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Navy DD(X) and LCS Ship Acquisition Programs: Oversight Issues and Options for Congress

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Summary

The Navy in FY2005 wants to finish procuring Arleigh Burke (DDG-51) class destroyers and begin procuring two new classes of surface combatants — a new destroyer called the DD(X), and a smaller surface combatant called the Littoral Combat Ship (LCS). These objectives, if implemented, would represent the most significant shift in Navy surface combatant procurement in 20 years.

The issue for Congress is whether to approve, modify, or reject the Navy's proposals. In marking up the FY2005 defense budget, the House Armed Services and Appropriations committees have recommended deferring the start of construction of the lead DD(X) beyond FY2005, while the Senate Armed Services and Appropriations committees have recommended that construction start in FY2005. The House and Senate Appropriations committees have stated that they view the first LCSs as prototypes and have recommended deferring the design and construction of follow-on LCSs until these prototypes are built and tested.

The Navy wants to acquire a total of up to 24 DD(X)s at a cost of up to roughly $40 billion (using Navy cost estimates) or roughly $54 billion (using CBO cost estimates). The Navy wants to acquire a total of up to 60 LCSs at a potential cost of up to $14 billion or perhaps more.

The Navy's proposals raise oversight issues for Congress concerning the surface combatant force-structure goal; mission requirements for the DD(X) and LCS; whether the DD(X) and the LCS represent the best approach for satisfying these mission requirements; the Navy's proposed acquisition strategies for the DD(X) and LCS; the potential affordability of the DD(X) and LCS programs; and the potential industrial-base implications of the DD(X) and LCS programs. Views developed on these issues can influence decisions on the DD(X) and LCS programs.

Potential options for Congress for either the DD(X) or LCS programs include approving the programs as proposed by the Navy; modifying their proposed acquisition strategies; and increasing or reducing their planned procurement rates. Additional potential options for the DD(X) program include procuring a few DD(X)s as a short-term bridge to an accelerated CG(X) cruiser program currently projected to start procurement in FY2018; and terminating the DD(X) program in favor of procuring modified DDG-51s or a new-design frigate instead. Additional options for the LCS program include procuring and evaluating a few LCSs while reserving judgment on whether to build a larger number; and terminating the LCS program in favor of procuring a new-design frigate or making other kinds of investments for improving littoral-warfare capabilities. Additional options for bolstering the surface combatant industrial base include procuring one or two additional DDG-51s in FY2006, and accelerating and expanding procurement of Coast Guard cutters under the Deepwater acquisition program, and accelerating procurement of Navy amphibious assault ships. This report will be updated as events warrant.

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The issue for Congress is whether to approve, modify, or reject the Navy's proposals for shifting surface combatant procurement from DDG-51s to DD(X)s and LCSs starting in FY2005. Surface combatants are a major component of the Navy, and construction of surface combatants represents a significant share of the Navy's shipbuilding program. Decisions that Congress makes on procurement of surface combatants will thus significantly affect future Navy capabilities, Navy funding requirements, and the U.S. defense industrial base.

Two short CRS reports — CRS Report RS21059 and CRS Report RS21305 — provide introductory overviews of the DD(X) and LCS programs, respectively, for readers seeking a short discussion of each program.[1] This long CRS report discusses these programs in more depth, particularly with regard to oversight issues and options for Congress, and to potential linkages between the DD(X) and LCS programs.

The next section of the report provides background information on Navy surface combatants. The following section discusses potential oversight issues for Congress relating to the DD(X) and LCS programs. The subsequent section presents options for Congress on the two programs. A final section presents recent legislative activity on the two programs. This report will be updated as events warrant.

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[1] CRS Report RS21059, *Navy DD(X) Destroyer Program: Background and Issues for Congress*, by Ronald O'Rourke; and CRS Report RS21305, *Navy Littoral Combat Ship (LCS): Background and Issues for Congress*, by Ronald O'Rourke.

Background

Surface Combatants in the Navy[2]

A Major Component of the Navy. Surface combatants are one of four major types of Navy combat ships, along with aircraft carriers, submarines, and amphibious ships.[3] Historically, surface combatants have accounted for 30% to 40% of the Navy's battle force ships.[4] At the end of FY2003, they accounted for about 36% (106 of 297 battle force ships).[5]

Surface combatants typically are equipped with sensors (radars and sonars) and weapons (missiles, guns, and torpedoes) for detecting and attacking enemy submarines, surface ships, aircraft, anti-ship cruise missiles, and land targets. Many surface combatants also carry one or two helicopters to assist in these operations.

In descending order of size, surface combatants include battleships, cruisers, destroyers, frigates, corvettes (also called light frigates), and patrol craft.[6] The Navy

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[2] For additional background information on surface combatants, see U.S. Congressional Budget Office, *Transforming the Navy's Surface Combatant Force*, March 2003, pp. 4-17; and CRS Report 94-343 F, *Navy DDG-51 Destroyer Procurement Rate: Issues and Options for Congress*, by Ronald O'Rourke. (Archived, available from author.)

[3] The Navy's fleet also includes mine warfare and support ships. Aircraft carriers, though sometimes referred to as surface combatants, are usually put into a category of their own because their main armament — an embarked air wing consisting of dozens of high-performance aircraft — is quite different from the typical main armament of other surface warships and leads to fundamental differences in ship design and operation.

[4] For a graph showing surface combatants as a percentage of the total number of Navy battle force ships for the years 1948-1993, see CRS Report 94-343 F, *Navy DDG-51 Destroyer Procurement Rate: Issues and Options for Congress*, by Ronald O'Rourke. (Archived, available from author.)

[5] In public policy discussions about the Navy, the commonly cited number of ships in the Navy is the total number of battle force ships. Battle force ships are ships that can readily deploy overseas to participate in or directly support U.S. Navy combat operations, such as aircraft carriers, major surface combatants, submarines, amphibious ships, higher-readiness mine warfare ships, and Navy auxiliaries that resupply Navy combat ships at sea. Ships that do not qualify as battle force ships, such as patrol craft and military sealift ships that transport equipment and supplies from one land mass to another, are categorized as local defense and miscellaneous support forces. As of the end of FY2002, the Navy counted 297 battle force ships and 152 local defense and miscellaneous support forces ships.

[6] Battleships, cruisers, destroyers, and frigates are referred to as major surface combatants; patrol craft are sometimes referred to as minor surface combatants; and corvette-sized ships can be included in either group.

no longer operates battleships.[7] The Navy's surface combatant force in recent decades has consisted largely of cruisers, destroyers, and frigates.[8]

Roles, Missions, and Capabilities. From World War II until the 1980s, surface combatants were viewed largely as defensive escorts for protecting other Navy surface ships (i.e., aircraft carriers, amphibious ships, and auxiliary ships)[9] and commercial cargo ships. During this period, the primary missions of surface combatants were anti-air warfare (AAW) and anti-submarine warfare (ASW), and designs for Navy surface combatant classes were determined in large part by decisions as to whether a given class should emphasize AAW, ASW, or both. Additional but more secondary surface combatant missions during this period included anti-surface warfare (ASuW) and attacking coastal land targets with guns.

The largely escort-oriented role of Navy surface combatants changed in the 1980s with the advent of three major new systems — the Tomahawk cruise missile, the vertical launch system (VLS), and the Aegis ship combat system. The Tomahawk gave surface combatants an ability to attack enemy targets at ranges comparable to targets that could be attacked by carrier-based aircraft. The VLS, which is a battery of vertically oriented missile-launch tubes that is countersunk into the ship's deck, permitted surface combatants to carry and launch an increased number of Tomahawks (and other missiles). The Aegis system — an integrated ship combat system that includes the sophisticated SPY-1 multifunction phased-array radar[10] — significantly enhanced the AAW capability of surface combatants, giving them more potential for conducting operations independent of aircraft carriers.[11] In the eyes of many observers, the Tomahawk missile and the Aegis system transformed surface

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[7] As part of the Reagan-era buildup toward a planned 600-ship fleet, the Navy in the 1980s reactivated and modernized its four Iowa (BB-61) class battleships, which were originally built during World War II and were the last battleships built by the U.S. Navy. The four reactivated and modernized battleships, with Tomahawk cruise missiles and other new equipment, reentered service in 1982-1988. Two of the ships were used in the 1991 Persian Gulf war. The ships were removed from service in 1990-1992 as part of the post-Cold War reduction in the size of the Navy.

[8] In recent decades, the Navy's cruisers have become smaller while its destroyers have become larger, with the result that the Navy's current cruisers and destroyers are similar in size and (in some respects) capability. The Navy's frigates are considerably smaller and less capable than its cruisers and destroyers. At various times in the past, the Navy has also operated small numbers of patrol craft.

[9] The fixed-wing aircraft embarked on aircraft carriers in turn provided long-range air protection for both the carrier and the other surface ships (i.e., surface combatants and auxiliary ships) in the carrier battle group.

[10] The Aegis system also integrates, among other things, the SPS-49 air search radar (on CG-47 class cruisers), the Mk 99 target illumination radar, the SLQ-32 electronic warfare system, the Standard surface-to-air missile, the Mk 41 VLS system for launching the Standard missile and other missiles, the Phalanx close-in weapon system (CIWS), and the ship's tactical computers and computer displays.

[11] For an introductory discussion of the Aegis system, see CRS Report 84-180 F, *The Aegis System: Its Principal Components, Its Installation on the CG-47 and DDG-51 Class Ships, and Its Effectiveness*, by Ronald O'Rourke.

combatants back into significant offensive combatants for the first time since the period before World War II.

The capabilities of Navy surface combatants are currently being enhanced by new networking systems such as the Cooperative Engagement Capability (CEC) for air-defense operations and the Naval Fires Network (NFN) for land-attack operations. Networking systems like these enable surface combatants, other ships, and aircraft to share large amounts of targeting-quality data on a rapid and continuous basis, permitting them to engage in what is called network-centric warfare (NCW).[12]

In coming years, surface combatants are intended to take on a significant new role as platforms for conducting ballistic missile defense operations.[13] The capabilities of surface combatants may also be enhanced in coming years by increased application of networking technology and by the addition of unmanned air, surface, and underwater vehicles,[14] electromagnetic rail guns, directed-energy weapons such as lasers, and improved equipment for detecting and countering mines. Several of these developments are to be enabled by the application to surface combatants of advanced integrated electric drive propulsion technology.[15] As these developments unfold, surface combatants will likely continue to play a significant role in defending both themselves and other friendly surface ships against enemy submarines, surface ships, aircraft, and anti-ship cruise missiles.

Service Lives. For planning purposes, the Navy credits its cruisers and destroyers with 35- or 40-year expected service lives (ESLs), its frigates with 30-year ESLs, and its patrol craft with 20-year ESLs. In practice, however, numerous surface combatants in recent years have been decommissioned well before the end of their ESLs for various reasons, including decisions (like the one following the end of the Cold War) to reduce the size of the Navy, shifts in Navy mission requirements that made ships with certain capabilities inappropriate, and high operation and support (O&S) costs that made ships cost-ineffective compared to other approaches for performing their missions. The Navy currently plans to decommission more than two dozen of its current cruisers, destroyers, and frigates over the next several years, well before the end of their ESLs.

Current Surface Combatant Force. As of the end of FY2003, the Navy's surface combatant force consisted of 108 ships in four classes:

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[12] For more on naval NCW, see CRS Report RS20557, *Navy Network-Centric Warfare Concept: Key Programs and Issues for Congress*, by Ronald O'Rourke.

[13] For a discussion of the emerging role of Navy surface combatants in missile-defense operations, see CRS Report RL31111, *Missile Defense: The Current Debate*, coordinated by Steven A. Hildreth and Amy F. Woolf.

[14] For more information on naval unmanned vehicles, see CRS Report RS21294, *Unmanned Vehicles for U.S. Naval Forces: Background and Issues for Congress*, by Ronald O'Rourke.

[15] For a discussion of electric-drive technology and its application to Navy ships, see CRS Report RL30622, *Electric-Drive Propulsion for U.S. Navy Ships: Background and Issues for Congress*, by Ronald O'Rourke.

- 27 Ticonderoga (CG-47) class cruisers;
- 39 Arleigh Burke (DDG-51) class destroyers;
- 10 Spruance (DD-963) destroyers; and
- 30 Oliver Hazard Perry (FFG-7) class frigates.[16]

CG-47s, which have a full load displacement of about 9,500 tons,[17] are equipped with the Aegis system and are commonly referred to as Aegis cruisers. The first 5 CG-47s lack VLS; the final 22 ships are equipped with a 122-tube VLS. The CG-47s were procured between FY1978 and FY1988 and entered service between 1983 and 1994. The Navy plans to decommission the first 5 CG-47s, which cannot fire Tomahawks, by the end of FY2006. The Navy plans to modernize the final 22 ships in the class and keep them in service until they are about 40 years old.

DDG-51s, which displace about 9,200 tons,[18] are equipped with the Aegis system and are sometimes referred to as Aegis destroyers. They are also equipped with a 90- or 96-tube VLS. Procurement of DDG-51s began in FY1985, and 59 have been procured through FY2004. By the end of FY2003, 39 had entered service (the first in 1991) and 20 were in various stages of construction. The Navy has requested 3 final DDG-51s for FY2005, which would make for a total procurement of 62 ships.

DD-963s, which displace about 9,200 tons, are not equipped with the Aegis system. Most of the DD-963s were retrofitted with a 61-tube VLS after VLS became available to the Navy in the 1980s. A total of 31 DD-963s were procured between FY1970 and FY1978. The ships entered service between 1975 and 1983. Nineteen of the ships were decommissioned through the end of FY2003. The Navy plans to decommission the remaining 10 by the end of FY2006.

FFG-7s, which displace about 4,000 tons, were designed as lower-cost, lower-capability surface combatants for use in lower-threat environments. They lack both the Aegis system and VLS. A total of 51 FFG-7s were procured between FY1973 and FY1984. The ships entered service between 1977 and 1989. Twenty-one were

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[16] The Navy at the end of FY2002 also operated **13 Cyclone (PC-1) class patrol craft** that were procured between FY1990 and FY1996 and entered service between 1993 and 2000. The PC-1s, which displace about 330 tons, are high-speed craft that were built to support special operations forces. They have also been used by the Navy and Coast Guard for port-security operations. The ships are classified as local defense and miscellaneous support forces and consequently are not included in the total number of battle force ships in the Navy. The Navy has expressed an interest in decommissioning these ships or transferring them to the Coast Guard.

[17] Full load displacement is the weight of the ship including loads such as fuels and water. Another measure of ship size is light (i.e., empty) ship displacement, which excludes such loads. Full load displacement is the more commonly used measure in general discussions of Navy ships, but light displacement is generally more useful in estimating ship construction costs.

[18] This is the figure for the 29th and following ships in the class, which are referred to as the Flight IIA ships. The first 28 ships in the class, which are referred to as the Flight I and II ships, were built to a different design that lacked a helicopter hangar and have a full load displacements of about 8,900 tons. Flight IIA ships have a light ship displacement of about 6,950 tons.

decommissioned through the end of FY2003. The Navy plans to decommission several more over the next decade. Eight of the 30 FFG-7s in service at the end of FY2003 were operated as Naval Reserve Force (NRF) ships with crews consisting partly of Navy reservists.

All of these ships have landing pads for operating helicopters, and all but the first 28 DDG-51s have hangars for embarking and supporting 2 helicopters.

Surface Combatant Force-Structure Goal

310-Ship Fleet From 2001 QDR. In September 2001, as part of its final report on the 2001 Quadrennial Defense Review (QDR), the Department of Defense (DOD) approved a plan for maintaining a Navy of about 310 battle force ships. This plan, which is essentially the same as the Navy force-structure plan approved in the 1997 QDR, includes 116 surface combatants (108 active and 8 in the Naval Reserve Force), all of which are cruisers, destroyers, and frigates.

In approving the 310-ship plan (and other U.S. military force-structure goals), however, the 2001 QDR report stated that as DOD's "transformation effort matures — and as it produces significantly higher output of military value from each element of the force — DOD will explore additional opportunities to restructure and reorganize the Armed Forces."[19]

In February 2003, in submitting its proposed FY2004 defense budget and FY2004-FY2009 Future Years Defense Plan (FYDP) to Congress, DOD announced that it had initiated studies on DOD's undersea warfare requirements and on forcible entry options for the U.S. military. The studies on undersea warfare could affect, among other things, the required number of SSNs, while the studies on forcible entry options could affect, among other things, requirements for amphibious ships and for naval surface fire support capabilities. In launching these studies, DOD thus created uncertainty about two of the four principal categories of ships that define the 310-ship plan (submarines and amphibious ships), and about requirements for a certain capability (naval surface fire support) to be performed by the Navy's surface combatant force.

Navy Proposal For 375-Ship Fleet. Navy leaders since 2002 have spoken of an alternative plan for a 375-ship Navy. The principal difference between the 310-ship plan and the 375-ship plan is that the 375-ship plan calls for a total of 160 surface combatants, including 104 cruisers, destroyers, and frigates, and 56 LCSs. Although Navy leaders, in speeches and testimony to Congress, routinely refer to the 375-ship plan, the plan remains a Navy proposal rather than an official DOD goal. At a hearing before the House Armed Services Committee on February 5, 2003, Secretary of Defense Donald Rumsfeld, when asked about the 375-ship plan, explicitly declined to endorse it.

Thus, while DOD in recent months has taken steps that raise questions about key elements of the 310-ship plan, it has also declined to endorse the Navy's 375-

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[19] U.S. Department of Defense, *[Report on] Quadrennial Defense Review*, Sept. 2001, p. 23.

ship proposal — or any other alternative plan for the future size and structure for the Navy. As a result, there is now some uncertainty regarding DOD plans for the size and structure of the Navy. This uncertainty affects the surface combatant force in particular, because surface combatants account for most of the difference between the 310- and 375-ship plans, and because the forcible entry options study could affect requirements for naval surface fire support capability.[20]

Surface Combatant Industrial Base

Construction Yards. All of the Navy's larger surface combatants procured since FY1985 have been built at two shipyards — General Dynamics' Bath Iron Works shipyard (GD/BIW) in Bath, ME, and Northrop Grumman's Ingalls shipyard (NOC/Ingalls) in Pascagoula, MS. Both yards have long histories of building surface combatants. Construction of Navy surface combatants in recent years has accounted for virtually all of BIW's ship-construction work and for a significant share of Ingalls' ship-construction work.[21] The Navy's smaller Cyclone (PC-1) class patrol boats were built at Bollinger Shipyards at Lockport, LA.

LCSs, because of their smaller size and relative simplicity (i.e., the lack of a major built-in combat system), could be built not only by a traditional builder of larger surface combatants such as BIW or Ingalls, but also by other private-sector shipyards that have not traditionally built larger surface combatants for the Navy. The three industry teams now competing for the LCS program are proposing to build the LCS at yards other than BIW or Ingalls.[22]

System Integrators And Supplier Firms. Lockheed Martin and Raytheon are generally considered the two leading Navy surface ship radar makers and combat system integrators. Boeing is another system integrator and maker of Navy surface ship weapons and equipment. The surface combatant industrial and technological base also includes hundreds of additional firms that supply materials and components. The financial health of the supplier firms has been a matter of concern

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[20] Instances of uncertainty over the planned size and structure of the Navy occur from time to time; the last instance was during the first two years (1989-1990) of the former Bush Administration. For additional discussion of Navy force-planning goals, see CRS Report RS20535, *Navy Ship Procurement Rate and the Planned Size of the Navy: Background and Issues for Congress*, by Ronald O'Rourke.

[21] In earlier years, some Navy surface combatants were built at other yards, such as Northrop Grumman's Avondale shipyard near New Orleans, LA (which built most of the Navy's Knox [FF-1052] class frigates between 1967 and 1974), Northrop Grumman's Newport News Shipbuilding of Newport News, VA (which built 6 nuclear-powered cruisers in the 1970s), Todd Shipyards of Seattle, WA, and San Pedro, CA (which built many of the FFG-7s between 1977 and 1989), and Lockheed Shipbuilding of Seattle, WA (which built some of the FF-1052s between 1968 and 1972). Additional private-sector shipyards and government-operated naval shipyards were involved in building Navy surface combatants in the 1960s and previous years.

[22] Navy surface combatants are overhauled, repaired, and modernized at BIW, Ingalls, other private-sector U.S. shipyards, and 4 government-operated naval shipyards (NSYs) located at Portsmouth, NH, Newport News, VA, Bremerton, WA, and Pearl Harbor, HI.

in recent years, particularly since some of them are the sole sources for what they make for Navy surface combatants.[23]

Surface Combatant Acquisition Programs

This section provides background on 6 Navy surface combatant acquisition programs:

- the current DDG-51 destroyer program,
- the terminated arsenal ship program,
- the terminated DD-21 destroyer program,
- the proposed DD(X) destroyer program,
- the proposed LCS program, and
- the proposed CG(X) cruiser.

Although the arsenal ship and DD-21 programs have been terminated, they are reviewed below because they provide context for understanding the DD(X) destroyer and LCS programs. The proposed CG(X) cruiser program is related to the DD(X) program.

DDG-51 Destroyer (Current). The Arleigh Burke (DDG-51) class destroyer has been the sole class of larger surface combatant in procurement for the Navy since FY1989. In the early 1990s, the Navy ended the use of competition between BIW and Ingalls for DDG-51 construction contracts and began allocating contracts equally between the two shipyards on a noncompetitive basis. That arrangement remained in place until 2002, when a new agreement was reached between General Dynamics, Northrop Grumman, and the Navy. Under this agreement, construction of San Antonio (LPD-17) class amphibious ships was consolidated at Northrop Grumman's Avondale and Ingalls shipyards (rather than being split on a 2-to-1 basis between the Northrop yards and BIW, respectively) and construction of most of the remaining DDG-51s was shifted to BIW (rather than being split on a 1-for-1 basis between BIW and Ingalls).

Arsenal Ship (Terminated).[24] The Navy initiated the arsenal ship program in early 1996. The program was aimed at developing and acquiring a class of 6 large surface combatants that were each equipped with 512 VLS tubes for firing Tomahawk cruise missiles and other land-attack weapons. The arsenal ships were to be relatively simple and (for their size) relatively low cost ships manned by crews of not more than 50 sailors. The stated purpose of the program was to provide U.S.

