| Ship type | CSBA force | CNA force range | Navy 375-ship proposal of 2002-2004 ^a | Notional Navy fleets for FY2035 | |
|--------------------------------------|-------------------------------|-----------------------|--|---------------------------------|-----------------|
| | | | | 260 ships | 325 ships |
| Ballistic missile submarines (SSBNs) | 12 ^b | 14 | 14 | 14 | 14 |
| Cruise missile submarines (SSGNs) | 6 ^b | 4 | 4 | 4 | 4 |
| Attack submarines (SSNs) | 54 ^c | 38 to 62 | 52 | 37 | 41 |
| Large-deck aircraft carriers (CVNs) | 10 | 10 to 12 | 12 | 10 | 11 |
| Medium aircraft carriers (CVEs) | 4 | 0 | 0 | 0 | 0 |
| Afloat forward staging base (AFSB) | 1 | 0 | 0 | 0 | 0 |
| Cruisers and destroyers | 84 or 86 | 66 to 112 | 109 | 67 | 92 |
| Littoral combat ships (LCSs) | 84 | 40 to 70 | 56 | 63 | 82 |
| Amphibious ships | 32 ^d | 18 to 30 | 36 | 17 | 24 |
| Maritime Prepositioning Force ships | 16 ^e | 19 to 21 ^e | 18 ^e | 14 ^e | 20 ^e |
| Combat logistics (resupply) ships | 36 ^f | 25 to 33 | 33 | 24 | 26 |
| Other ^g | 34 ^h | 22 | 41 | 10 | 11 |
| Total battle force ships | 373 or 375ⁱ | 256 to 380 | 375 | 260 | 325 |

Source: Table prepared by CRS based on CSBA report, CNA report, and March 2005 Navy report.

a Composition as shown in CNA report as the program of record for 2022. An earlier and somewhat different composition is shown in CRS Report RL32665.

b Alternatively, 10 SSBNs and 8 SSGNs.

c Includes one special-mission submarine. Total number drops slightly over next 12 years.

d Includes 8 LHDs and 24 LPD-17s.

e In the CSBA force, these are existing MPF ships; in the other fleets, they are MPF(Future) ships.

f Includes 8 TAOEs, 11 TAKEs, and 17 TAOs.

g Includes command ships, and support ships (such as salvage ships and submarine tenders), dedicated mine warfare ships, and sea basing connector ships.

h Includes, among other ships, 2 TAVBs and 8 TLKAs associated with the amphibious and MPF ships.

i In addition to these ships, the CSBA report notes that U.S. maritime forces would include 35 DOD prepositioning and surge sealift ships used primarily by the Army and Air Force, and 91 large, medium, and fast-response (i.e., small) cutters planned for procurement under the Coast Guard Deepwater acquisition program.

The CSBA report makes numerous specific recommendations for ship force structure and ship acquisition, including the following:

- **Aircraft carriers.** When the George H.W. Bush (CVN-77) enters service in 2008 or 2009, do the following:
 - Retire the two remaining conventional carriers — the Kitty Hawk CV-63) and the Kennedy (CV-67).

- Convert the Enterprise (CVN-65) into an afloat forward staging base (AFSB) with a mixed active/reserve/civilian crew, to be used in peacetime for aviation testing and in crises for embarking special operations forces, Army or Marine Corps forces, or joint air wings.
 - Begin replacing the 10 Nimitz (CVN-68) class carriers on a one-for-one basis with CVN-21-class carriers procured once every five years using incremental funding.
 - Redesignate the LHA(R) as a medium sized carrier (CVE) and procure one every three years starting in FY2007 using incremental funding.³⁶
- **Submarines.**
 - Maintain Virginia-class SSN procurement at one per year for the next several years, producing an eventual total of perhaps 20 Virginia-class boats.
 - Begin immediately to design a new “undersea superiority system” with a procurement cost 50% to 67% that of the Virginia-class design, with the goal of achieving a procurement rate of two or three of these boats per year no later than FY2019.
 - Study options for extending the service lives of the three Seawolf SSNs and the 31 final Los Angeles-class SSNs to mitigate the projected drop in SSN force levels during the 2020s.
 - Reduce the SSBN force from 14 ships to 12 ships and convert an additional two SSBNs into SSGNs, for a total of six SSGNs.
 - Study the option of reducing the SSBN force further, to 10 ships, which would permit another two SSBNs to be converted into SSGNs, for a total of eight SSGNs.³⁷
 - **Destroyers and cruisers.**
 - Procure a single DD(X) in FY2007, using research and development funding, as the first of three surface combatant technology demonstrators.
 - Start a design competition for a next generation, modular surface combatant or family of combatants, with capabilities equal to or greater than the DD(X)/CG(X), but with a substantially lower procurement cost.
 - Build two additional surface combatant technology demonstrators to compete against the DD(X) design.
 - Use the results of this competition to inform the design of a new surface combatant, called SCX, with a procurement cost perhaps one-third to one-half that of the DD(X).
 - Begin procuring this new design in FY2015 as a replacement for the DD(X)/CG(X) program.
 - Consider modifying the LPD-17 design into a low-cost naval surface fire support ship carrying the Advanced Gun System (AGS) that was to be carried by the DD(X).
 - Consider procuring two additional DDG-51s to help support the surface combatant industrial base in the near-term.³⁸

³⁶CSBA report, slides 154-158.

³⁷CSBA report, slides 276, 284, 289, 297, 299.

³⁸CSBA report, slides 246, 249, and 251-253. Slide 249 states that possibilities for a reduced-cost alternative to the DD(X) include a surface combatant based on the LPD-17 design, a semi-submersible ship built to commercial standards (like a ship called the “Stryker” that was proposed several years ago), and a large or medium “carrier of large objects,” perhaps built to relaxed commercial standards.

- **Littoral Combat Ships and Coast Guard Deepwater cutters.**
 - Procure six LCSs per year for a total of 84 LCSs — 42 of the Lockheed design, and 42 of the General Dynamics design.
 - Organize these 84 ships into 42 divisions, each consisting of one Lockheed ship and one General Dynamics ship, so that each division can benefit from the complementary strengths of the two designs.
 - Ensure that mission packages for the LCS and mission packages for the Coast Guard’s large and medium Deepwater cutters are as mutually compatible as possible.
 - Include the Coast Guard’s Deepwater cutters when counting ships that contribute to the country’s total fleet battle network.
 - Begin a research and development and experimentation program aimed at building several competing stealth surface combatant technology demonstrators for operations in contested or denied-access waters.³⁹

- **Amphibious ships.**
 - Complete LHD-8 to create a force of eight LHDs.
 - Rather than stopping procurement of LPD-17s after the ninth ship in FY2007, as now planned by the Navy, increase the LPD-17 procurement rate to two ships per year and use multiyear procurement (MYP) to procure a total of 24 LPD-17s.
 - Retire the 12 existing LSD-41/49 class ships, leaving a 32-ship amphibious fleet consisting of eight LHDs and 24 LPD-17s.
 - Form eight “distributed expeditionary strike bases” — each of which would include one LHD, three LPD-17s, one Aegis cruiser, three Aegis destroyers, two LCSs, and one SSGN.⁴⁰

- **MPF and other ships.**
 - Retain the three existing MPF squadrons over the near- to mid-term.
 - Reconfigure two of the squadrons for irregular warfare.
 - Use the third squadron as a swing asset to either reinforce the two irregular-warfare squadrons or to provide lift for assault follow-on echelon amphibious landing forces.
 - Develop high-speed intra-theater and ship-to-shore surface connectors.
 - Design an attack cargo ship (TAKA) to help support sustained joint operations ashore, with a target unit procurement cost of \$500 million or less, and begin procuring this ship in FY2014.
 - Replace the two existing hospital ships, the four existing command ships, and existing support tenders with new ships based on the LPD-17 design.
 - Initiate a joint experimental program for future sea-basing platforms and technologies.⁴¹

The CSBA report raises several questions about the Navy’s emerging sea basing concept for conducting expeditionary operations ashore. The report states:

The work done thus far on sea basing is intriguing, but neither the concept nor the supporting technologies appear sufficiently mature to justify any near-term decisions such as canceling LPD-

³⁹CSBA report, slides 275, 277, and 283.