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[23] In addition to production facilities located at shipyards, system integrators, and supplier firms, the surface combatant industrial base includes naval architects and engineers who work for shipyards, systems integrators, supplier firms, and independent naval architectural engineering firms, and research and development organizations and laboratories in the Navy and at shipyards, system integrators, supplier firms, Federally Funded Research and Development Centers (FFRDCs), and universities and colleges.

[24] For detailed background information on the arsenal ship program, see CRS Report 97-455 F, *Navy/DARPA Arsenal Ship Program: Issues and Options for Congress*, by Ronald O'Rourke. (Report available from author at 202-707-7610.)

regional military commanders with substantial additional in-theater or early-arriving firepower for use in the early phases of regional crises and conflicts.

The Navy pursued the arsenal ship program under a streamlined acquisition strategy using what is known as Section 845/804 contracting authority. This statutory authority exempted the arsenal ship program from many of the regulatory requirements that DOD acquisition programs at the time were normally required to meet.[25] In line with this streamlined acquisition strategy, the Navy prior to starting the arsenal ship program did not issue a traditional DOD document known as a Mission Need Statement (MNS) establishing a formal DOD requirement for substantial additional in-theater or early-arriving firepower. Also consistent with the streamlined acquisition strategy, the Navy did not conduct a rigorous analysis — then known as a cost and operational effectiveness analysis (COEA) and now known as an analysis of multiple concepts (AMC) or analysis of alternatives (AOA) — demonstrating that developing and acquiring a force of 6 arsenal ships was not simply one way, but rather the best or most promising way, of providing this capability.

The arsenal ship program was widely understood to be a personal initiative of Admiral Jeremy M. Boorda, who was the Chief of Naval Operations (CNO) from April 1994 until May 1996. The arsenal ship program did not appear to be as high a personal priority for Boorda's successor as CNO, Admiral Jay L. Johnson, and support for the arsenal ship program appeared to decline under Johnson's tenure. In April 1997, the program was incorporated into the Navy's SC-21 family of surface combatants for the 21st Century (see discussion below on the DD-21 program). The Navy at about this time also deemphasized the goal of procuring 6 arsenal ships and focused instead on the idea of procuring a single arsenal ship for use as a technology test-bed. The reduction of the program from a firm 6-ship effort to one involving perhaps no more than a single ship appeared to reduce industry interest in the program. Congress raised questions about the need for and cost-effectiveness of the arsenal ship and substantially reduced the Navy's FY1998 funding request for the program. The Navy responded to this reduction by announcing in October 1997 that it had decided to terminate the arsenal ship program for lack of sufficient funding.[26]

DD-21 Destroyer (Terminated).[27] The Navy initiated the DD-21 program in 1994-1995.[28] The DD-21 program was aimed at developing and acquiring a next-

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[25] For more on the Section 845/804 authority, see CRS Report 97-455 F, op cit, pp. 34-37.

[26] For a discussion of the termination the program, see CRS Report 97-1044 F, *Navy/DARPA Maritime Fire Support Demonstrator (Arsenal Ship) Program: Issues Arising From Its Termination*, by Ronald O'Rourke. (Report available from author at 202-707-7610.)

[27] For more on the DD-21 program, see CRS Report RS21059, *Navy Zumwalt (DD-21) Class Destroyer Program: Background and Issues for Congress*, by Ronald O'Rourke. (Archived, available from author.)

[28] The Department of Defense (DOD) Joint Requirements Oversight Council (JROC) approved a Mission Need Statement (MNS) for the SC-21 program in September 1994. DOD's Defense Acquisition Board (DAB) granted Milestone 0 approval for the SC-21 program in January 1995. USD(A&T) granted Milestone I approval for the program (which

(continued...)

generation destroyer called the DD-21, meaning the destroyer for the 21st Century. The ship was also called the land attack destroyer.[29] The Navy envisaged procuring a total of 32 DD-21s; the first was to be procured in FY2005 and enter service in 2010. The Navy hoped to procure DD-21s at an eventual rate of 3 ships per year, so as to replace retiring DD-963s and FFG-7s on a timely basis.

The DD-21 was to be the first member of the SC-21 family of surface combatants for the 21st century. Following completion of DD-21 procurement, perhaps around FY2015, the Navy planned to begin procuring the CG-21 — a cruiser variant of the basic DD-21 design — to replace aging CG-47s. A third intended member of the SC-21 family of ships was the arsenal ship, which, as mentioned above, was incorporated into the SC-21 family of ships in April 1997.

As envisioned by the Navy, the DD-21 was to have been a multimission ship with an emphasis on two mission areas — maritime dominance (which included ASW, ASuW, and countermine warfare) and land attack. The emphasis on maritime dominance reflected the DD-21's role as a replacement for the FFG-7s and DD-963s, which were designed with an emphasis on ASW. The emphasis on land attack reflected a requirement to replace the large-caliber naval gunfire support capability that the Navy lost in 1990-1992 when it removed its four reactivated Iowa-class battleships form service.[30]

The DD-21 was to have a crew of 95 to 150 sailors, which would have been significantly smaller than the crew of a CG-47 (about 400 persons), a DDG-51 or DD-963 (about 350), or a FFG-7 (about 235). The goal for a significantly smaller crew reflected a Navy emphasis on reducing ship operating and support (O&S) costs, which are driven in large part by crew-related costs.

The DD-21 was to have featured a new wave-piercing, tumblehome hull design[31] with significantly reduced radar, infrared, and acoustic signatures; a VLS with 64 to 256 tubes (128 may have been the final number), two copies of a new 155-

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[28] (...continued)
permitted the Navy to enter Phase I, the demonstration and validation phase) in January 1998. The Navy issued a Request for Proposals (RFP) for the program in March 1998.

[29] The DD-21 was subsequently also called the Zumwalt-class destroyer because the Navy in July 2000 announced that the lead ship in the class would be named in honor of the late Admiral Elmo R. Zumwalt, Jr., a surface combatant officer who was the Chief of Naval Operations in 1970-1974.

[30] The battleships were each equipped with nine 16-inch guns. All of the Navy's other surface combatants are equipped with 5-inch or 3-inch guns. More generally, the DD-21's emphasis on land attack reflected the Navy's post-Cold War shift in emphasis toward operations in littoral waters that are intended to influence events ashore.

[31] "Wave-piercing" means that the front end of the ship, instead of coming to a sharp tip that is well above the water, as in a conventional hull, instead narrows to a tip that slopes down toward the water, so that the front end of the ship looks somewhat like the blade on a farmer's plow that breaks through the ground as it is pushed forward. "Tumblehome" means that the ship's hull will have sides that slope inward from the waterline up, so as to reduce the ship's visibility to radar waves coming at the ship from the side.

mm (i.e., 6.1-inch) gun called the Advanced Gun System (AGS), each with a magazine containing 600 to 750 shells; sonars and other equipment for ASW and countermine warfare; a moderately capable air-defense system (like those on FFG-7s and DD-963s) rather than a highly capable air-defense system (like the Aegis system on CG-47s and DDG-51s); and a hangar for a helicopter and a few unmanned air vehicles (UAVs). In January 2000, the Navy announced that the DD-21 would be equipped with an integrated electric-drive system.

To permit a procurement rate of 3 ships per year within anticipated funding levels, the Navy wanted the DD-21 to have a unit procurement cost somewhat lower than that of the DDG-51. Specifically, the fifth and following DD-21s were to have a procurement cost of $750 million in FY1996 dollars — the equivalent of about $827 million in FY2004 dollars. The procurement cost of the first DD-21, which included the DD-21 program's non-recurring detailed design and engineering costs, was estimated at $2.03 billion in then-year dollars. The DD-21 was to have had an O&S cost equivalent of not more than $6,000 per steaming hour in FY2001 dollars. This figure, which represented a significant reduction from the O&S costs of other Navy surface combatants, was to have been achieved in significant part by designing the ship to be operated by crew of 95 to 150 sailors.

In July 1996, the Under Secretary of Defense for Acquisition and Technology (USD[A&T]) approved Part 1 of the SC-21 Cost and Operational Effectiveness Analysis (COEA), which examined surface combatant capabilities and requirements and developed acquisition alternatives. In April 1997, the Navy completed Part 2 of the COEA, which compared acquisition alternatives.

As with the arsenal ship program, the Navy for Phases I and II of the DD-21 program planned on using a streamlined acquisition strategy using Section 845/804 contracting authority.

Under a plan worked out by the Navy in the first half of 1998 after considerable consultation with industry and Congress, two industry teams were competing for the program — the **"Blue" team**, which included GD/BIW as the shipbuilder, Lockheed Martin as the combat system designer and integrator, and other firms; and the **"Gold" team**, which included NOC/Ingalls as the shipbuilder, Raytheon as the combat system designer and integrator, and other companies.

BIW and Ingalls were to build DD-21s in roughly equal numbers, paralleling the arrangement for building DDG-51s that the Navy put into place in the early 1990s. As a consequence, BIW and Ingalls were competing not for the right to build the DD-21, but rather for the right to design the DD-21 and to be the full-service contractor for the DD-21 class (i.e., the entity in charge of planning and conducting life-cycle support for DD-21s over the many years that they would be in service).[32]

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[32] Designing the DD-21 would involve hundreds of millions of dollars in design and engineering work, while being the FSC would involve a stream of potentially many millions of dollars of work spread out over a period of more than 40 years.

Navy and DOD support for the DD-21 program appeared to decline during 2001. In the spring of that year, the Navy twice delayed its planned announcement of the winner of the DD-21 competition.[33] In June 2001, two special DOD panels that were established by Secretary of Defense Donald Rumsfeld to review DOD programs indicated that they did not view the DD-21 as particularly transformational. At about the same time, Navy officials, in testifying to Congress on the proposed FY2002 defense budget, suggested that the Navy was uncertain about the merits of the program.[34]

The Navy's uncertainty was apparently due in part to the emerging size and cost of the ship: Although initial reporting suggested that the DD-21 might displace about 9,000 tons, like the Navy's current cruisers and destroyers, the reported size of the DD-21 design grew over time to about 16,000 tons. A ship of this size, it appeared, was needed either to accommodate two AGSs (each with a magazine containing 600 to 750 shells) along with a 128-tube VLS and a helicopter/UAV hangar, or to permit the DD-21 hull to serve as the basis for the projected CG-21 cruiser, or both. The projected size of the DD-21 led to concerns among observers, including Navy officials, that the DD-21 would substantially exceed its unit procurement cost goal and thus be difficult for the Navy to afford.[35] Navy and DOD officials were also concerned about the amount of technical risk in the DD-21 development effort,

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[33] On March 1, 2001, the Navy announced that it had delayed its planned selection of a winning industry design for the DD-21 program by two months, to May 2001. On May 31, 2001, the Navy announced that it had again delayed selection of a winning design until sometime after the completion of several defense studies, including the 2001 Quadrennial Defense Review, which was submitted to Congress on September 30, 2001.

[34] When asked whether the Navy needed the DD-21, Navy officials on more than one occasion answered that the Navy needed the technologies that were scheduled to be incorporated into the ship, but avoided stating directly that the Navy needed the ship itself. For a press report on this shift in Navy testimony, see McCarthy, Mike. Navy Rhetoric On New Destroyer Subtly Shifts. *Defense Week*, August 6, 2001: 6.

[35] One press account, published more than a year later, stated:

> In a March 10 [2003] interview with *Inside the Navy*, [Navy acquisition executive John] Young recounted how, in discussions going back a year or more, it became clear that officials were not comfortable with all of DD-21's attributes. Discussions were held with then-Navy Secretary Gordon England, Pentagon acquisition czar Pete Aldridge, Young, Chief of Naval Operations Adm. Vern Clark and Deputy Defense Secretary Paul Wolfowitz....
>
> Before DD-21 became DD(X), the new destroyer was not truly affordable, according to Young.
>
> "On DD-21, people were promising to deliver a DD-21 at something around 17,000 tons for the same cost of a 9,000-ton DDG-51," said Young. "I personally found that hard to believe. In fact, I didn't think it was doable...."

Christopher J. Castelli, "Young Seeks Smaller DD(X) Ship, Prompting Fire Support Discussions," *Inside the Navy*, Mar. 24, 2003.

particularly in light of the large number of new technologies that were to be incorporated into the ship.

These developments, plus the Administration's continued delay in announcing a winning design after DOD submitted the 2001 Quadrennial Defense Review (QDR) to Congress on September 30, 2001, gave rise to speculation that the Administration was considering cancelling or restructuring the program. In late October 2001, the House Appropriations Committee, in its markup of the FY2002 defense appropriation bill, recommended substantially reducing the Navy's request for FY2002 research and development funding for the program and posed basic questions about the DD-21's target crew size, unit procurement cost, and whether the DD-21 qualified as a "leap ahead" defense program. The Navy announced the next month that it was replacing the DD-21 program with the restructured DD(X) family of ships program (see discussion below).

Proposed DD(X) Family of Ships. On November 1, 2001, the Navy announced that it was replacing the DD-21 program with a new DD(X) Future Surface Combatant Program aimed at developing and acquiring a family of 3 new classes of surface combatants:

- **a destroyer called DD(X)** for the precision long-range strike and naval gunfire mission,
- **a cruiser called CG(X)** for the missile and air defense mission, and
- **a smaller combatant called the Littoral Combat Ship (LCS)** to counter submarines, small surface attack craft (also called "swarm boats") and mines in heavily contested littoral (near-shore) areas.[36]

Together, these 3 classes could encompass a notional total of up to 104 ships — 24 DD(X)s, 56 LCSs, and 24 CG(X)s — procured between FY2005 and FY2030.

The Navy stated that it planned to employ multiple competitions among industry teams for each of the three programs. In addition, DOD has announced that the DD(X) family of ships effort is to employ a relatively new acquisition strategy called evolutionary acquisition with spiral development (EA/SD). EA/SD aims at rapidly developing and fielding useful increments of capability and exploiting user feedback in developing additional increments, but poses potentially important issues for Congress regarding Congress' ability to conduct oversight of DOD acquisition programs.[37]

The DD(X), LCS, and CG(X) are each discussed in detail below.

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[36] Somewhat confusingly, "DD(X)" has been used to refer to both the entire effort for developing 3 classes of ships and (more frequently) to the destroyer program within the overall effort.

[37] For a discussion of EA/SD, see CRS Report RS21195, *Evolutionary Acquisition and Spiral Development in DoD Programs: Policy Issues for Congress*, by Gary J. Pagliano and Ronald O'Rourke.

DD(X) Destroyer (Proposed). The DD(X) destroyer is effectively the successor to the DD-21 destroyer and will resemble the DD-21 in terms of mission orientation and ship design. Specifically, the DD(X) would:

- be a multimission destroyer with an emphasis on land-attack operations that reflects a requirement to replace the large-caliber naval gunfire support capability that the Navy lost in 1990-1992, when it removed its four reactivated Iowa-class battleships from service;

- have a reduced-size crew (compared to the Navy's current surface combatants) of 125 to 175 sailors so as to permit reduced operating and support (O&S) costs; and

- feature a wave-piercing, tumblehome hull design with significantly reduced signatures; a VLS; two AGSs; equipment for ASW and perhaps countermine warfare; a moderately capable air-defense system less capable than the Aegis system; a hangar for a helicopter and a few unmanned air vehicles (UAVs); and an integrated electric-drive system.

Due to continuing Navy concerns over ship affordability, the DD(X) is to be somewhat smaller and less expensive than the DD-21. The DD(X)'s VLS would include 80 tubes rather than the 128 tubes on the DD-21, and the DD(X) would carry a combined total of not less than 600 shells for its two AGSs, rather than 600 to 750 shells for each AGS, as on the DD-21. As a result, the DD(X) is to displace about 14,000 tons rather than the DD-21's figure of almost 16,000 tons.[38] (It is possible, though, that if the DD-21 program had been continued, the Navy eventually might have decided to similarly reduce the size and cost of the DD-21 design.)

The initial version of the DD(X) design is to incorporate a significant number of new technologies, including the wave-piercing, tumblehome hull design, a superstructure made partly of large sections of composite materials rather than steel or aluminum, the integrated electric drive propulsion system and a related ship-wide electrical distribution system, a total-ship computing system for moving information about the ship, automation technologies for the reduced-sized crew, a dual-band radar, a new kind of VLS called the peripheral VLS (PVLS),[39] and a new type of gun (the AGS).

The Navy earlier indicated it was planning to procure 24 DD(X)s through FY2017 before shifting to procurement of CG(X)s in FY2018. Recently, however,

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[38] As of October 2003, the ship's estimated full load displacement (including loaded fuels, water, etc.) was 14,064 tons, and the ship's estimated light (i.e., empty) displacement was 12,135 tons. (Source: Navy Office of Legislative Affairs, Oct. 3, 2003.)

[39] The system is called the Peripheral VLS because the VLS tubes, instead of being installed into the ship's main deck in a cluster along the ship's centerline, as with the current VLS system, would be installed in the ship's main deck in a line along the outer perimeter (i.e., periphery) of the ship.

the Navy indicated it may accelerate the start of CG(X) procurement to sometime between FY2011 and FY2014, which suggests it may procure 10 to 16 DD(X)s before switching over to procurement of CG(X)s.[40] The FY2005-FY2009 Future Years Defense Plan (FYDP) calls for procuring the first DD(X) in FY2005, another two in FY2007, two more in FY2008, and three more in FY2009. As shown in **Table 4**, a long-range shipbuilding plan that the Navy submitted to Congress in May 2003 showed the remaining 16 ships in a 24-ship program being procured in FY2010 and future years at a rate of 2 ships per year.

The Navy estimates that the first DD(X) will cost about $2.8 billion to design and build, including about $1.8 billion in hands-on construction costs for the ship and about $1 billion in detailed design and nonrecurring engineering costs (DD/NRE) for the class. (The DD/NRE costs for each new class of Navy ships have traditionally been included in the procurement cost of the lead ship of the class.) The Navy plans to procure the first DD(X) through the Navy's research and development account rather than the Navy's ship-procurement account (known formally as the Shipbuilding and Conversion, Navy [SCN] appropriation account), where Navy combat ships traditionally have been procured. The second and subsequent DD(X)s would be procured through the ship-procurement account.

The Navy estimates that the fifth and sixth DD(X)s will have an average unit procurement cost of $1.2 billion to $1.4 billion in FY2002 dollars. The Congressional Budget Office (CBO) estimates that a class of 24 DD(X)s built at a rate of 2 per year would have an average unit procurement cost of $1.8 billion in FY2003 dollars.[41]

As shown in **Table 1** below, the Navy's estimated procurement cost for the fifth and sixth DD(X)s equates to a cost per thousand tons (CPTT) of light-ship displacement (i.e., the empty weight of the ship without fuel) that is 36% to 45% less than that of today's DDG-51 destroyers, while CBO's estimated average DD(X) cost equates to a CPTT that is 18% less. If the DD(X) CPTT is set equal to that of the DDG-51, DD(X)s would cost more than $2 billion each to procure.

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[40] Malina Brown, "Young Acknowledges Navy To Curtail DD(X) Buy, Accelerate Cruiser," *Inside the Navy*, June 21, 2004: 1; Castelli, Christopher J. "Navy May Buy Fewer DD(X) Destroyers, Accelerate Cruiser Program," *Inside the Navy*, May 24, 2004: 1.

[41] In its March 2003 report on surface combatant programs (U.S. Congress. Congressional Budget Office. *Transforming the Navy's Surface Combatant Force*. Washington, 2003. [A CBO Study, March 2003] 63 pp.), CBO estimated that a class of 16 DD(X)s displacing 17,000 tons and procured at a rate of 3 ships per year after FY2009 would have an average unit procurement cost of about $1.9 billion in FY2003 dollars. The $1.8-billion figure presented above is a revised CBO estimate provided to CRS on June 26, 2003 that reflects the Navy's decision, reported in June 2003, to reduce the size of the DD(X) to 14,000 tons. This revised estimate is for a 24-ship DD(X) program in which the ships are procured at a rate of 2 ships per year after FY2009, as shown in the 30-year shipbuilding plan that the Navy submitted to Congress in May 2003. CBO estimates that a class of 24 DD(X)s of 14,000 tons, if procured at a rate of 3 ships per year after FY2009, would have an average procurement cost of about $1.7 billion each.

Table 1. Cost Per Thousand Tons (CPTT)

Ship	Cost (when procured at 2 per year)	Full load displacement (tons)	Light-ship displacement (tons)	CPTT	DD(X) CPTT compared to DDG-51
DDG-51	$1.25 bil.	~9,000	6,950	~$180 mil.	—
Estimates for DD(X)					
Navy	$1.2-1.4 bil.	~14,000	12,135	$99-115 mil.	-36% to -45%
CBO	$1.8 bil.	~14,000	12,135	$148 mil.	-18%
CPTT = DDG-51	$2.18 bil.	~14,000	12,135	$180 mil.	equal

Including more than $9.6 billion in program research and development costs, the total acquisition (i.e., development plus procurement) cost for a class of 24 DD(X)s would range from about $40 billion-$45 billion (using the Navy's estimated cost for follow-on DD[X])s) to about $54 billion (using CBO's estimate) to more than $60 billion (if follow-on DD[X]s cost more than $2 billion each).

Table 2 shows funding for the DD(X) program through FY2009.

Table 2. Funding For DD(X) Program, FY2002-FY2009

(millions of then-year dollars)

	2002	2003	2004	2005	2006	2007	2008	2009	Total thru FY2009
Research, Development, Test & Evaluation, Navy (RDTEN) account									
Ship 1 construction	—	—	—	103	288	294	353	269	1307*
DD/NRE	—	—	—	118	349	252	127	87	933*
All other**	490	895	1059	1230	1097	791	439	259	6260*
Total RDTEN* **	490	895	1059	1451	1734	1337	919	615	8500*
Shipbuilding and Conversion, Navy (SCN) account									
Ship 2	—	—	—	—	49	2004	—	—	2053
Ship 3	—	—	—	—	49	1493	—	—	1542
Ship 4	—	—	—	—	—	49	1729	—	1778
Ship 5	—	—	—	—	—	49	1494	—	1543
Ship 6	—	—	—	—	—	—	49	1695	1744
Ship 7	—	—	—	—	—	—	49	1478	1527
Ship 8	—	—	—	—	—	—	—	1523	1523
Total SCN	0	0	0	0	98	3595	3321	4696	11710
TOTAL	490	895	1059	1451	1832	4932	4240	5311	20210

Source: Navy data provided to CRS by Navy Office of Legislative Affairs, February 20, 2004.

* Additional funding required in FY2010-FY2011 to complete construction of lead ship, and in years after FY2009 for DD/NRE and all other RDT&E.

** Funding for all RDT&E for the DD(X) program other than DD/NRE.

*** Figures do not include a total of $1,111.4 million in research and development funding provided for the DD-21/DD(X) program during the period FY1995-FY2001.

Following the replacement of the DD-21 program with the DD(X) program, the Blue and Gold teams that were competing for the DD-21 program continued to compete for the right to be the lead preliminary design agent for the DD(X) destroyer. On April 29, 2002, the Navy announced it had selected the Gold team to be the lead preliminary design agent for the ship. The team was awarded a $2.88 billion contract from FY2002 through FY2005 to perform preliminary and system design work for the ship and to design, build, and test engineering development models (EDMs — test examples) of several of its key subsystems.[42] The Gold team has since been expanded into a **DD(X) "national" team** that also includes BIW, Lockheed Martin, and Boeing. The Navy wanted BIW to be involved in the ship-design process to ensure that both yards could compete effectively in a separate competition for the detailed design and construction of the first DD(X) destroyer in FY2005.

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[42] On May 9, 2002, BIW filed a protest of the Navy's contract-award decision with the General Accounting Office (GAO). On August 19, 2002, GAO announced that it had denied the Blue team's protest and upheld the Navy's decision.

The Navy originally anticipated holding another competition for the next phase in the program, which includes completing the ship's design and building the first ship. On March 3, 2004, however, the Navy stated that, to avoid delaying the program, it had decided to award the contract for the next phase on a sole-source basis to NGSS. The Navy has also stated that "The ship construction contracts will be allocated equally between NGSS and BIW for the first six ships... and will be Cost Plus Incentive Fee (CPIF) type contracts.... The strategy for contracting for construction of the seventh ship and beyond will be proposed at [Milestone B] and will include consideration of limited competition such as exercised under the DDG-51 Program."

Littoral Combat Ship (LCS) (Proposed). The Navy has testified that the LCS program is its "number one budget priority."[43] Prior to announcing the DD(X) family in November 2001, however, the Navy had no plans to acquire a smaller combatant like the LCS and had resisted proposals for such ships.

The LCS would be the smallest member of the DD(X) family of ships. The primary intended missions of the LCS are countering enemy mines, submarines, and fast attack craft in littoral (near-shore) waters. Secondary missions include intelligence, surveillance, and reconnaissance (ISR); homeland defense/maritime intercept; special operations forces (SOF) support; and logistics support for movement of personnel and supplies.

The LCS would be much smaller and faster than the Navy's current major surface combatants. It would displace 1,500 to 3,000 tons — about the size of a Coast Guard cutter or a corvette (i.e., a light frigate). It would have a maximum speed of 40 to 50 knots, compared to about 30 knots for the Navy's current surface combatants. The LCS would have a shallower draft than the Navy's current surface combatants, permitting it to operate in certain coastal waters and visit certain ports that are not accessible to the Navy's current surface combatants. The LCS would use a novel hull form rather than the traditional monohull used on current Navy surface combatants.

Rather than being a multimission ship like the Navy's current surface combatants, the LCS would be a focused-mission ship that would be equipped to perform one or two types of missions at any one time. The LCS would also be capable of having its mission orientation changed relatively quickly. To support this concept, the LCS, rather than having a built-in combat system like the Navy's current surface combatants, would use modular "plug-and-fight" payload packages for various missions that could be loaded on and off the ship relatively quickly.[44]

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[43] Statement of Admiral Vern Clark, U.S. Navy Chief of Naval Operations, U.S. Congress, Senate Armed Services Committee, Seapower Subcommittee, *Navy and Marine Corps Development and Procurement*, Apr. 1, 2003, p. 7.

[44] These payload packages could be boxes, canisters, or containers of some kind that could be quickly bolted onto the deck of the LCS or stored in a garage-like space on the ship. The equipment for performing the mission in question would be stored inside the container. Alternatively, the payload packages could simply be pieces of equipment, such as (continued...)

The LCS would make extensive use of unmanned vehicles (UVs), and employ automation to achieve a reduced crew size of 15 to 50 "core" crew members, not including the additional crew members that would operate the embarked mission modules.

In light of these features and the ship's littoral mission orientation, the Navy considers the LCS a key component of efforts to transform the Navy to meet 21st-Century military challenges.[45]

The LCS in some ways is reminiscent of a concept for a small, fast Navy surface combatant called the Streetfighter. The Streetfighter study effort began in 1998 and was centered at the Naval War College. It was led by Vice Admiral Arthur Cebrowski, who became the President of the college that year. Cebrowski in the late 1990s helped to develop and publicize the concept of network-centric warfare, and emerged as a leading proponent of naval transformation. He retired from the Navy in 2001. In October 2001 — a month prior the replacement of the DD-21 program with the DD(X) family of ships — he became the civilian director of DOD's Office of Force Transformation.

The Streetfighter study effort was aimed at generating new naval concepts for fighting in heavily defended littoral waters. The Streetfighter concept for a small, fast surface combatant, unveiled publicly in 1999, generated significant debate. Supporters viewed it as innovative, transformational, and responsive to the Navy's needs for affordable, littoral-oriented forces. Critics doubted the feasibility of combining high speed, overseas sustainability, and significant payload in a small ship, as well as the survivability of a small ship in combat. Navy officials allowed the Streetfighter project to proceed, but most Navy leaders at the time appeared to politely resist the idea of a smaller combatant. Although Navy officials emphasize that the LCS is not the Streetfighter proposal of 1999-2001,[46] the LCS — in terms of its littoral orientation, smaller size, high speed, and planned reliance on UVs — does appear broadly rooted in some of the thinking that came out of the Streetfighter project.

Given the LCS's anticipated size, cost, and baseline capabilities, Navy and Coast Guard officials at first noted that the LCS design, or a derivative of it, could be suitable for procurement by the Coast Guard as the Offshore Patrol Cutter (i.e., the medium-endurance cutter) that forms part of the Coast Guard's Deepwater recapitalization program.[47] Subsequently, however, Navy and Coast Guard officials

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[44] (...continued)
helicopters or unmanned vehicles, that could be directly loaded aboard ship and tied down on the deck or stored inside a garage-like space.

[45] For more on naval transformation, see CRS Report RS20851, *Naval Transformation: Background and Issues for Congress*, by Ronald O'Rourke.

[46] See, for example, Randy Woods, " Mullen, Balisle Distance Littoral Combat Ship From 'Street Fighter,'" *Inside the Navy*, Dec. 24, 2001.

[47] For more on the Deepwater program, see CRS Report RS21019, *Coast Guard Deepwater* (continued...)

reportedly have begun to deemphasize the possibility that the LCS hull design could serve as the basis for the Offshore Patrol Cutter.[48] Navy officials have also noted that the LCS might be suitable for export to foreign countries, many of whose navies and coast guards are built around ships the size of the LCS.

Navy officials state that they plan to procure 30 to 60 LCSs. The FY2005-FY2009 Future Years Defense Plan (FYDP) calls for procuring the first LCS in FY2005, another two in FY2006, one more in FY2007, and three more in FY2008, and six more in FY2009. As shown in **Table 4,** a long-range shipbuilding plan that the Navy submitted to Congress in May 2003 showed the remaining ships in the program being procured in FY2010 and future years at a rate of five ships per year. The Navy plans to procure two LCS mission modules in FY2006, two more in FY2007, another four in FY2008, and 15 more in FY2009.

The Navy wants the first LCS to cost between $150 million and $220 million in then-year dollars, exclusive of any mission modules, and wants follow-on LCSs to cost no more than $250 million in then-year dollars, including a representative payload package. This is roughly the cost of a Coast Guard cutter, and a fraction of the cost (about $1,100 million when purchased at a rate of three per year) of a DDG-51 class Aegis destroyer. Navy budget figures (see **Table 3** on the next page) suggest that individual mission modules to be procured during the FYDP would cost an average of $82 million each. Using the $250-million figure for an LCS with a representative payload, the total procurement cost for a fleet of 30 to 60 LCSs might be $7.5 billion to $15 billion, not including at least $1.4 billion in general research and development costs for the program.

The Navy intends to procure the first and second LCSs through the Navy's research and development account rather than the Navy's ship-procurement account. The Navy plans to procure LCS mission modules through the Other Procurement, Navy (OPN) account rather than the Navy's ship-procurement account.

Three industry teams were competing for the program. On May 27, 2004, the Navy announced that it had awarded contracts to teams led Lockheed Martin and General Dynamics (GD) for final system design of the LCS, with options for detailed design and construction of up to two LCSs each. The third competing team, led by Raytheon, was not awarded a contract. The Lockheed team was awarded a seven-month, $46.5-million contract, while the GD team was awarded a 16-month, $78.8-million contract. If Congress approves funding for the ships, the Lockheed team would build the LCS proposed for FY2005, while the GD team could build one of the two LCSs proposed for FY2006. If funded in FY2005, the Lockheed-built LCS would be delivered to the Navy in 2007. If the GD design is built, this ship, like the first LCS, would be funded through the Navy's research and development account rather than its ship-procurement account.

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[47] (...continued)
Program: Background and Issues for Congress, by Ronald O'Rourke.

[48] Malina Brown, "Navy, Coast Guard Back Away From Idea of Sharing Littoral Hull," *Inside the Navy*, Aug. 18, 2003.

Table 3 below shows funding for the LCS program through FY2009.

Table 3. Funding For LCS Program, FY2002-FY2009
(millions of then-year dollars; totals may not add due to rounding)

	2003	2004	2005	2006	2007	2008	2009	Total thru 2009
Research, Development, Test & Evaluation, Navy (RDT&EN) account								
Ship 1 construction			107.7	107.8				215.5*
Ship 2 construction				106.7	107.0			213.7*
All other RDTE**	35.3	166.2	244.4	288.4	285.9	130.5	207.5	1358.3
Subtotal RDTEN	35.3	166.2	352.1	502.9	392.9	130.5	207.5	1787.5
Shipbuilding and Conversion, Navy (SCN) account								
Ship 3				219.7				219.7
Ship 4					220.0			220.0
Ships 5, 6, 7***						625.7		625.7
Ships 8-13***							1303.6	1303.6
Subtotal SCN	0	0	0	219.7	220.0	625.7	1303.6	2369.0
Other Procurement, Navy (OPN) account for procurement of LCS mission modules								
(Qty. of modules)				(2)	(2)	(4)	(15)	(23)
Funding	0	0	0	180.0	180.0	351.3	1171.3	1882.6
TOTAL	35.3	166.2	352.1	902.6	792.9	1107.5	2682.4	6039.1

Source: Navy data provided to CRS by Navy Office of Legislative Affairs, February 20 and 27, 2004.
* Cost figures for each ship include the detailed design/nonrecurring engineering (DD/NRE) costs for that ship.
** Funding for all program RDT&E other than for construction of Ships 1 and 2.
*** Three ships funded in FY2008 at total cost of $625.7 million; six ships funded in FY2009 at total cost of $1,303.6 million.

CG(X) Cruiser (Projected). The CG(X) is the Navy's projected long-term replacement for the CG-47s. As shown in **Table 4**, the notional long-range shipbuilding plan that the Navy submitted to Congress in May 2003 calls for the first CG(X) to be procured in FY2018 (the year following the final year of DD(X) procurement), another 22 CG(X)s to be procured at a rate of two ships per year during the 11-year period FY2019-FY2029, and the final ship in the 24-ship program to be procured in FY2030. As mentioned earlier in the discussion of the DD(X) program, however, the Navy in mid-2004 indicated that it may curtail procurement of DD(X)s and accelerate the start of CG(X) procurement to sometime between FY2011 and FY2014.

The CG(X) would likely differ from the DD(X) in at least three basic ways:

- In contrast to the moderately capable air-defense system to be installed on the DD(X), the CG(X), reflecting its intended role as a replacement for the CG-47s, would be equipped with a powerful radar suite and a highly capable combat system for air- and missile-defense operations. This system could be either an improved version of the Aegis system or a next-generation successor.

- The CG(X) would likely have more than the 60 to 80 missile-launching tubes of the DD(X).

- In contrast to the DD(X)'s two AGSs, the CG(X) might have none, or perhaps one.

Although the CG(X) would differ from the DD(X) in these respects, the Navy wants the CG(X) to make maximum use of technologies already developed for the DD(X). The Navy also wants the DD(X) hull design to serve as the basis for the CG(X), but the Navy's recent decision to reduce the size of the DD(X) so as to lower its procurement cost may make the DD(X) hull too small to be used without modification as the basis for the CG(X). The Navy reportedly believes that the procurement-cost savings made possible by reducing the size of the DD(X) design (about $100 million per ship, or about $2.4 billion for 24 DD[X]s) will be much greater than the potential increase (perhaps $500 million to $600 million) in the CG(X)'s non-recurring design cost that might now be required to redesign the DD(X) hull for the CG(X) program.[49]

Although the CG(X) might lack one or both of the DD(X)'s AGSs, the CG(X)'s more capable air-defense system and its potentially greater size suggest that the CG(X) might have a higher unit procurement cost than the DD(X).

Table 4 summarizes the Navy's long-range surface combatant procurement plans as of May 2003.

[49] Malina Brown, "Navy Officials Back Off From Plans To Use Same Hull For DD(X) Family," *Inside the Navy*, June 23, 2003.

Table 4. Long-Range Surface Combatant Procurement Plan as of May 2003

Fiscal year	DDG-51	DD(X)	LCS	CG(X)
2004	3			
2005	3	1	1	
2006		1**	1***	
2007		1**	0***	
2008		2	3	
2009		3	4***	
2010		2	5	
2011		2	5	
2012		2	5	
2013		2	5	
2014		2	5	
2015		2	5	
2016		2	5	
2017		2	5	
2018			5	1
2019			2	2
2020				2
2021				2
2022				2
2023				2
2024				2
2025				2
2026				2
2027				2
2028				2
2029				2
2030				1
Total	6*	24	56	24

Source: U.S. Department of the Navy, *A Report to Congress on Annual Long-Range Plan For The Construction Of Naval Vessels*, Director of Surface Warfare [OPNAV N76] Washington, 2003. p. 15.
* Plus 56 ships procured during FY1985-FY2003, for a total procurement of 62 ships.
** These figures changed in FY2005 budget to 0 in FY2006 and 2 in FY2007.
*** These figures changes in FY2005 budget to 2 in FY2006, 1 in FY2007, and 6 in FY2009.

Oversight Issues for Congress

The Navy's plan for procuring surface combatants in FY2005 and subsequent years raises several sets of potential oversight issues for Congress. These issues include:

- the surface combatant force-structure goal;
- mission requirements for the DD(X) and LCS;
- whether the DD(X) and the LCS represent the best approach for satisfying these mission requirements;
- the Navy's proposed acquisition strategies for the DD(X) and LCS;
- the potential affordability of the DD(X) and LCS programs; and
- the potential industrial-base implications of the DD(X) and LCS programs.

Each of these issue areas is discussed below. Views developed on these issues can influence choices made on acquisition options such as those presented in the Options for Congress section of this report.

Force-Structure Goal and Program Justification

One potential oversight issue for Congress concerns the future size and composition of the Navy's surface combatant force. Should the force consist of 116 cruisers, destroyers, and frigates — the goal that DOD approved in the 2001 QDR but also indicated was subject to later revision? Should it consist of 160 surface combatants, including 104 cruisers, destroyers, and frigates, and 56 LCSs — the goal that the Navy proposed as part of its desired 375-ship fleet? Or should it consist of some other number of surface combatants — as suggested by other DOD and Navy studies that have been conducted in recent years?[50]

This uncertainty over the planned size and composition of the surface combatant force raises a number of potentially significant questions for Congress, some very basic, relating to the Navy's plans for procuring surface combatants in FY2005 and subsequent years, including the following:

Planned Procurement Quantities. Given the absence of an agreed-upon OSD-Navy plan for the future size and composition of the surface fleet, how certain can the Navy be that it needs to procure up to 24 DD(X)s, 56 LCSs, and 24 CG(X)s? What basis does Congress have for assessing the likelihood that the DD(X) and LCS programs, if pursued, would eventually result in production runs of about 24 and 56 ships, respectively? Would these programs still be cost-effective, particularly in

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[50] As reviewed in the March 2003 CBO report on surface combatants, DOD and Navy studies conducted since 1995 have recommended surface combatant force-level goals ranging from about 100 ships to almost 200 ships. Some of the studies recommended force levels in the range of 135 to 145 surface combatants, which would fall roughly mid-way between the 116- and 160-ship goals. U.S. Congressional Budget Office, *Transforming the Navy's Surface Combatant Force*, Mar. 2003, pp. 8-9.

terms of amortizing their initial research and development costs, if their production runs turn out to be smaller than the Navy now plans?

Best Programs for a Force Closer to 116 Ships. If OSD and the Navy eventually agree on a surface combatant force-level goal that is closer to 116 ships than to 160 ships, would a combination of DD(X)s, LCSs, and CG(X)s still be the best combination of ships to procure starting in FY2005? Using as a template the Navy's proposed 160-ship surface combatant force (including 24 DD(X)s, 56 LCSs, and 24 CG(X)s), would a proportionately smaller force of 116 surface combatants, including about 17 DD(X)s, 41 LCSs, and 17 CG(X)s, be the most cost-effective 116-ship force that the Navy could procure and support within available funding? Has the Navy analyzed the operational implications of shifting from the current force of fewer than 116 surface combatants, including no LCSs, to a roughly equal-sized force that included a significant number of LCSs?

Force-Structure Justification for LCS. What officially approved force-structure requirement would a 30- to 60-ship LCS program fulfill? Programs to acquire major defense platforms, including Navy ships, are traditionally justified in part on the basis that they are needed to fill out specific parts of approved service force-structure plans. A role in filling an approved force-structure requirement traditionally has been viewed as necessary for a program to proceed. Although the Navy's proposal for a 375-ship fleet includes slots for 56 LCSs, the Secretary of Defense has explicitly declined to endorse the 375-ship plan. The last officially approved Navy force-structure plan — the 310-ship plan from the 2001 QDR — contains no slots for LCSs. The Navy at this juncture thus appears to be without an officially approved force-structure plan that includes slots for a significant number of LCSs. Supporters of a 30- to 60-ship LCS program could argue that a force-structure plan for the Navy with slots for 30 to 60 LCSs will eventually be approved. Critics could argue that, until such a plan is approved, the Navy has no approved force-structure basis for proposing a program to build any significant number of LCSs.

OSD and Navy Views on LCS and Total Fleet Size. Does OSD's decision to support the LCS program while not endorsing the Navy's proposal for a 375-ship fleet reflect a difference between OSD and the Navy regarding the size of the fleet that the LCS program is to help the Navy to maintain? Specifically, does OSD view the LCS program not as a program to help move the Navy from a 310-ship fleet to a 375-ship fleet (the Navy view), but rather as a program to reduce the average costs of building and maintaining a fleet of about 300 ships? Are Navy leaders using the proposal for a 375-ship fleet to help sell the LCS program to supporters of today's force of cruisers, destroyers, and frigates by suggesting that the Navy can procure a force of 56 LCS without significantly reducing the total number of cruisers, destroyers, and frigates?

Analysis for 375-Ship Plan, Including 160 Surface Combatants. Although Navy officials routinely mention their proposed 375-ship plan, they have provided few details in public about the composition of this fleet, and little explanation of how they arrived at the 375-ship proposal. This has led some observers to speculate that Navy leaders may have chosen the 375-ship figure as an arbitrary starting point that reflected a general desire to have a fleet closer to 400

ships than to 300 ships, and then filled out the 375-ship force by simply taking the 310-ship fleet and then adding the number of ships (mostly LCSs) that was needed to reach 375. What formal analysis of future Navy mission requirements did the Navy perform in arriving at its proposal for a fleet of 375 ships, including 160 surface combatants, of which 104 are cruisers, destroyers, and frigates and 56 are LCSs?

New Ship-Deployment Cycles and Proposed 160-Ship Figure. The Navy in 2002 began experimenting with new approaches to ship-deployment cycles for maintaining day-to-day forward deployments of surface combatants. If implemented widely, new approaches such as multiple crewing of ships and long-duration forward deployments with crew rotation could substantially reduce the number of surface combatants that the Navy would need to have in inventory to keep a certain number of surface combatants forward-deployed to overseas operating areas on a day-to-day basis.[51] Did the Navy take into account the potential force-sizing implications of these new approaches in arriving at the 160-ship figure for surface combatants within the Navy's 375-ship fleet proposal? If not, is the 160-ship figure in the Navy's 375-ship proposal (and, for that matter, the 116-ship figure in the 310-ship plan form the 2001 QDR) overstated? To what degree might potential reductions in the number of surface combatants needed for maintaining day-to-day forward deployments be offset by continuing requirements to have a certain minimum number of surface combatants for warfighting purposes?

Taking Advantage of Uncertainty. Is OSD or the Navy taking advantage of the current uncertainty over the planned size and composition of the Navy, including the surface combatant force, to propose new surface combatant acquisition programs without having to show how these programs would fit into an overall investment strategy for maintaining a Navy of a specific size and composition within projected resources?

OSD Plans for Resolving Uncertainty. When does OSD plan to resolve the current uncertainty over the planned size and composition of the Navy, including the surface combatant force?

Mission Requirements

A second potential oversight issue for Congress concerns mission requirements for the DD(X) and LCS. The issue is whether these requirements are valid. Potential questions for Congress regarding DD(X) and LCS mission requirements — some of them again quite basic — include the following:

Surface Combatant Missions in General. Does the current uncertainty over the planned size and composition of the surface combatant force (see previous section) reflect uncertainty or disagreement between OSD and the Navy over the roles and missions of surface combatants in future U.S. military operations? If so,

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[51] For more information on these new ship-deployment concepts, see CRS Report RS21338, *Navy Ship Deployments: New Approaches — Background and Issues for Congress*, by Ronald O'Rourke and U.S. Congressional Budget Office, *Transforming the Navy's Surface Combatant Force*, Mar. 2003, pp. 32-37.

how certain can the Navy be that it has correctly identified future surface combatant mission requirements? What basis does Congress have for assessing the Navy's efforts in this area?