⁴⁰CSBA report, slides 227 and 236.

⁴¹CSBA report, slides 228-232, and 307.

17 [procurement] in favor of MPF(F) ships, or removing the well deck from the big deck amphibious assault platforms, both of which would severely curtail the [fleet's] ability to launch surface assaults over the longer term.

Given these large uncertainties, no major moves toward the sea basing vision should be made without further exploring the sea basing concept itself, and experimenting with different numbers and types of sea base platforms, connectors, and capabilities.⁴²

Observations

Observations about the CNA, OFT, and CSBA reports can be made on several points, including the following:

- organizations and authors;
- analytical approach;
- use of prospective ship-procurement funding levels as a force-planning consideration;
- fleet size and structure;
- whether the recommended force qualifies as an alternative fleet architecture;
- fleet capability;
- transition risks; and
- implications for the industrial base.

Each of these is discussed below.

Organizations and Authors.

CNA Report. CNA is a federally funded research and development center (FFRDC) that does much of its analytical at the Navy's request. The CNA 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.

OFT Report. 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 and the President of the Naval War College (NWC) from July 24, 1998 to August 22, 2001. During his time at NWC and OFT, Cebrowski was a leading proponent of network-centric warfare and distributed force architectures.

CSBA Report. The CSBA report was prepared by Robert Work, CSBA's analyst for maritime issues. CSBA describes itself as "an independent, policy research institute established to promote innovative thinking about defense planning and investment strategies for the 21st century. CSBA's analytic-based research makes clear the inextricable link between defense strategies and budgets in fostering a more effective and efficient defense, and the need to transform the US military in light of an emerging military revolution."⁴³ CSBA's Executive Director is Dr. Andrew F. Krepinevich, Jr., whose previous experience includes work in DOD's Office of Net Assessment, the

⁴²CSBA report, slide 212.

⁴³Source: CSBA's website [<http://www.csbaonline.org>].

office directed by Andrew Marshall. Krepinevich is generally considered a major writer on defense transformation.

Analytical Approach.

CNA Report. The CNA report grounds its analysis in traditional DOD force-planning considerations and campaign modeling. The report cites past DOD force-planning studies that reflect similar approaches. The implicit argument in the CNA report is that its findings have weight in part because they reflect a well-established and systematic approach to the problem.

OFT Report. In contrast to the CNA report, the OFT report “calls into question the viability of the longstanding logic of naval force building.”⁴⁴ The OFT report grounds its analysis in four major force-design principles that the report identifies as responsive to future strategic challenges and technological opportunities.⁴⁵ The report then seeks to design a fleet that is consistent with these principles, and assesses that fleet using a new set of metrics that the report believes to be consistent with these principles. The implicit argument in the OFT report is that its findings have weight in part because they reflect major force-design principles that respond to future strategic challenges and technological opportunities.

CSBA Report. The CSBA report employs an extensive historical analysis of the missions and structure of the U.S. Navy and other navies. The report argues that the structure of the U.S. Navy has shifted over time in response to changes in technology and U.S. security challenges, and that U.S. military forces have entered a new security era (which the report calls the “Joint Expeditionary Era”) during which the U.S. Navy will need to do three things.⁴⁶ To do these three things, the report argues, the Navy should be structured to include four different force elements.⁴⁷ The report constructs these four force elements and then combines them to arrive at an overall recommended Navy force structure. The implicit argument in the CSBA report is that its findings have weight in part because they reflect insights about future missions and force requirements gained through careful historical analysis of the missions and structure of the U.S. Navy and other navies.

Prospective Ship-Procurement Funding Levels As A Consideration.

CNA Report. The CNA report aims at designing a cost-effective fleet. It also mentions cost estimates relating to the option of homeporting additional attack submarines at Guam.⁴⁸ Prospective ship-procurement funding levels, however, are not prominently featured in the CNA report as a force-planning consideration.