DD(X) Missions in General. The September 1994 Mission Need Statement (MNS) that set forth the mission requirements for the old DD-21 destroyer continues to serve as the foundation mission-requirements document for the new DD(X) destroyer. In light of developments since 1994, including the war on terrorism and the new emphasis on defense transformation, is the 1994 DD-21 MNS still valid as a foundation description of the missions to be performed by the DD(X)? To what extent has DOD or the Navy reviewed the 1994 MNS to assess its current validity? How might mission requirements as set forth in the 1994 MNS be affected by transformation-related developments such as the new emphasis in U.S. military operations on precision-guided air-delivered weapons and unmanned vehicles, and new warfighting concepts such as effects-based warfare?[52] If the missions set forth in the 1994 MNS need to be revised, how might this affect the mission requirements (and thus the design) of the DD(X)?

DD(X) Naval Gunfire Support Mission. The DD(X) design, like the earlier DD-21 design, was significantly influenced by a requirement for the ship to carry two AGSs. This requirement reflects a need to replace the high-volume, all-weather, naval surface fire support capability for supporting Marines and other friendly forces ashore that the Navy lost in 1990-1992 when it removed the four reactivated Iowa-class battleships from service. Is the DD(X) requirement to carry 2 AGSs still valid?

Supporters of the requirement could argue that it is still valid for the following reasons:

- The requirement for additional high-volume, all-weather naval fire support capability has been periodically reviewed and revalidated by the Navy and Marine Corps since the early 1990s, and has not been rejected by OSD.

- Much of the world's population and major areas of economic activity — and thus many of the areas where U.S. military forces may operate in the future — are located within about 100 miles of the shore, within the range of the AGS.

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[52] Effects-based warfare, also called effects-based operations, refers to a warfighting strategy that has been proposed as an alternative to traditional attrition-style warfare. Rather than focusing on seeking out and destroying enemy forces wherever they might be, effects-based operations focuses on attacking selected key elements of the enemy's ability to fight in a coordinated manner. Under an effects-based strategy, U.S. forces might attack the enemy's military leadership, its military command-and-control systems, and the most politically and militarily significant elements of the enemy's fielded military forces while bypassing less significant enemy military forces. The goal of effects-based warfare is to create specific effects on the enemy that lead to a rapid collapse of the enemy's willingness and ability to fight, without having to go through a time-consuming and potentially costly effort to destroy the bulk of the enemy's military forces through a gradual process of attrition.

- Ship-mounted guns are more economical than ship- or air-launched missiles for providing high-volume fire support, because gun shells are much less expensive than missiles.

- Ship-mounted guns can provide more timely fire support than aircraft because aircraft might not be close to the scene of the ground fighting and might need to spend time flying there before they can launch their weapons against the enemy ground forces.

- Ship-mounted guns can provide fire support in adverse weather conditions that can degrade aircraft operations.

Skeptics could argue that the two-AGS requirement is no longer necessarily valid for the following reasons:

- Although the requirement for additional high-volume, all-weather fire support capability has been periodically revalidated since the early 1990s, the two most recent U.S. military operations — the war in Afghanistan in 2001-2002 and the Iraq war in early 2003 — suggest that in the future, the United States might rely more on operations conducted by smaller-sized ground-force units that are supported by smaller but more precise amounts of fire support, which could reduce requirements for high-volume fire support.

- Ship-launched missiles have much longer potential ranges than do guns, which have a practical maximum range of about 100 miles. All U.S. ground operations in Afghanistan were conducted more than 300 miles inland, and a large share of U.S. and coalition ground operations in Iraq were conducted more than 100 miles inland. Ship-mounted guns like the AGS, with a maximum range of about 100 miles, would thus have been of no direct value in supporting operations in Afghanistan, and would have played only a limited role in supporting operations in Iraq.

- U.S. operations in Afghanistan and Iraq demonstrated that U.S. air superiority can permit manned aircraft and unmanned air vehicles (UAVs) to orbit over the battlefield on a virtually round-the-clock basis, enabling them to provide timely fire support to friendly ground forces. In contrast, it is not clear whether a ship-mounted gun can provide timely fire support to friendly ground forces at ranges of 100 miles.[53]

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[53] If naval surface fire support is to be effective, some observers argue, no more than 8 to 10 minutes should elapse between the time that the Marines or other friendly ground forces ask the ship for supporting fire and the time that the ship's gun shells arrive on target. Within this 8- to 10-minute period, all of the following would need to occur: the ground forces contact the ship and request the ship to fire on targets at certain coordinates; the ship receives and processes the request; an AGS becomes available and is allocated to the task; the AGS fires the shell, and the shell flies to the target. If this sequence of events requires (continued...)

- The advent of relatively inexpensive, GPS-guided,[54] air-delivered precision-guided munitions (PGMs) that can work in all weather conditions, such as the Joint Direct Attack Munition (JDAM),[55] give manned aircraft and UAVs an improved ability to provide precision fire support to friendly ground forces under adverse-weather conditions.

In addition to the above arguments, a comparison of the DD-21 and DD(X) programs raises potential questions regarding how clearly the Navy has defined the requirement for additional gunfire support capability. The Navy previously planned to procure a force of 32 DD-21s with a total of 64 AGSs. The Navy now plans to procure a total of up to 24 DD(X)s with a total of up to 48 AGSs. In addition, as part of the effort to reduce the size and cost of DD(X) design, the Navy has reduced the firing rate of the AGS (i.e., the number of shells that an AGS can fire per minute) by about 20%. As a result, an individual DD(X) would provide about 80% as much firing-rate capability as an individual DD-21, and a force of 24 DD(X)s would provide about 60% as much combined firing-rate capability as the previously planned force of 32 DD-21s.[56]

In light of this reduction in firing-rate capability, would the Navy's planned force of 24 DD(X)s provide sufficient large-caliber naval gunfire capability to meet the Marine Corps' requirements in this area? Navy officials reportedly have suggested that it would.[57] But if a force of 24 DD(X)s equipped with AGSs whose firing rate has been reduced by 20% is sufficient to meet a naval gunfire capability requirement that previously was to have been met by a force of 32 DD-21s with faster-firing AGSs, then how firmly defined is the requirement for additional naval gunfire capability? If 60% to 80% of the previously planned firing-rate capability is sufficient, then would less than 60% to 80% still be sufficient?

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[53] (...continued)
more than 8 to 10 minutes to complete, they argue, the fire support will arrive too late, since the ground forces after about 8 to 10 minutes will likely have either sustained casualties from attacking enemy forces or moved to a new location to avoid being attacked. Some observers question whether, at ranges approaching 100 nautical miles (the approximate maximum range of the AGS), this sequence of events is likely to be completed within 8 to 10 minutes, even with advanced communication links that are designed to minimize the time needed to transmit, receive, and process the request for fire.

[54] GPS is the Global Positioning System, a constellation of U.S. satellites that provides precise, real-time geographic location information to systems equipped to receive GPS signals.

[55] The JDAM is essentially a standard gravity bomb that has been fitted with a strap-on GPS receiver and steering fins.

[56] Seventy-five percent as many ships (24 rather than 32) times 80% as much rate of fire per ship equals 60% as much total firing-rate capability.

[57] Malina Brown, "Navy Officials Back Off From Plans To Use Same Hull For DD(X) Family," *Inside the Navy*, June 23, 2003.

DD(X) Missions Other Than Naval Gunfire Support. Even with the Navy's recent decisions to reduce the DD(X)'s size and cost, the DD(X), like the DD-21, is to be not just a naval gunfire support ship, but a multimission ship. The nature of the DD-21 as a multimission ship can be viewed as a reflection of the fact that its predecessor, the DD-21, was to be the Navy's sole surface combatant program for replacing the various mission capabilities resident in the Navy's aging multimission DD-963s and FFG-7s. Now, however, the Navy plans to procure not just a new destroyer (the DD[X]), but a smaller combatant (the LCS) as well. The LCS is to perform some missions — such as ASW and (as a secondary mission) maritime intercept — that have been performed by DD-963s and FFG-7s.

In light of the planned mission capabilities of the LCS, how much capability does the DD(X) need to have for performing missions other than naval gunfire support? If gunfire support is the DD(X)'s primary mission, and if the DD(X) is no longer to be the sole platform for replacing the capabilities resident in the DD-963s and FFG-7s, should requirements for the non-gunfire mission capabilities of the DD(X) design be reduced further? How much further might the cost of the DD(X) design be reduced if its non-gunfire capabilities are reduced and the ship's design is modified to make the ship more of a pure naval gunfire support platform?

LCS Littoral Warfare Missions. The LCS program is based on a Navy requirement for additional capability for countering enemy submarines, surface attack

craft and mines in heavily contested littoral areas.[58] Has the Navy accurately projected this requirement?

Those who support the notion that the Navy has accurately projected this requirement could argue the following:

- The Navy experienced difficulties countering mines in a 1984 mining incident in the Red Sea, in the 1987-1988 Navy operation to escort reflagged Kuwaiti tankers and other U.S.-flag commercial ships in the Persian Gulf, in the 1991 Persian Gulf War, and (to a

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[58] Mission requirements for the LCS program are technically covered (i.e., "grandfathered") by the MNS that was issued for the old SC-21 (i.e., DD-21) program. The analysis behind the SC-21 MNS, however, did not focus on potential littoral anti-access challenges in littoral waters. The Navy's requirement for additional capability for countering enemy submarines, surface attack craft, and mines in littoral waters instead reflects an analysis aimed at identifying gaps or weaknesses in Navy capabilities that the Navy performed initially in February 2001, which did focus on potential littoral anti-access challenges in littoral waters. The Navy refined this analysis further in 2001 and 2002 and then issued mission requirements for the LCS in a Preliminary Design Interim Requirements Document dated February 10, 2003. (U.S. Department of the Navy, *Littoral Combat Ship Flight 0 Preliminary Design Interim Requirements Document [PD-IRD]*, Feb. 10, 2003.) The document states:

> The primary threat to sea based U.S. joint forces will be from mines, aircraft, ships, boats, submarines, and coastal defense units armed with Anti-Ship Cruise Missiles (ASCM), and submarine-launched torpedoes. Mines present the most challenging threat because they can be deployed from ships and aircraft, both military and civilian, and can also be deployed from submarines. Significant threats will also come from air and ship launched torpedoes; fighter-launched Tactical Air-to-Surface Missiles; other ordnance carried by sea and land-based aircraft (fixed- and rotary-wing); chemical, biological and nuclear weapons, and in the future, directed energy weapons. While operating in the littoral regions, additional threats from coastal defense sites (artillery, missile, multiple rocket launchers, and possibly torpedoes) small boats and Tactical Ballistic Missiles may be encountered. A third tier threat will include preemptive attacks or covert action from special operations forces, combat divers, and terrorists. The weapons threats may be supported by C3 [command, control, and communications], electronic attack, and electronic support [i.e., electronic eavesdropping] systems.
>
> Further details on existing, projected, and technologically feasible threats are contained in the Classified "Major Surface Ship Threat Assessment", ONI-TA-018-01, January 2001....
>
> The LCS will deliver focused mission capabilities to enable joint and friendly forces to operate effectively in the littoral. These focused mission capabilities are an enhanced mine warfare capability, a better shallow-water ASW capability, and an effective counter to small craft. There are other capabilities inherent in the LCS that support other missions such as Maritime Interdiction Operations (MIO) and Intelligence, Surveillance, and Reconnaissance (ISR).

smaller degree) in the recent Iraq war. Navy ships were damaged by mines in the 1987-1988 and 1991 operations.

- The Navy has also been challenged by surface attack craft while operating in littoral waters, such as during the 1987-1988 escort operation.

- While the Navy does not appear to have been significantly challenged by enemy submarines in littoral waters in recent military operations, proliferation of modern non-nuclear-powered submarines to potential adversaries has been a concern among Navy officials and other observers for several years.

- In light of the many firms globally that are marketing non-nuclear-powered submarines, surface attack craft, and mines to foreign buyers, and the interest that numerous countries, including potential foreign adversaries, have shown in either buying such systems from foreign suppliers or building them indigenously, it is reasonable to expect that the Navy in the future will need additional capability for countering such systems.

Those who question the notion that the Navy needs to acquire additional capability for countering mines and surface attack craft in littoral waters could argue the following:

- recent major U.S. military combat operations — in Kosovo in 1999, in Afghanistan in 2001-2002, and in Iraq in early 2003 — suggest that the Navy faces no immediate crisis in littoral-warfare capabilities; and

- potential U.S. adversaries do not appear to be acquiring submarines, surface attack craft, and mines at the rate that some observers have expected, and may attempt to circumvent the Navy's littoral-warfare plans by focusing on acquiring different kinds of littoral-defense systems, such as autonomous underwater vehicles (AUVs).[59]

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[59] A May 2003 report on DOD programs for countering enemy anti-access and area-denial forces written by the Center for Strategic and Budgetary Assessments (CSBA) — a non-governmental study group generally supportive of defense transformation — argued this point at length, stating:

> Although none of these three threats [diesel subs lurking close to shore, mines, and swarming boats] are new, naval and civilian leaders have concluded that their previous efforts to deal with them have been ineffective....
>
> All of these judgments and conclusions are also open to debate. Indeed, the Navy may be preparing to fight the last maritime AD [area-denial] network, and with the wrong tools. As [naval analyst and author] Norman Friedman has noted after a careful review of global naval arms transfers and purchases, coherent

(continued...)

[59] (...continued)

> maritime AD networks comprised of submarines, mines, and boats — and even ASCMs [anti-ship cruise missiles] — are not materializing. This suggests one of three things: potential adversaries have decided not to develop maritime AD networks; they are attracted to the maritime AD capabilities that currently occupy US naval planners, but have elected not to pursue them in the near term for other political or military reasons; or they are pursuing new capabilities to outflank DON transformation plans.
>
> This last circumstance would seem not only plausible, but highly probable. For any adversary contemplating a long-term competition with the US battle fleet, building a maritime AD network that US naval expeditionary forces are being specifically designed to defeat would not appear to be an attractive transformation path. From an adversary's perspective, crewed submarine operations are an extremely expensive pathway, and the prospect of taking on the US attack submarine fleet is not an attractive one. The United States is expending an enormous amount of resources and effort, however belatedly, to sweep *stationary* mines and to effect rapid but relatively narrow penetrations of *static* minefields. For an adversary to embark now on a major procurement program to buy these types of weapons would appear to be huge gamble. And except for surprise attacks, no serious naval opponent is going to emphasize swarming boats (except perhaps in special cases like the Persian Gulf, where sea room for US naval forces is limited). As was conclusively demonstrated at the Battle of Bubiyan Channel, a naval engagement during the first [i.e., 1991] Gulf War, fast attack craft attacking a prepared naval force that enjoys air superiority is not a survivable tactic.
>
> An alternative approach might be to pursue new underwater attack systems combining the technology of torpedoes, mobile mines, and new autonomous underwater vehicles (AUVs). Pursuing new types of stealthy uncrewed attack submarines, or long-range autonomous torpedoes, or mobile mines that constantly shift their position or patrol an engagement area would appear to be a far more attractive competitive strategy for maritime AD, in that it would side-step most, if not all, of US counter-AD plans. Moreover, such a strategy would allow attacks beyond the littoral dead zone to threaten the very viability of the [U.S.] sea base. AUV technology available today could easily allow an adversary to conduct wake-homing attacks on surface vessels at ranges out to 250 miles. In the future, even longer-range attacks will be possible, perhaps extending to ocean basin ranges. In addition, unlike in the past when the military sector dominated the development of underwater systems, today's revolution in remotely operated underwater vehicles and AUVs is being driven by the commercial and scientific communities. Since most of the research and development (R&D) for long-range AUVs is being borne by them, the costs for weaponizing AUVs are likely to be reasonable, meaning that AUV-based weapons might be built in numbers, and quickly, opening the possibility of springing either an operational or tactical surprise. Moreover, once built, weaponized AUVs would require little infrastructure overhead, and they could operate largely autonomously after the start of a war.

(Andrew Krepinevich, Barry Watts, and Robert Work, *Meeting the Anti-Access and Area-Denial Challenge*, Center for Strategic and Budgetary Assessments, 2003, pp. 57-58. Emphasis as in the original. The excerpted passage is from the chapter of the report (continued...)

Potential questions for Congress regarding the mission requirements for the LCS include the following:

- The Navy has been aware of challenges posed by enemy mines, surface attack craft, and submarines in littoral waters since its operations in the Persian Gulf in 1987-1988 and 1991, if not before. Why did the Navy not begin to identify these challenges as a source of significant new mission requirements until 2001? Is the Navy exaggerating the threat posed by these area-denial systems to help justify the start of the LCS program?

- Does OSD agree with the Navy's view on the scale and composition of current and projected threats to Navy ships operating in littoral waters?

- What is the latest evidence on whether potential foreign adversaries are developing improved littoral-defense systems based on submarines, surface attack craft, and mines?

- To what degree might potential U.S. adversaries attempt to circumvent current Navy plans for improving its littoral-warfare capabilities by acquiring different kinds of littoral-defense systems, such as AUVs?

DD(X) and LCS as Proposed Way to Perform Missions

If mission requirements have been accurately projected (see discussion above), a third potential oversight issue for Congress is whether building ships like the DD(X) and the LCS represents not just one approach, but rather the best or most promising approach, for performing these missions.

DD(X). Is a ship like the DD(X) the best or most promising approach for performing the DD(X)'s stated missions? DD(X) supporters could argue that this question was resolved by the extensive SC-21 Cost and Operational Effectiveness (COEA) study that the Navy performed in 1995-1997 in support of the old DD-21 destroyer program. That study, they could argue, reviewed several surface combatant acquisition options for performing the missions set forth in the 1994 SC-21 Mission Need Statement (MNS) and identified the acquisition of a ship like the DD-21 as the best possible approach. The DD(X), they could argue, is covered by the SC-21 COEA and will broadly resemble the DD-21.

Supporters could also argue that a surface combatant like the DD(X) is the best approach for performing its stated missions for the basic reason that surface combatants are better suited than aircraft, submarines, aircraft carriers, and amphibious ships for carrying and operating a larger-caliber gun like the AGS.

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[59] (...continued)
focusing on Navy programs, which was written by Robert Work, CSBA's naval issues analyst.)

Aircraft and submarines, they could argue, cannot (or cannot easily) carry and operate a larger-caliber gun like the AGS, and putting a larger-caliber gun on an aircraft carrier or an amphibious ship could interfere with these ships' primary respective missions of supporting aircraft operations and embarked Marine forces.

Skeptics could argue that technological developments since the 1995-1997 COEA, such as the advent of network-centric warfare, raise potential questions as to whether a ship like the DD(X) still represents the best or most promising approach to performing the DD(X)'s stated missions. Network-centric warfare, they could argue, is associated with concepts of distributed firepower and ships operating as part of a larger system of systems. Such concepts, they could argue, might make it possible for mission requirements to be better performed by platforms significantly different than the DD(X). Skeptics can also argue that the Navy's 1995-1997 COEA did not examine options for acquiring a small combatant like the LCS and thus did not explore how the presence in the force of a small combatant like the LCS might affect the analysis of the best or most promising approach for performing mission requirements other than those being met by a ship like the LCS.

LCS. In contrast to the DD(X), which reflects the outcome of a formal analysis intended to identify the best or most promising way to perform certain surface combatant missions (the SC-21 COEA of 1995-1997), the Navy prior to announcing the start of the LCS program in November 2001 did not conduct a formal analysis — which would now be called an analysis of multiple concepts (AMC) — to demonstrate that a ship like the LCS would be more cost-effective than potential alternative approaches for performing the LCS's stated missions. Potential alternative approaches for performing the LCS's stated missions include (1) manned aircraft, (2) submarines equipped with UVs, (3) a larger (perhaps frigate-sized) surface combatant equipped with UVs and operating further offshore, (4) a non-combat littoral support craft (LSC) equipped with UVs, or (5) some combination.

An AMC is often performed before a service starts a major acquisition program. The absence of an AMC raises a question regarding the analytical basis for the Navy's assertion that the LCS is the most cost-effective approach for performing the LCS's stated missions, particularly given the Navy's pre-November 2001 resistance to the idea of a smaller combatant. As a result, the issue of whether a ship like the LCS represents the best or most promising approach has become a subject of some debate.

Arguments Supporting LCS as Best Approach. Supporters of the LCS could argue that the LCS program represents the best possible approach for performing the LCS's stated missions because the LCS program:

- builds on about four years of analytical work on small, fast surface combatants done in 1998-2001 at the Naval War College under the Streetfighter project, which showed several potential operational advantages of using a smaller ship like the LCS for performing littoral-warfare missions;

- would respond to the Navy's need for forces that can operate in littoral waters (including shallow-draft waters inaccessible to larger

Navy surface ships) to counter enemy submarines, surface attack craft, and mines;

- has been shown in computer simulations and wargames to substantially improve Navy littoral warfare capabilities;

- would be a key Navy program for achieving and exploiting the concept of network-centric warfare, which is a key component of naval transformation;

- would take full advantage of unmanned vehicles, which are another key component of naval transformation;

- would exploit the new concept of modular payload packages to achieve significant mission flexibility and an improved ability to accept upgrades and new missions over its life-cycle;

- would be more numerous and mobile in littoral waters than larger and slower surface ships, and would thus be more effective in terms of making it difficult for the enemy to plan and react to U.S. operations in littoral waters;

- would achieve survivability through speed, stealth, battlespace awareness, self-defense weapons, and support from other Navy platforms;

- would avoid the need to put at risk larger and more expensive surface ships, with their larger crews, to conduct operations in potentially dangerous littoral waters; and

- would respond to the Navy's need for more affordable ships.

Supporters of the LCS program can also argue that the Navy in the past has built prototype ships without having first done an AMC, and that the Navy is now conducting an AMC for the LCS program.

For additional Navy testimony and citations to journal articles presenting arguments in favor of the LCS as the best or most promising approach for performing the LCS's stated missions, see Appendix B.

Arguments Questioning LCS as Best Approach. Skeptics of the LCS program could argue that while many of the above arguments may be true, they do not demonstrate that the LCS is the best or most promising approach for performing the LCS's stated missions, and that the Navy is proposing the LCS program on the basis of "analysis by assertion." More specifically, skeptics could argue the following:

- Although it might be argued that the LCS is covered under the SC-21 COEA, the SC-21 COEA did not examine options for acquiring a small combatant like the LCS and thus cannot in substance provide

a formal analytical basis for arguing that the LCS is the best or most promising approach.