⁴⁴OFT report, p. 1

⁴⁵The principles are complexity, smaller ships and improved payload fraction, network-centric warfare, and modularity.

⁴⁶These three things are: (1) contribute to the global war on terrorism (GWOT); (2) prepare for possible nuclear-armed regional competitors; and (3) hedge against the possibility of a disruptive maritime competition with China.

⁴⁷These four force elements are: (1) a sea-based power-projection and regional deterrence force; (2) a global patrol, GWOT, and homeland defense force; (3) a force for prevailing over enemy anti-access/area-denial forces; and (4) a strategic deterrence and dissuasion force.

⁴⁸CNA Report, p. 36.

OFT Report. Prospective ship-procurement funding levels are a significant force-planning consideration in the OFT report. The report argues that an important metric for assessing a proposed fleet architecture is the ease or difficulty with which it can be scaled up or down to adapt to changes in ship-procurement funding levels.

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 288 ships, except that the future force would include a substantial number of relatively inexpensive LCSs. If proportionate reductions are applied to the OFT fleets shown in **Table 3**, 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.

CSBA Report. As with the OFT report, prospective ship-procurement funding levels are a significant force-planning consideration in the CSBA report. The CSBA report estimates that in future years, the Navy may have an average of about \$10 billion per year in ship-acquisition funding. The report then aims at designing a force whose ships could be acquired for this average annual amount of funding.

Fleet Size and Structure.

CNA Report. 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 similar in size and composition to the Navy's 260-ship fleet for FY2035, except that the 260-ship fleet has more LCSs and fewer ships in the "other ships" category.⁴⁹

OFT Report. The OFT-recommended fleet would have a much larger total number of ships than the Navy's planned fleet. The OFT fleet would also feature a much larger share of small combatants. Of the ships shown in **Table 3**, the small combatants account for about 75% in Alternative A, about 79% in Alternative B, and about 72% in Alternative C. (Adding into the mix SSNs and other kinds of ships not shown in **Table 3** would reduce these percentages somewhat.) In the Navy's notional 260- and 325-ship fleets, by contrast, LCSs account for about 25% of the total number of ships.

The OFT architecture is similar in certain ways to a fleet architecture proposed by the Naval Surface Warfare Center (NSWC) between 1989 and 1992 and sometimes referred to as the Carrier of Large Objects (CLO) proposal. 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,

⁴⁹Additional points of comparison: The CNA range of 256 to 380 ships overlaps with potential ranges of 290 to 375 ships, 260 to 325 ships, and 243 to 302 ships presented in the Navy's February 2005 testimony to Congress. 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.

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 NSW 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.⁵⁰

CSBA Report. The CSBA force would have about the same total number of ships as the Navy's 375-ship fleet proposal. CSBA's subtotals for some ship categories are similar to subtotals in one or more of the other fleet proposals shown in **Table 4**. Significant differences between the CSBA proposal and the other fleet proposals shown in **Table 4** include:

- the four medium-sized aircraft carriers (CVEs);
- the conversion of a carrier into an afloat forward staging base;
- the composition of the cruiser-destroyer force (which would include SCXs rather than DD(X)s and CG(X)s);
- the composition of the amphibious fleet (which would have additional LPD-17s in lieu of today's LSD-41/49s); and
- the composition of the maritime prepositioning force (which would continue to include, for a time at least, today's MPF ships rather than the Navy's planned MPF(F) ships).

Does It Qualify As An Alternative Force Architecture?

CNA Report. As mentioned earlier, the CNA report uses essentially the same kinds of ships and naval formations as those 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.

OFT Report. Since the OFT report proposes building ships that are substantially different from those currently planned, and combines them 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, the OFT-recommended force arguably would qualify as an alternative fleet platform architecture.

CSBA Report. Since the CSBA report proposes building ships that in some cases are different from those currently planned, and combines these ships into formations that in some cases are different in composition from those currently planned, the CSBA-recommended force arguably

⁵⁰For more on this proposed fleet architecture, see Norman Polmar, "Carrying Large Objects," *U.S. Naval Institute Proceedings*, December 1990: 121-122; Michael L. Bosworth *et al*, "Multimission Ship Design for an Alternative Fleet Concept," *Naval Engineers Journal*, May 1991: 91-106; Michael L. Bosworth, "Fleet Versatility by Distributed Aviation," *U.S. Naval Institute Proceedings*, Jan. 1992: 99-102; and Victor A. Meyer, "Naval Surface Warfighting Vision 2030," *Naval Engineers Journal*, May 1992: 74-88. See also "USN's '2030' Plan For Future Fleet," *Sea Power*, Apr. 1992: 79, 82; Edward J. Walsh, "'Alternative Battle Force' Stresses Commonality, Capability," *Sea Power*, Feb. 1991: 33-35; Robert Holzer, "Navy Floats Revolutionary Ship Design for Future Fleet," *Defense News*, May 14, 1990: 4, 52; and Anne Rumsey, "Navy Plans Ship Look-A-Likes," *Defense Week*, Mar. 13, 1989: 3.

would qualify as an alternative fleet platform architecture, though less dramatically so than the OFT-recommended force.

New Ship Designs.

CNA Report. The CNA report does not propose any ship designs other than those already planned by the Navy.

OFT Report. The 57,000-ton aircraft carrier in the OFT report would be roughly the same size as the United Kingdom's new aircraft carrier design, and somewhat larger than the 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.

The 57,000-ton missile-and-rocket ship in the OFT report 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.⁵¹

The 13,500-ton aircraft carrier in the OFT report 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 flight deck. This ship could be considered a small, high-speed aircraft carrier.

The 1,000- and 100-ton surface combatants in the OFT report could be viewed as similar to, but smaller than, the 2,500- to 3,000-ton Littoral Combat Ship (LCS). Compared to the LCS, they 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).

The AIP submarine in the OFT report could be similar to AIP submarines currently being developed and acquired by a some foreign navies.

CSBA Report. The proposal in the CSBA report for an afloat forward staging base (AFSB) is similar to other proposals for AFSBs that have been reported in recent years, though other proposals have suggested using commercial ships or military sealift ships rather than converted aircraft carriers as the basis for the AFSB.⁵²

⁵¹For 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.

⁵²See, for example, Stephen M. Carmel, "A Commercial Approach to Sea Basing — Afloat Forward Staging Bases," *U.S. Naval Institute Proceedings*, January 2004: 78-79; Christopher J. Castelli, "Budget Anticipates Developing MPF(F) Aviation Variant From LMSR," *Inside the Navy*, January 19, 2004; Christopher J. Castelli, "Brewer Proposes Commercial Ship To Test Seabasing Technologies," *Inside the Navy*, January 27, 2003; Christopher J. Castelli, "In POM-04, Navy Cancels JCC(X), Plans To Substitute MPF(F) Variant," *Inside the Navy*, September 2, 2002; Christopher J. Castelli, "Navy May Develop New Support Ships, Pursue Sealift Experimentation," *Inside the Navy*, May 27, 2002.

The CVE in the CSBA report, like the 57,000-ton carrier in the OFT report, can be viewed as a medium-sized carrier. With a full load displacement of perhaps about 40,000 tons, the CVE would be somewhat smaller than the 57,000-ton carrier and consequently might embark a smaller air wing. The CVE, however, would be based on the LHA(R) amphibious ship design rather than a merchant-like hull, and consequently could incorporate more survivability features than the 57,000-ton carrier.

The proposal in the CSBA report for a new undersea superiority system with a procurement cost 50% to 67% that of the Virginia-class SSN design is similar to the Tango Bravo SSN discussed earlier in this testimony.

The proposals in the CSBA report for a reduced-cost new-design surface combatant called the SCX, and for a low-cost gunfire support ship, are broadly similar to the options for a reduced-cost new-design surface combatant discussed earlier in this testimony.

Fleet Capability.