- In testimony to the House Armed Services Committee in April 2003, the Navy acknowledged that, on the question of what would be the best approach to perform the LCS's stated missions, "The more rigorous analysis occurred after the decision to move to LCS."[60]

- The four years of analysis done by the Navy prior to announcing the LCS program revolved to a large degree around the Streetfighter concept, which differs in certain respects from the LCS concept.[61] More important, the analysis focused primarily on what a Streetfighter might look like and what kind of warfighting contribution it could make as part of a larger Navy force, rather than on the more basic question of whether a smaller surface ship represented a better approach than other alternatives for performing the missions in question.

- Although Navy computer simulations and wargames may show that a ship like the LCS would increase the Navy's warfighting effectiveness in the littoral environment, the Navy has not shown that this increase is greater than the increase that might be achieved by investing a similar amount of funding in other approaches for performing littoral warfare missions. The Navy identified a need for additional littoral warfighting capability and leaped to the conclusion that the LCS would be the best way to provide it, without thoroughly examining potential alternative approaches. Helicopters, frigates, and submarines have performed littoral warfare missions for years, and the Navy has not shown through rigorous analysis why these platforms — or unmanned vehicles deployed from manned aircraft, submarines, or larger surface ships operating further from shore — would be inferior to the LCS for performing them.

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[60] Spoken testimony of Vice Admiral John Nathman, Deputy Chief of Naval Operations (Warfare Requirements and Programs), at an April 3, 2003 hearing on Navy programs before the Projection Forces subcommittee of the House Armed Services Committee. At this hearing, the chairman of the subcommittee, Representative Roscoe Bartlett, asked the Navy witnesses about the Navy's analytical basis for the LCS program. The witnesses defended the analytical basis of the LCS program but acknowledged that "The more rigorous analysis occurred after the decision to move to LCS." See U.S. Congress, House Committee on Armed Services, Subcommittee on Projection Forces, *Hearing on National Defense Authorization Act for Fiscal Year 2004 — H.R. 1588, and Oversight of Previously Authorized Programs*. 108th Cong., 1st sess., Mar. 27, and Apr. 3, 2003, (Washington: GPO, 2003), p. 126. For an article discussing the exchange, see Jason Ma, "Admiral: Most LCS Requirement Analysis Done After Decision To Build," *Inside the Navy*, Apr. 14, 2003.

[61] The Streetfighter, for example, was often described as a ship of several hundred (i.e., less than a thousand) tons displacement, while the LCS is usually described as a larger ship displacing 1,500 to 3,000 tons.

- The survivability of the LCS in dangerous littoral waters is open to question. Speed, stealth, and battlespace awareness may not be sufficient to avoid being targeted and attacked by modern sensors and weapons, particularly in waters close to an enemy's shore, and the LCS's modest self-defense weapons may not be adequate to counter incoming missiles and torpedoes. Larger ships are generally more capable than smaller ships of withstanding a hit from a weapon of a given size without sinking. The cruise missiles, mines, and boat bomb that in recent years have significantly damaged some of the Navy's current surface combatants and amphibious ships, but not sunk them, would have a higher likelihood of sinking a smaller ship like the LCS. It is not clear that it would be necessary or preferable to send a small and potentially vulnerable manned ship into heavily defended littoral waters to deploy UVs when UVs could also be launched from aircraft or from larger ships operating further offshore.

- The cost-effectiveness of the LCS as a focused-mission ship employing modular mission payload packages (rather than a ship with a built-in multimission combat system) is open to question. LCS mission modules would not be changed in open waters; they would be changed in a friendly port. If the friendly port is near the LCSs' operating area, then are LCSs needed in that area? If the friendly port is not near the operating area, will the LCSs be able to change mission modules in a timely manner? Where and how will mission modules that are not loaded on the LCSs be stored in the theater of operation? How many LCSs, and how many LCS mission modules, will need to be procured and deployed into a theater to ensure that an adequate number of LCSs equipped with the right mission modules will be on station in the operating area when they are needed?

- While it may be acceptable to build 1, 2, or a few ships as prototypes without first having analytically validated the cost-effectiveness of the effort, it is quite another thing to propose a 56-ship procurement program with a potential total acquisition cost of more than $14 billion without first examining through rigorous analysis whether this would represent the most cost-effective way to spend such a sum.

- Although the Navy is now conducting an AMC for the missions to be performed by the LCS, the results of that analysis will be of questionable credibility because it is being performed well after the fact, in the knowledge that the Navy has already announced that the LCS is the preferred approach for performing these missions. AMCs should be performed before the selection of a preferred concept, to help officials identify that concept, not after it has been selected, to provide officials with an after-the-fact justification for their selection.

Given the relatively recent beginning of the LCS program, few independent studies have been published that have examined the LCS program and commented in depth on the issue of whether the LCS represents the best or most promising approach to performing the LCS's stated missions. Three examples are a March 2003 CBO report on the Navy's surface combatant force, a May 2003 report by the Center for Strategic and Budgetary Assessments (CSBA), and a February 2004 report by CSBA. These studies questioned whether the LCS represents the best or most promising approach. For CBO's and CSBA's comments, as well as citations to additional journal articles questioning whether the LCS is the best or most promising approach, see Appendix C.

Potential Oversight Questions Regarding LCS. Potential oversight questions for Congress on the issue of whether the LCS represents the best or most promising approach for performing the LCS's stated missions include the following:

- Why did the Navy, prior to announcing the start of the LCS program in November 2001, not perform an analysis of multiple concepts (AMC) showing through a formal, rigorous analysis that a ship like the LCS was not just one way, but the best or most promising way, to perform the LCS's stated littoral warfare missions? If the analysis that the Navy conducted prior to its November 2001 announcement, including its Streetfighter analysis from 1998-2001, was sufficient to serve as an AMC justifying the Navy's decision to initiate the LCS program, why did the Navy not collect this analysis, reformat it, and present it as an AMC? Given differences between the original Streetfighter concept and the LCS as currently proposed (and statements from Navy officials that the LCS is not the Streetfighter), how applicable is the Streetfighter analysis to the question of whether a ship like the LCS represents the best or most promising way to perform the LCS's stated missions?

- Why did the Navy apparently wait until months after announcing the start of the LCS program to begin doing an AMC for the LCS program? Given the Navy's commitment to the LCS program, can an AMC at this point be done in an unbiased manner?

- If the LCS program is granted approval to proceed as the Navy has proposed, would this set a precedent for other major DOD acquisition programs to be initiated without first conducting an AMC showing that the proposed acquisition solution is the best or most promising approach? If so, what might be the potential advantages and disadvantages for DOD acquisition of such a precedent?[62] What might be the potential implications for Congress'

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[62] At a May 13, 2003, professional conference, Vice Admiral Albert Konetzni, the deputy commander and chief of staff for the Atlantic Fleet, expressed misgivings regarding a number of DOD acquisition programs that he believes were initiated without sufficient prior analysis. An article reporting on Konetzni's remarks stated:

(continued...)

ability to conduct effective oversight of future DOD acquisition programs?

- What are the relative operational advantages and disadvantages of performing the LCS's stated littoral warfare missions using (1) a ship like the LCS, (2) a somewhat larger, frigate-sized ship, (3) submarines, (4) manned helicopters and fixed wing aircraft, and (5) unmanned vehicles deployed from manned aircraft, submarines, and ships larger than the LCS operating further from shore? How do these options compare in areas such as payload capacity, ability to deploy payload systems into littoral waters in a timely fashion, ability to maintain on-station for extended periods of time, vulnerability and survivability, and potential acquisition and life-cycle operation and support costs?

Acquisition and Funding Strategy

If mission requirements are valid and the DD(X) and LCS represent the best or most promising approach for performing those missions, an additional potential oversight issue for Congress concerns the acquisition and funding strategies that the Navy has proposed for the DD(X) and LCS programs. Potential areas of interest here include:

- whether Congress has sufficient information on the DD(X) and LCS programs for deciding whether to start procuring DD(X)s and LCSs in FY2005;

- the Navy's proposed rapid acquisition strategy for the LCS;

- the Navy's plan to fund the construction of the lead DD(X) and LCS ships in the Navy's research and development account;

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[62] (...continued)

> "I feel very strongly that we have lost our bearings when it comes to transformation because most of the talk is not backed up by solid intellectual analysis," states the admiral's prepared speech for event....

Unfortunately, service officials in recent times "have largely abandoned operations analysis," Konetzni said. "Without looking clearly at the mission and rigorously analyzing the potential of new tactics and technologies to improve warfighting, we just get PowerPoint solutions," he said, adding, "I just can't take seeing another slide with red, yellow, and green blocks for effectiveness with nothing mathematical behind them."

> A better path would be one in which proposals for innovation are studied analytically and developed with a "complete plan" — including concept of operations, training and maintenance — "before we throw these things on our ships," he said. (Keith J. Costa, "Konetzni: Transformation In Need of 'Solid Intellectual Analysis,'" *Inside the Pentagon*, May 22, 2003.)

- the Navy's plan to fund the LCS mission payload modules in the Other Procurement, Navy (OPN) account; and

- the Navy's plan for managing technical risk in the DD(X) and LCS programs.

Each of these is discussed below.

Sufficiency of Information for a Procurement Decision. Although the Navy wants to begin procuring DD(X)s and LCSs in FY2005, certain key features of the DD(X) and LCS programs are currently unclear or potentially subject to change, including the following:

- **DD(X) and LCS procurement quantities and schedules.** Although the Navy stated in its May 2003 report to Congress that it wants to procure a total of 24 DD(X)s and 56 LCSs along the notional schedules presented in **Table 4**, these total quantities and schedules are associated with the Navy's proposal for a 375-ship fleet, which, as discussed earlier, was not endorsed by OSD as an official DOD force-structure goal. If OSD eventually approves a plan for the size and structure of the Navy that differs from the Navy's 375-ship proposal, planned quantities and annual procurement rates for the DD(X) and LCS programs could change. As mentioned earlier, Navy officials in mid-2004 indicated that they might want to procure a total of 10 to 16 DD(X)s rather than 24. They have also indicated that the total number of LCSs to be procured ranges from 30 to 60.

- **The design of the initial version of the DD(X).** The design of the initial version (i.e., flight) of the DD(X) changed in the spring of 2003, when the Navy reduced both the number of VLS tubes to be installed on the ship and the number of gun shells carried aboard the ship so as to reduce the ship's size to about 14,000 tons. It changed again in July 2003 as a result of a decision to equip the ship with an S-band radar rather than the previously planned L-band radar.[63] Have the basic features of the initial version of the DD(X) design been firmly fixed, or are additional design changes still possible?
- **DD(X) unit procurement cost.** The Navy's estimated unit procurement cost for the DD(X) — about $1.2 billion to $1.4 billion — is not very precise compared to estimated unit procurement costs that the Navy has provided for previous ship designs being considered for procurement. The estimated unit procurement cost, moreover, has changed in recent months as the design of the ship has been changed. The spring 2003 reduction in the ship's size reduced

[63] S-band and L-band refer to designations for different radar frequency bands. Radars operating in different frequency bands have differing performance characteristics and therefore differing strengths and weaknesses when used for various purposes, such as detecting and tracking airborne objects.

its estimated cost by about $100 million, and the July 2003 decision to equip the ship with an S-band radar increased the ship's estimated cost by about $15 million. DOD did not report the $15-million cost increase in its announcement of the decision to change the radar.[64] (The information was provided about two weeks later, when a reporter asked a Navy official about the cost impact of the decision.[65]) Perhaps more significant, CBO's estimated unit procurement cost for the ship — $1.8 billion in FY2003 dollars — is $400 million to $600 million, or 29% to 50%, higher than the Navy's estimated cost. This large difference between the Navy and CBO estimates suggests that there are substantial points of analytical difference regarding the ship's potential procurement cost.

- **Design for initial version of the basic LCS.** The three industry teams now competing for the LCS program have offered designs for the initial version (i.e., flight) of the basic LCS "seaframe" that differ significantly from one another. The design of the basic LCS is thus uncertain at this point. In addition, the Navy has decided that it will procure initial copies of two of the designs, rather than one, so as to give the Navy a chance to evaluate the designs in a real-world setting. One key design uncertainty is how many mission modules the LCS might carry at any given time — a factor that influences the capability and cost of an LCS fully loaded with mission modules.

- **Design and cost of LCS mission modules.** The Navy has provided a list of potential sensors and weapons that might form the basis for initial LCS mission modules,[66] but information about the design and cost of LCS mission modules does not appear well defined at this point. One key uncertainty is the projected average procurement cost of an LCS mission module, which is critical to understanding the total program acquisition cost of a 30- to 60-ship LCS program.

- **Total number of LCS mission modules to be procured.** Although the Navy has stated that it would like to procure a total of 30 to 60 LCSs, it has not defined the total number of mission modules that it would procure for a 30- to 60-ship LCS force. The total number of LCS mission modules, along with an average cost per module, is critical to understanding the total program acquisition cost of the LCS program. What is the anticipated ratio between LCSs and LCS

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[64] DOD's July 30, 2003 news release concerning the change in the radar (New Release No. 562-03) can be found on the Internet at [http://www.dod.mil/releases/2003/nr20030730-0273.html].

[65] For an article reporting the $15-million cost impact, see Nathan Hodge, "New Radar Adds Millions To Destroyer's Cost," *Defense Week Daily Update*, Aug. 12, 2003.

[66] See, for example, Andrew Koch, "US Navy Studies Combat Ship Payload Options," *Jane's Defence Weekly*, Aug. 6, 2003, p. 10.

mission modules, and how might this ratio change in relation to the total number of LCSs that are procured?

As mentioned in the background section, the DD(X) and LCS programs are being pursued under a relatively new DOD acquisition strategy called evolutionary acquisition with spiral development (EA/SD). EA/SD, which is discussed in another CRS report,[67] is aimed at achieving certain widely accepted goals in defense acquisition, such as shortening the time needed to get improved systems into the hands of U.S. military personnel, but poses potentially important challenges for Congress in carrying out its legislative functions, particularly committing to and effectively overseeing DOD weapon acquisition programs. In particular, EA/SD permits important features of a proposed weapon acquisition program, including system design, quantities to be procured, production schedule, and program cost, to remain undefined in the program's initial stages, which can put Congress in the position of approving the start of procurement for programs that in certain key respects have not yet been well defined.

Supporters could argue that the Navy's plan to use EA/SD for the DD(X) and LCS programs is appropriate because the ships are to incorporate a range of new technologies that are not yet fully developed. EA/SD, they can argue, will preserve flexibility for the Navy in developing and modifying the DD(X) and LCS designs as these technologies mature and as the Navy's operational requirements evolve.

Opponents could argue that EA/SD will complicate congressional oversight of the DD(X) and LCS programs because it will permit these programs to enter procurement even though in certain key respects they have not yet been fully defined. Opponents could argue that the Navy's use of EA/SD on the DD(X) and LCS programs creates a potential for drawing Congress into these programs to a point where extrication becomes difficult if not impossible, and without a clear idea of the programs' ultimate objectives.

Potential oversight questions for Congress include the following:

- Does Congress have sufficient — and sufficiently reliable — information about the DD(X) and LCS programs to decide whether to begin procuring DD(X)s and LCSs in FY2005? Does Congress have sufficient information about total DD(X) and LCS program costs to compare the merits of these programs against the merits of other proposed DOD acquisition programs?

- Although EA/SD can help achieve certain widely desired goals in defense procurement, is EA/SD in this instance masking or actually promoting Navy confusion about its plans for the surface combatant force? Is the Navy taking advantage of EA/SD to avoid providing more specific answers to congressional questions regarding the DD(X) and LCS programs?

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[67] CRS Report RS21195, *Evolutionary Acquisition and Spiral Development in DOD Programs: Policy Issues for Congress*, by Gary J. Pagliano and Ronald O'Rourke.

Rapid Acquisition Strategy for LCS. Compared to previous Navy combat ship acquisition programs, which typically have required 12 or more years to move from program inception to the commissioning of the first ship in the class,[68] the Navy is proposing to have the first LCS enter service in early 2007, or less than six years after the announcement of the program in November 2001. Meeting this schedule will require Congress to approve the procurement of the lead ship in the FY2005 budget. Congress would likely make this decision sometime in 2004 (and before November of that year), which would be less than three years after the announcement of the LCS program.

Navy officials say that the LCS program's rapid acquisition strategy is consistent with DOD acquisition reform, a chief goal of which is to significantly reduce acquisition "cycle time" — the time needed to move a program from initial conception to first deployment of usable hardware. They also argue that the LCS is urgently needed to meet an urgent Navy need for improved littoral-warfare capabilities.

Skeptics, while acknowledging that the LCS program's rapid acquisition strategy is consistent with DOD acquisition reform, could question whether such a strategy is needed to meet an urgent Navy operational need. They could argue the following:

- Recent major U.S. military combat operations — in Kosovo in 1999, in Afghanistan in 2001-2002, and in Iraq in early 2003 — suggest that the Navy faces no immediate crisis in littoral-warfare capabilities.

- If improved enemy littoral anti-access/area-denial capabilities do emerge, they are likely to do so gradually, over a period of many years, as potential adversaries incrementally acquire and learn to use such capabilities, permitting time for a less-hurried start to LCS procurement; and

- The Navy's argument about having an urgent operational need for LCSs is undercut by its own procurement profile for the LCS program, which would procure the planned total of 56 ships over a relatively long 15-year period, with the final ships in the program not delivered until about 2021.

Some observers believe that the LCS program's rapid acquisition strategy is motivated primarily not by concerns for the Navy's near-term littoral warfare capabilities, but rather by one or more of the following four factors, all of which are essentially political in nature rather than operational:

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[68] The Virginia (SSN-774) class submarine program, for example, was announced in early 1991, and the first ship in the class is scheduled to enter service in 2004. The DDG-51 program was begun in the late 1970s and the first ship in the class entered service in 1991. The DD-21 program is the de facto successor to the DD-21 program, which began in 1994-1995, and the first DD(X) is scheduled to enter service in 2011.

- **A belief that LCS production must start before there is a change in administration.** Some observers believe the Navy adopted a rapid acquisition strategy for the LCS program due to a belief that, to maximize the LCS program's chances of survival, the Navy must start building the first LCS before there is a change in administration, which could occur as early as 2005, depending on the outcome of the 2004 presidential election. The DD-21 program, these observers believe, was vulnerable to termination because it was initiated during the Clinton administration but was still years away from production when the Clinton administration was succeeded by the Bush administration. This, they believe, made it easier for the Bush administration to view the DD-21 program as a Clinton administration initiative in which the Bush administration had no stake, and easier for the Bush administration to consider terminating because defense firms at that point had not become dependent on the construction of DD-21s as a significant source of revenue. Navy officials, these observers believe, have "learned the lesson" of the DD-21 program and have concluded that starting to build the first LCS before there is a change in administration is important, if not critical, to the LCS program's chances of survival.

- **A belief that funding to begin LCS production must be secured before there is a change in the Chief of Naval Operations.** Other observers (including some in the group above) believe the Navy adopted a rapid acquisition strategy for the LCS program due to a belief that, to maximize the LCS program's chances of survival, the Navy must secure funding for building the first LCS before there is a change in the Chief of Naval Operations (CNO). Admiral Vernon Clark became the CNO in July 2000 and it was generally expected that Clark, like most CNOs in recent years, would serve a four-year term in office, meaning that he would remain CNO through the end of June 2004. At that point, the House and Senate Armed Services Committees will likely have reported their versions of the FY2005 defense authorization bill, and the House and Senate Appropriations may have reported their versions of the FY2005 defense appropriation bill. Admiral Clark, a surface warfare officer by training, is perhaps the leading proponent of the LCS program. Some observers believe Clark's successor may not be as strong a supporter of the LCS, particularly if that successor is a naval aviator or submariner rather than a surface warfare officer. LCS supporters, these observers believe, "learned the lesson" of the arsenal ship program and concluded that securing funding to build the first LCS before there is a change in CNO is important, if not critical, to the LCS program's chances of survival.[69]

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[69] On October 21, 2003, DOD announced that Admiral Clark's term in office would be extended by two years, through the end of June 2006, making him only the second CNO since the position was established by law in 1915 to serve more than four years. (Admiral (continued...)

- **A belief that LCS procurement must not be scheduled to start after the start of DD(X) procurement.** Other observers (including some of those in the groups above) believe that Navy officials who support the LCS adopted a rapid acquisition strategy for the LCS program due to a belief that, to maximize the LCS program's chances of survival, LCS procurement must not start after DD(X) procurement. In the eyes of these observers, since the LCS and DD(X) programs may compete for a limited amount of surface combatant procurement funding, starting DD(X) procurement before LCS procurement would create an opportunity — a window of time following the start of DD(X) procurement but prior to the start of LCS procurement — for DD(X) supporters to advocate terminating the LCS program so as to better ensure that there will be sufficient surface combatant procurement funds in the future to continue the DD(X) program. Navy officials, these observers believe, understand this potential dynamic and adopted a rapid acquisition strategy for the LCS program so that the LCS procurement start date could match the DD(X) procurement start date of FY2005, thereby depriving DD(X) supporters of such an opportunity.

- **A desire to limit congressional review of the program prior to seeking congressional approval for starting procurement.** A fourth group of observers (including some in the above three groups) believe that Navy officials adopted a rapid acquisition strategy for the LCS program in part to limit the amount of time available to Congress to assess the merits of the LCS program and thereby effectively rush Congress into approving the start of LCS procurement before Congress fully understands the details of the program.

With regard to the possibility of rushing Congress into a quick decision on LCS procurement, it can be noted that announcing the LCS program in November 2001 and subsequently proposing to start procurement in FY2005 resulted in a situation of Congress having only three annual budget-review seasons to learn about the new LCS program, assess its merits against other competing DOD priorities, and make a decision on whether to approve the start of procurement. These three annual budget-review seasons would occur in 2002, 2003, and 2004, when Congress would review the Navy's proposed FY2003, FY2004, and FY2005 budgets, respectively. Congress' opportunity to conduct a thorough review of the LCS program in the first two of these three years, moreover, may have been hampered:

- **2002 budget-review season (for FY2003 budget).** The Navy's original FY2003 budget request, submitted to Congress in February

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[69] (...continued)
Arleigh Burke was CNO for almost six years, from August 17, 1955, to August 1, 1961.) By the end of June 2006, the House and Senate Armed Services Committees will likely have reported their versions of the FY2007 defense authorization bill, and the House and Senate Appropriations may have reported their versions of the FY2007 defense appropriation bill.