CNA Report. The CNA report uses essentially the same kinds of ships and formations as planned by the Navy, and recommends generally the same numbers of ships as a function of force-planning variables such as use of crew rotation. As a consequence, the CNA-recommended force range would be roughly similar in overall capability to the Navy's planned architecture.

OFT Report. The OFT architecture differs so significantly from the Navy's planned architecture that assessing its capability relative to the Navy's planned architecture is not easy. As a general matter, the OFT report stresses overall fleet survivability more than individual-ship survivability, and argues that fleet effectiveness can be enhanced by presenting the enemy with a complex task of having to detect, track, and target large numbers of enemy ships. The OFT report argues that in addition to warfighting capability, a fleet can be judged in terms of its capability for adapting to changes in strategic demands and funding levels.⁵³

⁵³The OFT report argues that its recommended fleet architecture would:

- "provide a quantum leap ahead in capabilities against a spectrum of enemies ranging from large, highly developed competitors to small but determined asymmetric adversaries" (page 6) 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; (pages 1 and 2)
 - 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;" (page i)
 - permit more constant experimentation with new operational concepts, and thereby achieve
- (continued...)

Readers who agree with most or all of these propositions might conclude that the OFT-recommended architecture would be more capable than the Navy's planned architecture. Readers who disagree with most or all of these propositions might conclude that the OFT-recommended architecture would be less capable than the Navy's planned architecture. Readers who agree with some of these propositions but not others (or who agree with these propositions up to a certain point, but less fervently than OFT), might conclude that the OFT-recommended architecture might be roughly equal in total capability to the Navy's planned architecture.

In addressing the question of fleet capability, the OFT 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 [Navy's] programmed fleet often is as good as the [OFT] 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.⁵⁴

CSBA Report. The CSBA report argues that its architecture would provide a total capability equal to that of the Navy's planned architecture, but at a lower total cost, because the CSBA architecture would:

⁵³(...continued)

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

⁵⁴ OFT report, pp. 75-76. Italics as in the original.

- employ new ship designs, such the new undersea superiority system and the SCX, that, because of their newer technologies, would cost less than, but be equal in capability to, current designs such as the Virginia-class SSN and DD(X) destroyer; and
- make more use of the LPD-17 hull design, whose basic design costs have already been paid, and which can be produced efficiently in large numbers and adapted economically to meet various mission requirements.

It is plausible that using newer technologies would permit new, reduced-cost, ship designs to be more capable than such designs would have been in the past. Whether the increases in capability would always be enough to permit these ships to be equal in capability to more expensive current designs is less clear. The Navy may be able to achieve this with a new SSN design, because several new submarine technologies have emerged since the Virginia-class design was developed in the 1990s, but achieving this with a new large surface combatant design could be more challenging, because the DD(X) design was developed within the last few years and few new surface combatant technologies may have emerged since that time. If one or more of the reduced-cost designs turn out to be less capable than current designs, then the CSBA architecture would not generate as much total capability as the report projects.

The CSBA report also argues that its architecture would produce a force with a mix of capabilities that would better fit future strategic demands. To achieve this, the report recommends, among other things, reducing currently planned near-term procurement of new destroyers and MPF(F) ships, increasing currently planned procurement of new amphibious ships, and a changing the currently planned investment mix for aircraft carriers.

Readers who agree with CSBA's description of future strategic demands, and who agree that CSBA's recommended investment changes respond to those demands, might conclude that the CSBA-recommended architecture would be better optimized than the Navy's planned architecture to meet future needs. Readers who disagree with one or both of these propositions might conclude that the Navy's planned architecture might be better optimized, or that neither architecture offers clear advantages in this regard.

Transition Risks.

CNA Report. Since the CNA report uses essentially the same kinds of ships and naval formations as those in use today or planned by the Navy, and recommends similar numbers of ships, the transition risks of shifting from the Navy's currently planned force to the CNA-recommended force would appear to be small.

OFT Report. The OFT report does not include a detailed plan for transitioning from today's fleet architecture to its proposed architecture,⁵⁵ but such a plan could be developed as a follow-on

⁵⁵On 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

(continued...)

analysis. The plan could involve replacing existing ship designs and associated formations as they retire with OFT's recommended new ship designs and associated formations.

Compared to the CNA-recommended force, the OFT-recommended force would pose significantly greater transition risks because of the number of new ship designs involved, the differences between several of these ship designs and today's designs, and the new kinds of naval formations that would be used, which could require development of new doctrine, concepts of operations, and tactics.

CSBA Report. A stated goal of the CSBA report is to provide a detailed, practical transition road map for shifting from today's fleet structure to the report's recommended fleet structure. The many specific recommendations made in the report could be viewed as forming such a road map. Given that the CSBA-recommended force represents, in terms of ship designs and formations, more of a departure from Navy plans than the CNA-recommended force, but less of a departure from current Navy plans than the OFT-recommended force, the transition risks of the CSBA-recommended force might be viewed as somewhere in between those of the CNA- and OFT-recommended forces.

Implications For Industrial Base.

CNA Report. Since the CNA report uses essentially the same kinds of ships and naval formations as those in use today or planned by the Navy, and recommends similar numbers of ships, the industrial-base implications of the CNA-recommended force would appear to be similar to those of the Navy's current plans.

OFT Report. The OFT report seeks to 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. Similarly, the OFT report seeks to 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. The OFT report also aims to 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.

⁵⁵(...continued)

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 pp. 76-77 of the report.

As a consequence of these objectives, the OFT 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.⁵⁶

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."⁵⁷

CSBA Report. The CSBA report similarly raises significant potential issues for the six shipyards that have built the Navy's major warships in recent years. The report states that "Rationalizing the defense industrial base is... a critical part of DoN's [the Department of the Navy's] maritime competition strategy, and should be the subject of immediate consideration and deliberation by the Congress, DoD, and the DoN."⁵⁸ The report states:

Numerous studies have indicated that the six Tier I yards [i.e., the six yards that have built the Navy's major warships in recent years] have "exorbitant excess capacities," which contribute to the rising costs of [Navy] warships, primarily because of high industrial overhead costs. These capacities are the result of "cabotage laws and fluctuating national security acquisition policies that force shipbuilders of combatants to retain capacities to address required surges in coming years." This last point is especially important: the DoN contributes greatly to the problem of "exorbitant capacities" by its consistent tendency to portray overly optimistic ramp ups in ship production in budget "out years."⁵⁹

The report recommends the following as part of its overall transition strategy:

- Minimize production costs for more expensive warships (defined in the report as ships costing more than \$1.4 billion each) by consolidating production of each kind of such ship in a single shipyard, pursuing learning curve efficiencies, and requesting use of multiyear procurement (MYP) whenever possible.

⁵⁶OFT report, p. 76.

⁵⁷OFT report, p. 80.

⁵⁸CSBA report, slide 314.

⁵⁹CSBA report, slide 315.

- Minimize production costs for warships and auxiliaries costing less than \$1.4 billion each by emphasizing competition, shifting production to smaller “Tier II” yards, using large production runs, and enforcing ruthless cost control.⁶⁰

The report states that “the strategy developed in this report suggests that [Navy] planners might wish to:”

- maintain production of aircraft carriers at NGNN,
- consolidate production of large surface combatants and amphibious ships at NG/Ingalls, and
- consolidate submarine building GD/EB, or with a new, single submarine production company.⁶¹

The report states that the second of these possibilities is guided by the building sequence of LPD-17s and SCXs recommended in the report, NG/Ingalls’ ability to build a wider variety of ships than GD/BIW, NG/Ingalls’ surge capacity, and the availability of space for expanding NG/Ingalls if needed.⁶²

The report states that the third of these possibilities is guided by the low probability that procurement of Virginia-class submarines will increase to two per year, the cost savings associated with consolidating submarine production at one yard, GD/EB’s past experience in building SSBNs and SSNs, GD/EB’s surge capacity, and the fact that building submarines at GD/EB would maintain two shipyards (GD/EB and NGNN) capable of designing and building nuclear-powered combatants of some kind.⁶³