2002, contained no apparent funding for development of the LCS.[70] In addition, the Navy in early 2002 had not yet announced that it intended to employ a rapid acquisition strategy for the LCS program. As a result, in the early months of 2002, there may have been little reason within Congress to view the LCS program as a significant FY2003 budget-review issue. In the middle of 2002, the Navy submitted an amended request asking for $33 million in FY2003 development funding for the LCS program. Navy officials explained that they did not decide until the middle of 2002 that they wanted to pursue a rapid acquisition strategy for the LCS program, and consequently did not realize until then that there was a need to request $33 million in FY2003 funding for the program. By the middle of 2002, however, the House and Senate Armed Services committees had already held their spring FY2003 budget-review hearings and marked up their respective versions of the FY2003 defense authorization bill. These two committees thus did not have an opportunity to use the spring 2002 budget-review season to review in detail the Navy's accelerated acquisition plan for the LCS program or the supporting request for $33 million in funding.

- **2003 budget-review season (for FY2004 budget).** To support a more informed review of the LCS program during the spring 2003 budget-review season, the conferees on the FY2003 defense authorization bill included a provision (Section 218) requiring the Navy to submit a detailed report on several aspects of the LCS program, including its acquisition strategy. In response to this legislation, the Navy in February 2003 submitted a report of eight pages in length, including a title page and a first page devoted mostly to a restatement of Section 218's requirement for the report. The House and Senate Armed Services committees, in their reports on the FY2004 defense authorization bill, have expressed dissatisfaction with the thoroughness of the report as a response to the requirements of Section 218. (For details, see the Legislative Activity section of this CRS report.) It is thus not clear whether the defense authorization committees were able to conduct their spring 2003 budget-review hearings on the FY2004 budget with as much information about the LCS program as they might have preferred.

Only the 2004 budget-review season on the Navy's proposed FY2005 budget now remains for further reviewing and considering the merits of the LCS program prior to deciding whether to approve the start of LCS procurement.

Potential oversight questions for Congress concerning the LCS program's rapid acquisition strategy include the following:

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[70] The conference report (H.Rept. 107-772 of November 12, 2002) on the FY2003 defense authorization bill (H.R. 4546) states: "The budget request for FY2003 included no funding for research and development for a littoral combat ship (LCS)." (Page 562)

- Is the Navy pursuing a rapid acquisition strategy for the LCS program to meet an urgent operational requirement for improved littoral warfare capabilities, or for essentially political purposes that are aimed at maximizing the LCS program's chances of survival? What would be the operational risk of deferring the start of LCS procurement by one or two years, so as to provide additional time for learning about and assessing the merits of the program?

- Is the Navy employing a rapid acquisition strategy for the LCS program in part in an attempt to rush Congress into a quick decision on LCS procurement before Congress fully understands the details of the program? If so, and if DOD later concludes that this strategy worked for the LCS program, would this encourage DOD to use a similar approach for securing congressional approval on other defense acquisition programs in the future? If so, what might be the potential consequences for future congressional oversight of proposed DOD acquisition programs?

Lead Ships Funded in Research and Development Account. The Navy argues that funding the construction of the lead ships in the DD(X) and LCS programs in the Navy's research and development account rather than in the Navy's ship-procurement account, where lead ships traditionally have been funded, will permit the Navy to mitigate technical risk in the programs by permitting the ships' new technologies to be developed in a more R&D-like managerial environment. In addition, the Navy argues, funding lead ships in the research and development account will encourage the Navy managers of the programs to invest funds in improved production processes that can help reduce the recurring production costs of the ships.

Skeptics of the Navy's plan to fund the lead ships of both programs in the Navy's research and development account could argue that in the case of the LCS program, this approach is contradicted by the Navy's plan to fund the second LCS in the year after the year in which the lead LCS is funded. If building the lead LCS encompasses enough technical risk that the effort is better managed in an R&D-like managerial environment, they could argue, then the Navy's procurement plan should include at least one "gap" year (i.e., a year in which no ships are procured) between the years of lead ship procurement and second-ship procurement to provide sufficient time for discovering and fixing problems in the ship's design. Until recently, skeptics can argue, Navy ship-procurement programs traditionally included such a gap year so as to provide sufficient time for this purpose. Conversely, skeptics could argue, if building the lead ship encompasses so little technical risk that a gap year is not needed, then the lead ships should be procured through the Navy's ship-procurement account, like lead ships have in the past. Skeptics could argue that either there should be a gap year between lead-ship procurement and second-ship procurement or the lead ship should be procured in the Navy's ship-procurement account.

Skeptics could also argue that the Navy's plan to fund the lead ships of both classes in the Navy's research and development account could permit the Navy to blend construction funding with traditional research and development funding,

obscuring the construction cost of the lead ships, and also permit the Navy to fund the construction cost of each ship incrementally, through a stream of annual payments, rather than all at once (as normally required by the full funding policy for defense procurement),[71] further obscuring the total construction cost of the ship. Skeptics could argue that under the Navy's plan (see **Table 2**), funding for the construction of the lead DD(X) is not to be completed until FY2011, at which point DD(X)s two through ten will have been fully funded and the Navy will be seeking full funding for DD(X)s eleven and twelve (assuming two DD(X)s are funded in FY2010 and another two are funded in FY2011). Blending construction funding with traditional research and development funding, and funding the first ship through a stream of annual payments, skeptics could argue, could weaken congressional oversight, which depends in significant part on making total ship construction costs clear and fully visible. Skeptics could also argue that the Navy's argument about cost discipline turns on its head the longstanding congressional view, embodied in the full funding policy, that cost discipline is best achieved through up-front full funding of an item's procurement cost.

LCS Mission Modules Funded in Other Procurement Account. As mentioned in the background section, the Navy plans to procure LCS mission modules through the Other Procurement, Navy (OPN) appropriation account rather than the Navy's ship-procurement account. The OPN account, as its name suggests, is a large, "grab-bag" appropriation account for procuring a wide variety of items, many of them miscellaneous in nature.

Supporters of the Navy's plan can argue that it is consistent with the traditional practice of procuring ship weapons (e.g., missiles and gun shells) through the Weapon Procurement, Navy (WPN) appropriation account or the Procurement of Ammunition, Navy and Marine Corps (PANMC) appropriation account rather than the ship-procurement account. LCS mission modules, they could argue, are the payload of the LCS, just as missiles and gun shells are the payload of other types of surface combatants, and should therefore be funded outside the ship-procurement account.

Those skeptical of the Navy's plan to fund LCS mission modules through the OPN account could argue that the LCS mission modules are not comparable to missiles and gun shells. Missiles and gun shells, they could argue, are expendable items that are procured for use by various classes of ships while the LCS mission modules will incorporate sensors as well as weapons, are not intended to be expendable in the way that missiles and gun shells are, and are to be used largely, if not exclusively, by LCSs, making them intrinsic to the LCS program. In light of this, they could argue, it would be more consistent to fund LCS mission modules in the ship-procurement account rather than the OPN account.

Potential oversight questions for Congress include the following:

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

- Are LCS mission modules analogous to missiles and gun shells that are procured through the WPN and PANMC appropriation accounts?

- Does the Navy's plan to fund the LCS mission modules through this account effectively obscure a significant portion of the total LCS program acquisition cost by placing them in a part of the Navy's budget where they might be less visible to Congress? If so, was this the Navy's intention?

- Does funding a significant portion of the LCS program's total procurement cost through the OPN account give the LCS program an unfair advantage in the competition for limited ship-procurement funding by making the LCS program, as it appears in the ship-procurement account, look less expensive? If so, was this the Navy's intention?

Technical Risk. Managing technical risk is a longstanding theme in oversight in DOD acquisition programs. If a service has underestimated the amount of technical risk involved in developing a new weapon, and consequently has provided an insufficient amount of time or funding for developing the new technologies that are to be incorporated into the weapon, then the program could experience delays and cost overruns during the development stage and, potentially, performance problems after being fielded.

DD(X) Program. As mentioned in the background section, the initial version of the DD(X) design is to incorporate a significant number of new technologies, including a wave-piercing, tumblehome hull design, a superstructure made out of large sections of composite materials rather than steel or aluminum, an integrated electric drive propulsion system and related ship-wide electrical distribution system, a total-ship computing system, automation technologies for a reduced-size crew, new radars, a new kind of vertical launch system (the peripheral VLS), and a new gun (the AGS). This is the largest number of significant new technologies that the Navy has attempted to incorporate into a new surface combatant design in decades.[72]

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[72] Some DD(X) supporters have argued that the new technologies to be incorporated into the DD(X) represent an important reason for starting procurement of DD(X), because these technologies are key technologies for the future surface fleet. Starting procurement of the DD(X) promptly, they argue, will permit the Navy to start bringing that future into the present without delay. Skeptics could argue that although the DD(X)'s new technologies may be central to the future of the surface fleet, they do not by themselves represent an argument to begin procuring DD(X)s. The Navy, skeptics could argue, should begin procuring new ship designs only when those new designs are needed to perform required missions that current designs cannot perform or because the new designs could perform the missions more cost effectively than current designs. When procuring a new ship design is needed for those reasons, they can argue, the new design can incorporate these technologies. Stating that the DD(X)'s new technologies themselves justify starting DD(X) procurement, they could argue, puts the cart before the horse and amounts to a case of "technology lust."

A March 2004 report by the General Accounting Office (or GAO, now called the Government Accountability Office) on major DOD acquisition programs states:

> DD(X) is scheduled to enter system development with none of its 12 critical technologies fully mature. The program is pursuing risk mitigation by constructing and testing engineering development models for its critical technologies. The acquisition strategy calls for engineering development model construction and testing concurrent with system design. Because of schedule slippage, only two models will be mature by the award of the lead ship construction contract, currently planned for September 2005. Backups are available for only 2 of the 12 technologies. Program progress has been hampered by changes in desired ship size and capabilities.[73]

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[73] U.S. General Accounting Office, *DEFENSE ACQUISITIONS: Assessments of Major Weapon Programs*, GAO-04-248, Mar. 2004, p. 45. On page 46, the report elaborates on these points, stating:

> None of the 12 critical technologies for DD(X) are fully mature. The Navy does not anticipate any of these technologies reaching maturity prior to entering system development. At the time of the first ship production decision, the Navy expects to have only two critical technologies sufficiently tested to demonstrate maturity. Only two backup technologies exist, one for the integrated power system and one for the hull form. While the backup technology for the integrated power system is mature, the alternate hull form remains in development. If other critical technologies do not mature as planned, system redesign would occur.
>
> The DD(X) Program Office is managing risk in part by constructing and testing engineering development models for each of the 12 critical technologies. The program's acquisition strategy scheduled these models to be fully built and tested concurrent with system design and completed before authorizing construction of the first ship. Current testing schedules call for the integrated power system, dual band radar suite, total ship computing environment, and peripheral vertical launching system to continue development beyond lead ship production decision.
>
> A second element in the risk reduction strategy is "design budgeting." According to the program manager, this approach consists of designing the requirements for technologies with a margin for growth. The DD(X) program allows for a 10 percent margin to account for necessary increases in size, weight, or manpower discovered through testing of the engineering development models. If the 10 percent margin is exceeded, system redesign would occur.
>
> Modifications to ship size and capabilities affected the progress of the technology maturation process. In June 2003, the weight of the ship was reduced, prompting redesign of the advanced gun system and hull form engineering development models. Multiple reevaluations of radar characteristics contributed to a delay in the development of the dual band radar engineering development model....
>
> In commenting on a draft of this analysis, the program office stated that the ability of DD(X) to deliver revolutionary capabilities with reduced crew necessitates some element of development and production risk. Program officials

(continued...)

A September 2004 GAO report on the DD(X) program states:

> To reduce program risk, the Navy plans to build and test 10 developmental subsystems, or engineering development models, that comprise DD(X)'s critical technologies. While using these models represents a structured and disciplined approach, the program's schedule does not provide for the engineering development models to generate sufficient knowledge before key decisions are made. None of the technologies in the 10 engineering development models was proven to be mature when system design began, as best practices advocates. Moreover, the Navy does not plan to demonstrate DD(X) technology maturity and design stability until after the decision to authorize construction of the lead ship, creating risk that cost, schedule, and performance objectives will not be met. With many of the tests to demonstrate technology maturity occurring around the time of critical design review in late fiscal year 2005, there is the risk that additional time and money will be needed to address issues discovered in testing.
>
> Some of the technologies are progressing according to the Navy's plans, while others have experienced challenges. Four of the 10 engineering development models — the total ship computing environment, the peripheral vertical launch system, the hull form, and the infrared mockups — are progressing as planned toward demonstrating complete subsystems. However, four other models — the integrated power system, the autonomic fire suppression system, the dual band radar, and the integrated deckhouse — have encountered some problems. At this point, the most serious appear to be the schedule delay in the dual band radar resulting from the Navy's decision to change one radar type and the additional weight of the integrated power system. The two remaining engineering development models — the integrated undersea warfare system and the advanced gun system — are progressing as planned, but will not culminate in the demonstration of complete subsystems before being installed on

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[73] (...continued)

> expect that the spiral development approach adopted in 2001, combined with robust testing of the engineering development models, will mitigate that risk. Officials indicated that, since the 2002 contract award, the only significant schedule change was due to dual band radar changes.
>
> The program office also stated that the time required to design and build a ship makes the process unique from other weapon systems. DOD policy states that ship technologies must be mature in time for installation, and the program office stated that all DD(X) engineering development models will meet this requirement. At design review, the program expects that most engineering development models will be nearing maturity, and that design budgeting will enable incorporation of changes....
>
> The program will be integrating technologies into a ship-level system design at the same time that it is maturing individual technologies. Should any of these innovative technologies encounter challenges that cannot be accommodated by design budgeting, redesign of other technologies and of the integrated system may be needed. Redesign would likely result in additional costs and schedule delays as well as affect the planned installation schedule.

the first ship. While the Navy has fallback technologies for the hull form and the integrated power system, it does not have such plans for the other eight engineering development models.[74]

The Navy and other supporters of the DD(X) program can argue that the Navy has properly assessed the amount of technical risk in the DD(X) program and has taken steps that will permit the Navy to manage and mitigate this risk, including the following:

- **FY2005 start date.** The FY2005 procurement date for the DD(X) program reflects earlier Navy decisions to defer the start of DD-21 program from FY2003 to FY2004, and again from FY2004 to FY2005. Deferring the start of DD-21 procurement by a total of two years was intended to provide more time to develop certain technologies intended for the DD-21, particularly the ship's new radars. The DD(X), as the de facto successor to the DD-21 program, is benefitting from the added development time provided by these decisions, just as the DD-21 would have.

- **Use of EA/SD.** The DD(X) program's use of evolutionary acquisition with spiral development will allow new technologies to be inserted into successive versions of the DD(X) design in a sequential manner, when each new technology becomes ready, so that each flight (i.e., version) of the DD(X) design will be built with the most up-to-date technologies that are ready at that time, but no technologies that are not yet ready. EA/SD contrasts with the old DOD acquisition approach, now called single step to full capability, under which DOD would attempt to insert all the new technologies planned for a new weapon or platform into the initial version of that weapon or platform, even if doing so meant that there was inadequate time to fully or carefully develop some of those technologies.

- **Use of EDMs.** In structuring the DD(X) program, the Navy included a new feature that was not included in the DD-21 program — additional funding to design and build engineering development models (EDMs) of several key technologies that are scheduled to be incorporated into the DD(X). These EDMs, which are essentially test examples of these technologies, will be used to retire much of the technical risk associated with developing these technologies.

- **Lead ship funded in R&D**. In structuring the DD(X) program, the Navy implemented another change from the DD-21 program — the idea of procuring the first DD(X) through the Navy's research and development account rather than through the Navy's ship-procurement account. This change will permit the ship to be

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[74] U.S. Government Accountability Office, *DEFENSE ACQUISITIONS: Challenges Facing the DD(X) Destroyer Program,* GAO-04-973, Sept. 2004.

designed and built in a R&D managerial environment that is better suited to managing the risks associated with developing and fielding new technologies.

- **Fall-back options.** In structuring the DD(X) program, the Navy has also included technology fall-back options — existing technologies that could be used in the event that one or more of the planned new technologies encounter unexpected development difficulties. The Navy's existing 5-inch gun, for example, can be installed on the ship if the AGS is not ready in time. These fall-back options, also called technology off-ramps, will further mitigate technical risk in the DD(X) program.

Skeptics, while acknowledging the above points, could argue the following:

- **Number of new technologies.** Even with the use of EA/SD, EDMs, an R&D-like building environment for building the lead ship, and technology fall-back options, the large number of new technologies to be incorporated into the DD(X) together pose a more complex surface-combatant development challenge than the Navy has faced in years. If any one of these technologies experiences delays, it could complicate the schedule for the entire ship. Fall-back options may require added time to implement, particularly if they require changing the ship's design in some way, and could leave the DD(X) with less capability than intended. In addition to developing each of these new technologies, the Navy will need to integrate all of them into a single platform that works as intended. This kind of total-platform system integration has often proved to be a particularly difficult engineering task for the services.

- **Other recent Navy ship programs.** The Navy's recent track record in assessing and managing technical risk in shipbuilding programs is mixed. The Virginia (SSN-774) class submarine program appears to have experienced no major technical problems. The San Antonio (LPD-17) class amphibious ships program and the Advanced Swimmer Delivery System (ASDS) program,[75] however, have experienced significant delays and cost overruns due to unforeseen design and technology issues.

LCS Program. The Navy and other supporters of the LCS program could, like supporters of the DD(X) program, again argue that the Navy has properly assessed the amount of technical risk in the LCS program and has taken steps that will permit the Navy to manage and mitigate this risk, including the following:

- **Use of EA/SD.** The LCS program's use of evolutionary acquisition with spiral development (EA/SD) will allow new technologies to be inserted into successive versions the DD(X) design in a sequential

[75] The ASDS is a mini-submarine that is to be attached to the back of Navy attack submarines and used for inserting and recovering special operations forces.

manner, when each new technology becomes ready, so that each flight of LCSs will be built with the most up-to-date technologies that are ready at that time, but no technologies that are not yet ready.

- **Preliminary design studies.** The Navy commissioned six conceptual design studies from industry teams on what an LCS-like ship might look like and be capable of doing. The Navy used the studies to gain a more complete and realistic understanding of what the LCS could be, and then used this more-informed understanding in writing the Preliminary Design Interim Requirements Document (PD IRD) that sets forth the performance requirements for the LCS.

- **Firms with appropriate experience.** The Navy has encouraged the leaders of the competing LCS industry teams to make maximum use of U.S. and foreign firms with experience in building smaller ships, ships with non-traditional hull forms, and ships incorporating new technologies. The competing industry teams have responded by including on their rosters firms with this kind of experience.

- **Possibility of building two initial designs.** The Navy may choose to fund the production of two initial LCS designs offered by different industry teams, rather than just one design. The Navy will thus give not one but two industry teams an opportunity to meet the technical risks involved in developing and building an initial version of the LCS.

- **Supporting research and development efforts.** The LCS program will incorporate lessons learned from recent Navy research and development programs that have developed and built prototypes of small, fast ships using novel hull forms, such as the X-Craft program (previously called the Littoral Support Craft — Experimental, or LSC-X program) and foreign-built high-speed vessels (HSVs). The LCS will also incorporate, where appropriate, technologies developed for the DD(X) program.

Skeptics, while acknowledging these points, could argue the following:

- **Different kind of ship with several new technologies.** As the Navy has pointed out, the LCS will differ significantly from past Navy surface combatants. The initial version of the LCS design is to incorporate a significant number of new technologies, including a non-traditional hull form, automation technologies for a smaller crew, and modular mission payload packages. In light of this, it may be very difficult for the Navy (or anyone else) to fully understand the technological risk involved in developing and building the LCS.

- **Schedule provides little time for development.** The acquisition strategy for the LCS program provides very little time for technology development prior to beginning construction of the first LCS. This might not be a concern for a program to build a traditional ship with

few new technologies, but the LCS is to be a different kind of ship incorporating significant new technologies.

- **Less use of EDMs.** Although the use of engineering development models is cited as a means for reducing technical risk in the DD(X) program, the LCS program does not appear to make as much use of EDMs as does the DD(X) program.

- **Problems can occur in adapting familiar technologies.** Although teams competing for the LCS include U.S. and foreign firms that have prior experience in building smaller ships, ships with non-traditional hull forms, and ships with new technologies, past experience in Navy ship acquisition problems demonstrates that adapting that experience to a new Navy ship program can present more difficulties than initially realized.[76]

Affordability

As shown in **Table 4** in the background section, current Navy plans call for procuring two DD(X)s and three LCSs in FY2008, three DD(X)s and six LCSs in FY2009, and two DD(X)s and five LCSs per year for the eight-year period FY2010-FY2017. Is this plan affordable? Will the Navy budget be sufficient to procure DD(X)s and LCSs at these annual rates without requiring undue reductions in other Navy programs?

Those who support the notion that the Navy's plan for procuring DD(X) and LCSs is affordable could argue the following:

- At a cost of $150 million to $220 million each in FY2005 dollars (excluding mission modules), procuring 5 LCSs per year would cost $750 million to $1,100 million per year. The high end of this range

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[76] In the early 1980s, for example, the Navy began a program to build a class of new minesweepers/hunters that were to be called the Cardinal (MSH-1) class. These ships were to be built by an industry team led by the U.S. firm Bell Textron Aerospace and the Swedish firm Karlskronavarvet. The ships were to use a surface effect ship (SES) hull design built from a sandwich structure of glass-reinforced plastic (or GRP). (An SES hull uses two side walls to trap a tunnel of air under the ship. As the ship gains speed, the tunnel of air passing under the center of the ship pushes more of the ship out of the water, allowing the ship to move at high speeds with less drag. GRP is essentially a form of fiberglass.) Bell had prior experience building SES hulls, and Karlskronavarvet had prior experience with sandwich GRP technology for ships. The Navy viewed the SES-GRP hull as an innovative approach that offered potential operational advantages. Adapting the Swedish GRP technology to the U.S. SES hull design, however, proved more difficult than anticipated: A test section of the ship failed a shock test, with the GRP showing signs of delamination. This and other development difficulties led to the cancellation of the MSH program. The Navy replaced the Cardinal-class effort with a new program to build a class of coastal minehunters called the Osprey (MHC-51) class. The Osprey-class design was based on a proven design for an Italian minehunter (the Lerici class). The Osprey-class program also, however, experienced schedule delays, design difficulties, and cost growth.

is roughly equivalent to the procurement cost of a single DDG-51. The low end of this range is less than that cost. The Navy's estimated unit procurement cost of $1.2 billion to $1.4 billion is not much higher than the unit procurement cost of a DDG-51. In this sense, procuring 2 DD(X)s and 5 LCSs per year would require roughly the same amount of funding as procuring 3 DDG-51s per year, which is a rate that the Navy budget currently funds.

- The Navy currently has many efforts underway to reduce costs and increase internal efficiencies so as to generate savings that can be applied to procurement programs like the DD(X) and LCS. Many of these efficiency efforts will be bearing fruit by FY2009, when the Navy plans to begin procuring a total of 7 DD(X)s and LCSs per year.

Those who are skeptical that the Navy's plan for procuring DD(X)s and LCSs is affordable could argue the following:

- Since the DD(X) and LCS programs were announced in November 2001, the federal budget situation has changed from one of projected surpluses to one of projected deficits. Projected deficits could lead to pressures to constrain federal spending. If actions to restrain federal spending include steps to constrain DOD spending, then the DOD budget may not grow as much in coming years as currently projected. Reductions in planned DOD spending could lead to reductions in the planned Navy budget and in turn to the Navy's ship-procurement account, leaving fewer funds for procurement of ships in coming years than now planned.

- Past Navy efforts to reduce costs and generate internal efficiencies have not always generated as much savings, or generated them as quickly, as hoped. Some of the savings generated by the Navy's current efforts may be used to fund Navy plans to maintain ships and strike fighters at higher rates of readiness so as to get more operational use out of them during their lifetimes.[77] They might also be used to help fund increases in Army end strength and costs associated with the Army's new transformation plan.

- The $150 million to $220 million unit procurement cost figure for the LCS does not include the cost of LCS mission modules. Procuring LCS mission modules will add to the total procurement cost of the LCS program, perhaps substantially, particularly if an average of more than one module is procured for each LCS.

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[77] For a discussion of the Navy's plans to spend additional funding to increase readiness rates for Navy strike fighters, see CRS Report RS21488, *Navy-Marine Corps Tactical Air Integration Plan: Background and Issues for Congress*, by Christopher Bolkcom and Ronald O'Rourke.

- There are reasons to be concerned about the Navy's ability to build follow-on DD(X)s at a cost of $1.2 billion to $1.4 billion, including the following: (1) The Navy's estimated cost includes a $200-million range of uncertainty, suggesting that the Navy does not have a complete understanding of potential costs for building the DD(X) design; (2) CBO's estimated cost for building DD(X)s ($1.8 billion) is 29% to 50% higher than the Navy's estimate, suggesting that there are major analytical differences between the Navy and CBO regarding the cost of the DD(X) design; and (3) The Navy has not explained in detail why it believes the DD(X) design will be any less expensive on a per-weight basis to build than the DDG-51 design. If the DD(X) design costs as much per unit weight to build as a DDG-51 design, the DD(X) design would cost more than $2 billion.

- Numerous Navy shipbuilding programs in recent years have experienced cost growth, in some cases substantial. In light of this experience, it is possible that the DD(X) or LCS programs might also cost more to procure than currently estimated. As mentioned in the background section, CBO estimates the procurement cost of the DD(X) design at $1.8 billion rather than $1.2 billion to $1.4 billion. Procuring two DD(X)s and five LCSs per year could thus require more funding than procuring three DDG-51s per year.

Supporters of both the DD(X) and LCS are concerned that limits on Navy funding might compel the Navy to choose between the DD(X) and LCS, while supporters of the Virginia-class submarine program are concerned that the Navy may keep Virginia-class procurement at one ship per year (rather than increasing it at some point to two per year) so as to generate funding to pay for the DD(X) and LCS. If the procurement cost of follow-on DD(X)s is closer to $2 billion than to $1 billion, pressures for the Navy to make a choice between the DD(X), LCS, and Virginia-class programs could grow more intense.[78]

The March 2003 CBO report on the Navy's surface combatant programs expressed concerns about the prospective combined affordability of the DD(X) and LCS programs, particularly in light of approaching attack submarine procurement requirements. The report stated that the Navy's plan for a 160-ship surface combatant force (i.e., the force associated with the Navy's plan to procure 24 DD(X)s and 56 LCSs)

> would require greater resources than the surface combatant force has received in recent years or expects to receive under the President's budget request for 2004. That request envisions that the Navy will spend $3.2 billion in 2004 — or about 28 percent of the ship building budget — to buy surface combatants. The rest of the ship construction budget would go to build aircraft carriers, submarines, amphibious ships, and support ships. In contrast, by CBO's estimate, the Navy would need to spend an average of $5.9 billion a year (in 2003 dollars) on

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

> procurement between 2003 and 2025 to implement the 160 ship plan — or more than half of the shipbuilding budget in the President's 2004 request....
>
> At the same time, other components of the Navy will need greater resources if Navy leaders are to achieve their overall force goals. CBO estimates that to meet those goals, the budget for ship construction would have to average about $17 billion a year between 2011 and 2020 — about $3 billion more than the average required for the 2003 2010 period... and twice what the Navy spent between 1990 and 2002. (The Navy's shipbuilding budget in 2003 is about $8 billion.)
>
> [An analysis of past and projected future ship construction funding] shows how deep the hole in the Navy's ship construction budget has become, and how building a larger surface combatant force would exacerbate the problem.... Sustaining a 300 ship Navy indefinitely (that is, in steady state) would require spending about $11 billion a year on ship procurement, CBO estimates. But since 1990, the Navy has spent only about $8.5 billion per year, on average. Thus, the total shortfall in ship construction relative to the spending necessary to maintain a steady state fleet of around 300 ships now stands at almost $39 billion. The lion's share of that shortfall involves attack submarines, of which the Navy bought seven between 1990 and 2002.
>
> In the past year, by contrast, senior Navy admirals have argued that they need 375 ships to perform all of the missions asked of the service. By far the biggest change in force goals is the increase in the desired level of surface combatants from 116 to 160. In short, the Navy is proposing a major expansion of the surface combatant force that will require considerable resources at the same time that other ship programs will need more funding if current force levels are to be maintained.[79]

Potential oversight questions for Congress include the following:

- In light of federal budget projections, will the Navy budget — and the ship-procurement part of the budget — grow at the rate projected in the FY2004-FY2009 Future Years Defense Plan (FYDP)?
- Are the Navy's estimated unit procurement costs for the DD(X) and LCS realistic? What is the likelihood that the unit procurement cost of the DD(X) or LCS will exceed the Navy estimate? Why is there a significant difference between the Navy and CBO concerning the estimated unit procurement cost of the DD(X)? What is the basis for the Navy's implicit assertion that the DD(X) design will cost 36% to 45% less per unit weight to build than the DDG-51 design?
- If future funding levels are not sufficient to procure two DD(X)s and five LCSs per year without reducing funding for submarine procurement or other Navy priorities below desired levels, how should this situation be reconciled? Should funding for submarine

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[79] U.S. Congressional Budget Office, *Transforming the Navy's Surface Combatant Force*, Mar. 2003, pp. xiv-xv.

procurement or other programs be reduced? If so, how might this affect future Navy capabilities? Should the DD(X) or LCS program be cancelled instead? If so, which one? Alternatively, should both the DD(X) and LCS programs continue, but at lower annual procurement rates than now planned? If so, how might this affect DD(X) and LCS unit procurement costs? If DD(X) or LCS unit procurement costs rise due to a reduction in annual procurement rates, would the programs still be cost effective?

Industrial Base

The Navy's plan for shifting from procurement of DDG-51s to procurement of DD(X)s and LCSs raises at least three potential industrial-base issues for Congress. These issues concern the planned transition from DDG-51 procurement to DD(X)/LCS procurement, the implications of building DD(X)s in one yard or two, and the implications of building LCSs in a yard or yards other than GD/BIW and NOC/Ingalls. Each of these issues is discussed below.

Transition From DDG-51s to DD(X)s and LCSs. **Table 5** below shows the Administration's plans for procuring surface combatants during the FY2004-FY2009 Future Years Defense Plan (FYDP). As can be seen in the table, the plan calls for procuring a total two surface combatants (both LCSs) in FY2006 and larger annual quantities before and after these dates.

Table 5. Planned Surface Combatant Procurement, FY2004-FY2009

	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009
DDG-51	3	3	0	0	0	0
DD(X)	0	1	0	2	2	3
LCS	0	1	2	1	3	6
Total	3	5	2	3	5	9

Supporters of the Navy's surface combatant industrial base, and particularly the two current surface combatant construction shipyards — GD/BIW and NOC/Ingalls — are concerned that this plan will provide BIW and Ingalls with insufficient work in FY2006, particularly since the two ships to be procured in FY2006 — both LCSs — will not be built at either of these yards.[80]

If none of the LCSs shown in **Table 5** are built at BIW and Ingalls, which is possible, then a total of 14 surface combatants — 8 DD(X)s and 6 DDG-51s — would be available for BIW and Ingalls under the Navy's plan during the period

[80] The Navy eliminated Northrop Grumman's industry team as a competitor for the LCS program in July 2003. Although General Dynamics' industry team remains a competitor for the LCS program, it anticipates building the first LCS at Austal USA, a team member's yard in Mobile, AL.

FY2004-FY2009. Based on their relative light-ship displacements of 12,135 and 6,950 tons, respectively, a single DD(X) might be the equivalent, in terms of shipyard work, to roughly 1.75 DDG-51s. If so, then the 8 DD(X)s shown in table might be the equivalent, in terms of shipyard work, to about fourteen DDG-51s, and the total number of DDG-51 equivalents shown in **Table 5** would be about 20 ships, or an average of about 3.3 ships per year. This is a bit more than the minimum of 3 DDG-51 equivalents per year that supporters of BIW and Ingalls in past years have said is needed, along with a certain amount of other non-DDG-51 construction work at Ingalls, to maintain the financial health of both BIW and Ingalls.

The ability of BIW and Ingalls to weather periods of reduced Navy surface-combatant-construction work, moreover, may now be better than it was in the early 1990s, when the workload at the two yards first became a concern due to post-Cold War reductions in Navy ship procurement, because, unlike the earlier period, BIW and Ingalls are now parts of larger defense firms — General Dynamics and Northrop Grumman, respectively — with significant financial resources. In addition, GD and NOC each own 3 shipyards involved in Navy shipbuilding, and at least in the case of NOC, there may be opportunities to bolster the workload at Ingalls with shipbuilding transferred from one of NOC's other yards (i.e., Avondale shipyards near New Orleans).

Even so, supporters of BIW and Ingalls can argue that the plan in **Table 5**, if implemented, would put BIW and Ingalls through a workload roller coaster (up in FY2005, down in FY2006, then up again in FY2007-FY2009) that could lead to production inefficiencies and increase shipbuilding costs. They could also question whether, in terms of shipyard work, a DD(X) is the equivalent to 1.75 DDG-51s. Although that may seem to be the case based on the light-ship displacements of the ships, the Navy's estimated procurement cost of the DD(X) is fairly close to cost of a DDG-51. If this estimate proves correct, they can argue, then the difference between the two ship designs in total shipyard work may not be as great as suggested by their differences in light-ship displacements.

Potential oversight questions for Congress include:

- What are the potential implications of the Navy's FY2005-FY2009 surface combatant procurement plan for total workloads, revenues, and employment levels at BIW and Ingalls, particularly in FY2006?

- Would the Navy's plan to reduce surface combatant procurement during FY2006 and then increase it in subsequent years lead to any production inefficiencies? If so, what are the potential additional costs resulting from these inefficiencies?

Building DD(X)s in One Yard or Two. Although the Navy has stated that production contracts for the first 2 DD(X)s would be equally divided between GD/BIW and NOC/Ingalls, if affordability considerations lead to a decision to procure DD(X)s at a rate of less than 2 ships per year, or to procure a total of less than 24 DD(X)s, the Navy might consider switching to a single-yard production strategy. In large part to avoid the added costs of maintaining two production lines for a program to build a total of 12 San Antonio (LPD-17) class amphibious ships,

the Navy in 2002 reached an agreement with GD and NOC to consolidate production of LPD-17s at NOC's Avondale and Ingalls yards rather than splitting the LPD-17s between NOC and GD, as previously planned. (As mentioned in the background section, in return for this, most of NOC's future DDG-51 production was shifted to GD/BIW.)

A Navy decision at some point to build DD(X)s at one yard rather than two could put the non-DD(X) yard under substantial financial pressure. This might particularly be the case for BIW, since BIW is almost entirely dependent on surface combatant construction. Building DDG-51s and CG-47s has been BIW's principal business since the late 1980s. If DDG-51 procurement ends, DD(X)s are built solely at Ingalls, and LCSs are not built at BIW, then BIW could go out of business as a Navy shipbuilder following completion of its final DDG-51s around 2010 or 2011.

If GD wins the LCS competition, then one option for GD would be to transfer at least some of the LCS production work from Austal USA — the GD team's shipyard in Mobile, AL, where the GD team proposes to build the first LCS — to BIW. Again based on potential ship displacements, three LCSs per year might be roughly equivalent, in terms of shipyard work, to one DDG-51 per year, which is an amount of work that could be sufficient to maintain BIW. Shifting production of some LCSs from Austal USA to BIW, however, could increase LCS procurement costs due to higher shipyard overhead costs at BIW and the potential additional costs of maintaining two LCS production lines at Austal USA and BIW.

Ingalls is not solely dependent on construction of U.S. Navy surface combatants: It has been the nation's sole builder of Tarawa (LHA-1) and Wasp (LHD-1) large-deck amphibious assault ships, and is generally considered the leading contender for building any similar ships for the Navy in the future. In addition, it is currently performing a portion of the LPD-17 construction work that is centered at Avondale, and could continue to do so. Ingalls is also to build new Coast Guard cutters under the Coast Guard's large Deepwater acquisition program. And Ingalls has had some success in the past in winning work to build and modernize smaller surface combatants for foreign navies and to build commercial ships. How well all these other forms of work could compensate for the loss of DD(X) construction work, however, is not clear.

Potential oversight questions for Congress include:

- What are the potential relative costs of building DD(X)s in one yard or two? How might these potential relative costs be affected by changes in the planned DD(X) annual procurement rate and total number of DD(X)s to be procured?

- If the Navy at some point decides to build DD(X)s in one yard, what are the potential financial and employment implications for the non-DD(X) yard?

Building LCSs in Yards Other Than BIW and Ingalls. The NOC/Ingalls-led team is no longer competing to become the builder of the LCS. The GD/BIW-led team is one of three remaining competitors for the program, but it is

proposing to build at least the first LCS at the Austal USA shipyard in Mobile, AL. It is thus possible — if the GD/BIW-led team is not selected to build LCSs, or chooses to build at least some LCSs after the first ship at the Austal USA yard — that some or all LCSs could be built at a yard or yards other than BIW and Ingalls. What are the potential implications if LCSs are built partly or entirely at a yard or yards other than BIW and Ingalls?

Supporters of the idea of building some or all LCSs in a yard or yards other than BIW and Ingalls could argue that this will help constrain LCS construction costs because the yards in question are smaller facilities than BIW and Ingalls that, unlike BIW and Ingalls, do not include equipment for installing, integrating, and testing complex surface combatant combat systems like the Aegis system. As a result, supporters could argue, the fixed overhead costs of these yards are lower than those of BIW and Ingalls, and these lower costs can be passed on to the Navy. In this way, supporters could argue, building LCSs in a yard or yards other than BIW and Ingalls could reduce LCS procurement costs by breaking the "lock" that large, higher-cost yards like BIW and Ingalls have maintained on major Navy shipbuilding programs. They could also argue that building LCSs at yards other than those that have traditionally built major Navy ships could broaden the geographic base of support for Navy shipbuilding programs.

Skeptics of the idea of building some or all LCSs in a yard or yards other than BIW and Ingalls could argue that BIW and Ingalls have considerable unused building capacity, and that building LCSs at BIW or Ingalls could reduce the cost of other Navy shipbuilding programs being performed at these yards (including potentially the DD(X) program) by spreading BIW's or Ingalls' fixed overhead costs over a larger amount of shipbuilding work. In this sense, skeptics could argue, the savings associated with building LCSs at a smaller yard with lower fixed overhead costs will be offset by the higher costs associated with reduced spreading of fixed costs at BIW or Ingalls. They could argue, in light of the effect on spreading of shipyard fixed costs, that building LCSs at a smaller yard might even be intended by OSD or the Navy to improve the apparent affordability of the LCS relative to other Navy shipbuilding programs while perhaps not significantly reducing overall Navy shipbuilding costs. Skeptics could also argue that the 6 large shipyards that have built all the Navy's major ships in recent years[81] currently have much more capacity than the Navy now needs, and that building some or all LCSs in a smaller shipyard would exacerbate this excess-capacity situation by effectively creating a seventh yard with a strong dependence on Navy shipbuilding contracts.

Potential oversight questions for Congress include:

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[81] These 6 yards are GD/BIW; GD/Electric Boat of Groton, CT, and Quonset Point, RI; GD/National Steel and Shipbuilding Company (NASSCO) of San Diego, CA; NOC/Ingalls, NOC/Avondale of New Orleans, LA; and NOC/Newport News Shipbuilding (NNS) of Newport News, VA. Ingalls and Avondale together form most of Northrop Grumman Shipbuilding Systems (NGSS).

- What are the potential implications for the combined cost of all Navy shipbuilding programs if some or all LCSs are built at a yard or yards other than BIW or Ingalls?

- What effect would building some or all LCSs at a yard other than the 6 yards that have built the Navy's major ships in recent years have on the balance between Navy shipbuilding capacity and prospective Navy programs for using that capacity? Would it in effect create a seventh yard with a strong dependence on Navy shipbuilding contracts?

- If LCSs are not built at BIW or Ingalls, will the Navy's plan to procure an average of 2 DD(X)s or CG(X)s per year between FY2005 and FY2030 be sufficient, along with other forms of work, to maintain both BIW and Ingalls?

- Does OSD or the Navy support building some or all LCSs at a yard or yards other than the 6 major Navy shipbuilders supported in part as a strategy for improving the apparent affordability of the LCS relative to other Navy shipbuilding programs while perhaps not significantly reducing overall Navy shipbuilding costs?

- Does OSD or the Navy support building some or all LCSs at a yard or yards other than the 6 major Navy shipbuilders supported in part as a strategy for pressuring GD or NOC to reduce production capacity at their 6 yards so as to bring capacity more into alignment with prospective levels of Navy shipbuilding work?

Options for Congress

This section presents three sets of potential options for Congress concerning future acquisition of surface combatants — options for the DD(X) program, options for the LCS program, and options for the surface combatant industrial base. As mentioned earlier, decisions made on these options can be influenced by views that are developed on the oversight issues discussed in the previous section of the report. Accordingly, the options below are presented in terms of how they could reflect views developed on these oversight issues.

Options for DD(X) Program

Potential options for Congress concerning the DD(X) program include (but are not limited) to the following:

- approve the DD(X) program as proposed by the Navy;
- shift procurement of the lead DD(X) to the SCN account;
- defer procurement of the lead DD(X) to FY2006 or a later year;
- procure DD(X)s at a rate of three per year;
- procure DD(X)s at a rate of less than two per year;

- modify the DD(X)'s design to a more pure gunfire emphasis;
- procure one or a few DD(X)s as a short-term bridge to an accelerated CG(X);
- terminate the DD(X) program and procure modified DDG-51s instead;
- terminate the DD(X) and LCS programs and instead procure a new-design frigate and perhaps also a low-cost gunfire support ship; and
- terminate the DD(X) program and procure no larger Navy surface combatant until the CG(X).

Some of these options could be pursued in combination with one another, or in combination with options for the LCS program. Each of these options is outlined below in terms of how they might reflect certain views on one or more of the oversight issues for Congress discussed in the previous section of this report.

Approve DD(X) Program as Proposed. A decision to proceed with the DD(X) program as proposed by the Navy, without any changes, could reflect a view that:

- the Navy has accurately projected future mission requirements for surface combatants;
- a combination of DD(X)s, LCSs, and CG(X)s, represents the best possible approach for collectively performing those missions;
- the Navy's proposed acquisition and funding strategy for the DD(X) program is appropriate;
- the DD(X) and LCS programs are affordable in the context of potential future Navy budgets and competing Navy spending priorities; and
- proceeding with the DD(X) and LCS programs as proposed would have desirable, or at least acceptable, industrial-base consequences.

The alternative options outlined below would reflect disagreement with one or more of the above points.

Shift Procurement of Lead DD(X) to SCN Account. A decision to shift procurement of the lead DD(X) to the Navy's ship-procurement account could reflect a view that procuring the ship in the Navy's research and development account is:

- not needed to mitigate technical risk or control costs on the lead ship;
- inconsistent with the Navy's plan to fund the second DD(X) the following year; or
- undesirable from the standpoint of keeping the lead ship's construction cost fully visible and thereby promoting effective congressional oversight of the program.

Defer Procurement of Lead DD(X) to FY2006 or Later Year. A decision to defer procurement of the lead ship to FY2006 or a later year could reflect the following views:

- additional time is needed to learn more about important DD(X) program details, such as unit procurement cost and production strategy, and to assess requirements for naval gunfire support or other surface combatant missions; and
- technical risk in the DD(X) program is excessive and can be mitigated by providing more time for developing one or more of the technologies that are to be incorporated into the lead DD(X).

Procure Three DD(X)s Per Year. This option would involve procuring DD(X)s at a steady annual rate of three ships per year, starting as soon as FY2007 or FY2006, rather than at two ships per year starting in FY2008 as the Navy now plans. A decision to pursue this option could reflect the following views:

- the requirement for additional naval gunfire capability is urgent, and can be met more quickly by procuring DD(X)s at a rate of three per year;
- a procurement rate of three DD(X)s per year, by reducing the cost of each DD(X) by roughly $100 million through better spreading of shipyard fixed overhead costs, could make the DD(X) more affordable and cost-effective;
- a procurement rate of three DD(X)s per year would more adequately support the surface combatant industrial base, particularly if some or all LCSs are built at yards other than BIW and Ingalls and the amount of shipyard work involved in building a DD(X) is not significantly greater than the amount involved in building a DDG-51; or
- the need to begin CG(X) procurement is more urgent than reflected in current Navy plans, and procuring three DD(X)s per year could permit DD(X) procurement to finish — and CG(X) procurement to begin — up to four years sooner than now planned.