The report acknowledges that yard consolidation would reduce the possibilities for using competition in shipbuilding in the near term and increase risks associated with an attack on the

⁶⁰CSBA report, slide 316. Other steps recommended as part of the report’s overall transition strategy (see slides 124 and 125) include the following:

- Plan to a fiscally prudent steady-state shipbuilding budget of \$10 billion per year.
- Maximize current capabilities and minimize nonrecurring engineering costs for new platforms by maintaining and pursuing hulls in service, in production or near production that can meet near- to mid-term GWOT requirements and that are capable of operating in defended-access scenarios against nuclear-armed regional adversaries.
- Identify and retain or build large numbers of common hulls that have a large amount of internal reconfigurable volume, or that can carry a variety of modular payloads, or that can be easily modified or adapted over time to new missions.
- Pursue increased integration of Navy and Marine warfighting capabilities and emphasize common systems to increase operational effectiveness and reduce operation and support (O&S) costs.
- Focus research and development efforts on meeting future disruptive maritime challenges, particularly anti-access/area-denial networks composed of long-range systems and possibly weapons of mass destruction.

⁶¹CSBA report, slides 317-318.

⁶²CSBA report, slide 318.

⁶³CSBA report, slide 318. See also slide 298.

shipbuilding infrastructure, but notes that DOD consolidated construction of nuclear-powered carriers in a single yard years ago, and argues that competition might be possible in the longer run if future aircraft-carrying ships, the SCX, and the new undersea superiority system could be built in Tier II yards.⁶⁴

The report states:

Given their current small yearly build numbers, consolidating construction of aircraft carriers, surface combatants, and submarines in one yard [for each type] makes sense. However, the same logic does not hold true for auxiliaries and smaller combatants. These ships can normally be built at a variety of Tier I and Tier II yards; competition can thus be maintained in a reasonable and cost-effective way. For example, competing auxiliaries and sea lift and maneuver sea base ships between NASSCO, Avondale, and Tier II yards may help to keep the costs of these ships down.

Building multiple classes of a single ship [type] is another prudent way to enforce costs, since the DoN can divert production of any ship class that exceeds its cost target to another company/class that does not. Simultaneously building both the [Lockheed] and [General Dynamics] versions of [the] LCS, and the Northrop Grumman National Security Cutter, Medium [i.e., the medium-sized Deepwater cutter] gives the DoN enduring capability to shift production to whatever ship stays within its cost target....

Of course, Congress and the DoN may elect to retain industrial capacity, and to pay the additional “insurance premium” associated with having excess shipbuilding capacity. For example: Congress and the DoN might wish to retain two submarine yards until the [undersea superiority system] design is clear, and wait to rationalize the submarine building base after potential [undersea superiority system] yearly production rates are clear....

In a similar vein, Congress and the DoN might wish to retain two surface combatant yards until the design of the SCX is clear, and wait to rationalize the surface combatant building base after potential SCX yearly production rates are clear. In this regard, Congress could consider authorizing a modest additional number of [Aegis destroyers] to keep both BIW and Ingalls “hot” until the SCX is designed....

The key point is that the US shipbuilding infrastructure must be rationally sized for expected future austere shipbuilding budgets, and whatever fiscally prudent [Navy] transition plan is finally developed by DoN planners.⁶⁵

Summary

In summary, the following can be said about the three reports:

- 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 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.

⁶⁴CSBA report, slides 318-319.

⁶⁵CSBA report, slide 319.

- The OFT report fundamentally challenges current Navy thinking on the size and composition of the fleet, and presents an essentially clean-sheet proposal for a future Navy that would be radically different from the currently planned fleet. This is perhaps not surprising, given both OFT's institutional role within DOD as a leading promoter of military transformation and retired admiral Cebrowski's views on network-centric warfare and distributed force architectures.
- The CSBA report challenges current Navy thinking on the size and composition of the fleet more dramatically than the CNA report, and less dramatically than the OFT report. Compared to the CNA and OFT reports, the CSBA report contains a more detailed implementation plan and a more detailed discussion of possibilities for restructuring the shipbuilding industrial base.

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