Procuring DD(X)s at a rate of three rather than two ships per year could increase annual DD(X) procurement funding requirements by $1.2 billion to $1.4 billion, using the Navy's estimated DD(X) unit procurement cost, or $1.8 billion, using CBO's estimated DD(X) unit procurement cost. Additional funds for financing this option could be generated by terminating the LCS program, by deferring procurement of LCSs until completion of DD(X) procurement, or by reducing funding for other Navy programs.[82]

Procure Fewer Than Two DD(X)s Per Year. A decision to procure DD(X)s at an average annual rate of fewer than two ships per year, instead of two ships per year as the Navy now plans, could reflect the following views:

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[82] Terminating the LCS program or deferring procurement of LCSs until completion of DD(X) procurement would permit most of the additional funding to be found within the surface combatant community's current share of the Navy budget. For potential reasons for terminating or deferring procurement of LCSs, see the section on LCS options.

- the requirement for additional naval gunfire capability is not as urgent, or not as large, as the Navy has argued;
- the other missions to be performed by the DD(X), such as antisubmarine warfare, can be adequately performed in part by the Navy's existing surface combatants and the LCS; or
- the Navy's plan for procuring two DD(X)s and five LCSs per year is not affordable in the context of potential future Navy budgets and competing Navy spending priorities.

Modify DD(X)'s Design to a More Pure Gunfire Emphasis. This option would involve reducing the DD(X)'s capabilities for performing missions other than naval gunfire support, such as antisubmarine warfare or anti-air warfare, perhaps to the point where these capabilities would now represent the minimum needed for self-defense. Reducing the DD(X)'s capabilities for performing these other missions would turn the DD(X) into more of a pure gunfire support platform. Depending on the depth of the reductions made in capabilities for performing the other missions, this option could reduce the unit procurement cost of the DD(X) by tens of millions of dollars, or possibly more than $100 million. A decision to reduce the DD(X)'s capabilities for performing missions other than naval gunfire support could reflect the following views:

- requirements for additional naval gunfire support capability are valid, and this is the DD(X)'s most important contribution to overall fleet capabilities;
- the DD(X)'s requirements for performing non-gunfire missions were inherited from the old DD-21 design, which was developed in the absence of a ship like the LCS; now that the LCS is to perform some of these missions, building these capabilities into the DD(X) is no longer as critical; and
- the procurement cost of the DD(X) needs to be reduced to help ensure that it can be procured in desired total numbers and at desired annual rates.

Supporters of additional naval gunfire support capability could support this option on the grounds that the resulting reduction in the procurement cost of the DD(X) might increase the likelihood that 24 DD(X)s, each equipped with 2 AGSs, will be procured as planned. Conversely, they could oppose this option on the grounds that it could reduce the likelihood of procuring 24 DD(X)s by narrowing institutional support in the Navy for the DD(X) program to a subset of officials who are concerned most about the naval gunfire support requirement, and by making plain to observers, both inside and outside DOD, the substantial cost — at least $30 billion, including research and development costs — of building a fleet of 24 ships strictly to meet this one mission requirement, which could lead to a reassessment of the requirement.

Procure a Few DD(X)s as Short-Term Bridge to CG(X). This option would involve building one DD(X) or a few DD(X)s as a short-term bridge to an accelerated CG(X) program that might begin procurement sometime between FY2008 and FY2014. Under this option, a single DD(X) could be procured to demonstrate key technologies that would be used in the CG(X), while a few

additional DD(X)s might also be procured to provide a workload bridge for the surface combatant industrial base between the end of DDG-51 procurement and the start of CG(X) procurement. Under this option, the CG(X) would be designed using technologies that would be ready for a ship to be procured in FY2008-FY2014. A decision to pursue this option could reflect the following views:

- the requirement for additional naval gunfire capability is either no longer valid, has been overstated, is not as operationally critical as argued, or can be sufficiently met through alternative means;
- the other missions to be performed by the DD(X), such as antisubmarine warfare, can be adequately performed by the Navy's existing surface combatants and the LCS; and
- the need for the CG(X) as a ballistic missile defense platform is critical and urgent, particularly as a potential platform for launching a large, new-design interceptor missile capable of attempting boost-phase intercepts that could be ready for service as soon as 2012.[83]

Terminate DD(X) and Procure Modified DDG-51s Instead. Under this option, the DD(X) program would be terminated and the Navy would instead procure modified DDG-51s until the start of CG(X) procurement. Modifications to the DDG-51 would include new technologies permitting crew size to be reduced by about 100 sailors, bringing the ship's crew size closer to the intended crew size of the DD(X) and thereby capturing much of the savings in annual operation and support costs that were to be generated by the DD(X)'s reduced crew size.[84] Under this option, CG(X) procurement could begin in FY2018, as currently planned by the Navy, or be accelerated to an earlier year. A decision to pursue this option could reflect the following views:

- the requirement for additional naval gunfire capability is either no longer valid, has been overstated, is not as operationally critical as argued, or can be sufficiently met through alternative means;
- a modified DDG-51 could perform the non-gunfire missions of the DD(X), such as AAW and ASW, as well as the DD(X) could;

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[83] DOD reportedly plans to demonstrate a land-based version of a new ballistic missile defense interceptor known as the Kinetic Energy Interceptor (KEI) between 2010 and 2011, and then shift its focus to fielding a sea-based variant around 2012. One report quotes a Navy admiral stating that potential launch platforms for the sea-based variant include Aegis-equipped ships, cargo ships, submarines (at least initially), and the CG(X) (in the longer term). (Sirak, Michael. US Details Boost-Phase Interceptor Plans. *Jane's Defence Weekly*, September 10, 2003.) A CG(X) procured in FY2008-FY2014 might be ready to enter service in FY2014-FY2020.

[84] GD/BIW, the lead designer of the DDG-51, has proposed modifying the DDG-51 design to permit such a reduction in crew size. GD/BIW made this proposal not to support the option described here, but rather to provide the Navy with an option for how to build the remaining DDG-51s in the Navy's ship-procurement plan, and how to modify DDG-51s already in service. A DDG-51 modified along the lines proposed by GD/BIW, however, could be procured in larger numbers to support the option described here.

- the Navy's plan for procuring 2 DD(X)s and 5 LCSs per year is not affordable in the context of potential future Navy budgets and competing Navy spending priorities;
- the combined development cost of a modified-DDG-51/CG(X) acquisition strategy could be less than the combined development cost of a DD(X)/CG(X) acquisition strategy, due to the potentially small development cost of modifying the DDG-51 design and the potentially significant development cost of modifying the DD(X) hull design for use by the CG(X);[85]
- a modified DDG-51 would have a lower unit procurement cost than the DD(X), particularly if one accepts CBO's estimated unit procurement cost for the DD(X) rather than the Navy's estimate, and would therefore place less pressure on the Navy's ship-procurement account; and
- a modified DDG-51, with its reduced crew, might have an annual operating and support cost not too much higher than that of the DD(X), which, in combination with reduced development and procurement costs, could give the modified DDG-51 a total life-cycle cost comparable to the DD(X).

Terminate DD(X) and LCS and Procure a Frigate and Perhaps Also a Low-Cost Gunfire Support Ship. Under this option, the DD(X) and LCS programs would be terminated and the Navy would instead procure a new-design frigate and perhaps also a new-design, low-cost gunfire support ship.

Frigate. The option for a new-design frigate was outlined in the March 2003 CBO report on surface combatants.[86] CBO estimated that such a ship, which it called the FF(X), might displace about 6,000 tons, which would be at least twice as large as the LCS, but about two-thirds as large as the Navy's current 9,000-ton cruisers and destroyers. CBO estimated that a 6,000-ton FFG(X) might have a unit procurement cost of about $700 million, which is almost three times the Navy's estimated procurement cost of an LCS with a representative modular payload package, but roughly half or a little more than half of the Navy's estimated procurement cost of a DD(X).

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 effectively replace the Navy's FFG-7s and DD-963s in the surface combatant force structure. 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-

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[85] Modifying the DDG-51 design to reduce its crew size might require tens of millions of dollars in development funding, while modifying the DD(X) hull design for use by the CG(X) might require a few hundred million dollars in development funding.

[86] U.S. Congressional Budget Office, *Transforming the Navy's Surface Combatant Force*, Mar. 2003, pp. 27-28, 63.

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 new-design, low-cost gunfire support ship could be 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. Such a ship might be considerably smaller and less expensive to procure than the DD(X).

Of the number of such ships procured — either 24 or some smaller number — some fraction (a total of perhaps 4 to 8 ships) might be forward-stationed at sites such as Guam or Diego Garcia, so as to be available for rapid crewing and movement to potential contingencies in the Western Pacific or Indian Ocean/Persian Gulf regions. The goal would be to procure specialized AGS-armed ships as a niche capability for the Navy, and then forward-station some of that capability so as to maximize the odds of being able to bring a desired number of AGSs to an overseas theater of operation in a timely manner on those occasions when it is needed.

A decision to pursue this option could reflect the following views:

- an FFG(X) could perform the non-gunfire missions of the DD(X) and LCS as well as the DD(X) and LCS could;
- additional naval gunfire capability may be required, but such a requirement can be met at less cost by procuring specialized, low-cost, AGS-armed ships and then forward-stationing some of those ships;
- the Navy's plan for procuring two DD(X)s and five LCSs per year is not affordable in the context of potential future Navy budgets and competing Navy spending priorities;
- the development cost of this option could comparable to, or less than, that of a DD(X)/LCS/CG(X) acquisition strategy;
- the procurement and annual operation and support costs of this option could be comparable to, or less than, that of a DD(X)/LCS/CG(X) acquisition strategy.

Terminate DD(X) and Procure No Large Ship Until CG(X). Under this option, the DD(X) program would be terminated and no Navy surface combatant larger than the LCS would be procured until the start of CG(X) procurement, which could be in FY2018, as currently planned by the Navy, or in some earlier year. A decision to pursue this option could reflect the following views:

- the requirement for additional naval gunfire capability is either no longer valid, has been overstated, is not as operationally critical as argued, or can be sufficiently met through alternative means;
- the other missions to be performed by the DD(X), such as antisubmarine warfare, can be adequately performed by the Navy's existing surface combatants and by the LCS; and

- the industrial-base consequences of this decision are acceptable, particularly if the cutter portion of the Coast Guard Deepwater program is accelerated and expanded. (For discussion of the Deepwater option, see the section below on options for the industrial base.)

Options for LCS Program

Potential options for Congress concerning the LCS program include (but are not limited) to the following:

- approve the LCS program as proposed by the Navy;
- shift procurement of the lead LCS to the SCN account;
- shift procurement of LCS mission modules to SCN account;
- insert a gap year between procurement of the lead LCS and the second ship built to that design;
- defer procurement of the lead LCS to FY2006 or a later year;
- procure LCSs at a rate of up to 10 per year;
- procure LCSs at a rate of fewer than 5 per year;
- procure and evaluate a few LCSs while reserving judgment on whether to enter into larger-scale series production of LCSs;
- terminate the LCS and DD(X) programs and procure a new-design frigate instead;
- terminate the LCS program and invest more in other littoral-warfare improvements; and
- terminate the LCS program and restore the pre-LCS program for investing in littoral-warfare improvements.

Some of these options could be pursued in combination with one another, or in combination with options for the DD(X) program. Each of these options is outlined below in terms of how they might reflect certain views on one or more of the issues for Congress discussed in the previous section of this report. Several of these options are analogous to options already presented for the DD(X) program, as are the potential reasons for adopting them. In those cases, the discussion of that option simply refers the reader back to the analogous DD(X) option.

Approve LCS Program as Proposed. See discussion of analogous DD(X) option.

Shift Procurement of Lead LCS to SCN Account. See discussion of analogous DD(X) option.

Shift Procurement of Mission Modules to SCN Account. A decision to shift procurement of the LCS mission modules to the Navy's ship-procurement account could reflect a view that procuring them in the Other Procurement, Navy (OPN) research and development account:

- understates the importance of the modules as elements of the LCS's combat system, and as intrinsic elements of the LCS program;

- gives the LCS program an unfair advantage in the competition for limited ship-procurement funds by making the LCS look less expensive in the SCN account compared to other Navy ships; and
- is undesirable from the standpoint of keeping total LCS program procurement costs fully visible and thereby promoting effective congressional oversight of the program.

Insert Gap Year Between Lead LCS and Second Ship. A decision to insert a gap year between the procurement of the lead LCS and procurement of the second ship built to that same design — that is, procure that second ship two years after the lead ship is procured, rather than in the following year — could reflect a view that in light of the number of new technologies to be incorporated into the lead LCS, a gap year would be a prudent measure to provide time to discover problems in the LCS design during the construction of the ship and fix them before they are built into the second and subsequent ships in the class.

Inserting a gap year could be viewed as consistent with the technology-risk-mitigation explanation offered by the Navy for procuring the lead LCS through the Navy's research and development account. It would also be possible, however, to view a gap year as prudent even if the lead ship is funded through the Navy's ship-procurement account, particularly since such gap years were a standard feature of Navy shipbuilding programs in the 1980s and 1990s, all of whose lead ships were procured through the Navy ship-procurement account.

Defer Procurement of Lead LCS to FY2006 or Later Year. A decision to defer procurement of the lead ship to FY2006 or a later year could reflect the following views:

- additional time is needed to learn more information about important LCS program details, such the number and cost of LCS mission modules, and to assess requirements for littoral warfare missions;
- technical risk in the LCS program is excessive, particularly given the program's rapid schedule for developing and building the lead ship, and can be mitigated by providing more time for developing one or more of the technologies that are to be incorporated into the lead LCS; and
- the Navy is proposing a rapid acquisition strategy for the LCS program primarily for political reasons rather than to meet an urgent operational need, so deferring the start of procurement to FY2006 or a later year will not cause significant operational risk.

Procure Up to 10 LCSs Per Year. This option would involve procuring LCSs at a steady annual rate of up to 10 ships per year, starting as soon as FY2008 or FY2007, rather than at 5 ships per year starting in FY2010 as the Navy now plans. Under this option, additional shipyards would be brought into the LCS production effort if needed to support this procurement rate. A decision to pursue this option could reflect the following views:

- the requirement for additional littoral-warfare capability in the form of the LCS is operationally urgent, and can be met more quickly by procuring LCSs at a rate of up to 10 per year;
- procuring LCSs at a rate of up to 10 ships per year would be consistent with the Navy's statement that the LCS program is the Navy's number one budget priority; and
- a procurement rate of up to 10 ships per year, by reducing the cost of LCSs and LCS mission modules through better spreading of fixed overhead costs at LCS ship component manufacturers and LCS mission module manufacturers, could make the LCS program more affordable and cost-effective.

Procuring LCSs at a rate of 10 ships per year rather than 5 ships per year could increase annual LCS procurement funding requirements by about $1 billion, excluding mission module procurement costs, or more than $1 billion if the procurement rate for LCS mission modules is increased in concert with the LCS procurement rate. Most or all of these additional funds could be generated by limiting the procurement rate of the DD(X) program to 1 ship per year during the period of LCS procurement, or by reducing funding for other Navy programs.[87]

Procure Fewer Than Five LCSs Per Year. A decision to procure LCSs at an average rate of fewer than five ships per year starting in FY2010, instead of five ships per year as the Navy now plans, could reflect the following views:

- the operational need for the LCS is not as urgent as the Navy argues; and
- the Navy's plan for procuring two DD(X)s and five LCSs per year is not affordable in the context of potential future Navy budgets and competing Navy spending priorities.

Procure and Evaluate a Few LCSs While Reserving Judgment. Under this option, a few LCSs would be procured and evaluated in tests and exercises while judgment is reserved on the question of whether to approve the LCS program as a series-production effort that could lead to the procurement of up to 56 ships. This option was proposed in the May 2003 CSBA report on anti-access/area-

[87] Limiting the DD(X) procurement rate to 1 ship per year until completion of LCS procurement would permit most or all of the additional required funding to be found within the surface combatant community's current share of the Navy budget. A decision to limit the DD(X) procurement rate to 1 ship per year during the period of LCS procurement could reflect a view that the need for the DD(X)'s additional gunfire capability and other mission capabilities is not urgent, and that the start of CG(X) procurement can also be deferred without significant operational risk.

denial challenges and the February 2004 CSBA report on the LCS program.[88] A

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[88] Krepinevich, Andrew, Barry Watts, and Robert Work. *Meeting the Anti-Access and Area-Denial Challenge*. Washington, Center for Strategic and Budgetary Assessments, 2003; and Work, Robert O. *Naval Transformation and the Littoral Combat Ship*. Washington, Center for Strategic and Budgetary Assessments, 2003. 178 pp. The February 2004 report states:

> Despite its promise, the LCS represents the first small US battle force capable combatant to be designed and built by the Navy and the US shipbuilding industry in over 60 years. Moreover, the LCS battle network system will introduce an entirely new concept of battle modularity that has no US or foreign naval precedent. There are therefore a number of unresolved issues about this ship and its associated organizational and support structure. Many of these issues appear to be irreducible through paper analysis. Therefore, a second proposition is that *the LCS program must undergo thorough operational experimentation in addition to any continued analytical study*.
>
> Current Navy LCS production plans appear to be overly ambitious. Accordingly, the Navy should consider a modification to its current plans to allow more thorough testing of the ship as a battle network component system.
>
> — Given the many degrees of design freedom in meeting the Flight 0 LCS requirements (six initial designs and three remaining designs, including a steel semi-planing monohull, a trimaran, and a surface effects ship), the Navy would be advised to build at least two different operational prototypes. However, choosing two different prototypes will not completely resolve many of the operational issues. It seems clear that only by testing squadron prototypes will the Navy be able to fully resolve some of the outstanding issues surrounding the LCS and its support structure.
>
> — The currently approved shipbuilding profile for the LCS could be modified to build two operational squadrons and to reduce the risk associated with the current, significantly compressed, LCS program. Assuming the Navy down-selects to two different designs, it should award one competitor a Research and Development (R&D) contract for a ship in FY05 and a follow-on version in FY06 paid for by ship construction money. Similarly, it should then award a second competitor a R&D ship contract in FY06 and a follow-on version in FY07. In this way, the Navy could have two different two-ship squadrons by FY08, which would seem to be the minimum size needed to conduct comparative squadron operational tests. The Navy could also opt for slightly larger squadrons by dividing the planned ships in FY08 and FY09 among the builders. Once the squadrons were organized, however, the Navy should then delay the final production decision for at least one year to conduct meaningful operational testing.
>
> A counter argument is made by those who believe the fleet is too small for its current global commitments, particularly those associated with the global war on terror. They argue that the LCS is needed now, in numbers. However, the Chief of Naval Operations undercut this position when he recently elected to retire some older ships early, and to accept a smaller fleet in the near term in order to free up the resources required to build up the fleet over the long term. Moreover, current strategic circumstances indicate the Navy appears to have some time before having to confront a serious naval competitor in the littorals. As a result,

(continued...)

decision to pursue this option could reflect the following views:

- reserving judgment on whether to approve the LCS program as a series-production effort would provide DOD with time to confirm the emergence of the projected enemy littoral anti-access/area-denial systems that the LCS is to counter;
- given the significant differences between the LCS and past Navy surface combatants, real-world tests and exercises involving actual LCSs are needed to verify the projected performance attributes of the LCS and better understand how LCSs might contribute to naval operations; and
- reserving judgment on whether to approve the LCS program as a series-production effort would provide DOD with an opportunity to perform a rigorous, thorough analysis of multiple concepts (AMC) for performing littoral-warfare missions that is not biased by a pre-existing decision that a series-production LCS program is the best or most promising approach.

Terminate DD(X) and LCS and Procure a Frigate Instead. See discussion of analogous DD(X) option.

Terminate LCS and Invest in Other Littoral-Warfare Programs. Under this discussion, the LCS program would be terminated and funding would instead be invested in other approaches for performing littoral-warfare missions. Potential recipients of increased funding include:

- littoral-oriented aircraft, such as certain kinds of helicopters;
- littoral-oriented sensors and weapons for airplanes, helicopters, and submarines;
- a non-combat littoral *support* craft (LSC) for deploying helicopters and unmanned vehicles into littoral waters;[89] and

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[88] (...continued)

> delaying the final LCS production run for a short period while squadron prototypes are tested would appear to appreciably lower the program's developmental risk without appreciably raising the fleet's overall operational risk. (Page iv; emphasis as in the original)

[89] The LSC is presented as an option in the May 2003 CSBA report, which states:

> Helicopters and unmanned surface and air systems, employed by large multi-mission combatants or sea base support ships operating within the protected confines of the sea base, and augmented by submarines and unmanned underwater vehicles, would appear to be a viable, lower risk option than those outlined in DON plans. Such an option might forego a littoral *combat* ship, and instead pursue a vessel along the lines of the littoral *support* craft (LSC) studied by the Office of Naval Research since 1997, or HSVs [high-speed vessels] like the HSV-X1, a high-speed wave-piercing catamaran leased by the Navy in 2001. Like the LCS, the LSC and HSV are both designed to operate at high speeds, but they both trade stealth for larger deck areas and more storage volume. Both

(continued...)

- unmanned vehicles that can be launched from aircraft, submarines, or other larger surface ships (either existing types or LSCs) operating further from shore than would the LCS.

A decision to purse this option could reflect a view that one or more of these alternative approaches represent a better or more promising approach than the LCS for performing littoral-warfare missions.

Terminate LCS and Restore Pre-LCS Littoral-Warfare Programs. This option would involve terminating the LCS program and using the released funding as needed to restore funds for littoral-warfare programs that were reduced when the LCS program was initiated. A decision to pursue this option could reflect a view that the requirements for littoral-warfare capability underpinning the LCS program are overstated, particularly given the time and expense needed by potential adversaries to field a highly capable network of littoral-defense systems, and that the Navy's pre-LCS collection of programs for improving its littoral-warfare capabilities is sufficient to meet the Navy's future littoral-warfare requirements.

Supplementary Options for the Industrial Base

Below are three supplementary options that could be used in conjunction with options for the DD(X) and LCS programs for purposes of bolstering the surface combatant industrial base.

Procure Additional DDG-51s in FY2006. This option, which would involve procuring 1one or two additional DDG-51s in FY2006, could be used to avoid the currently programmed procurement of no larger surface combatants in FY2006 shown earlier in **Table 5**. The DDG-51s could be built to either the current DDG-51 design or the modified (i.e., reduced-crew) DDG-51 design discussed in the section on DD(X) options. Based on current procurement costs for DDG-51s, procuring two additional DDG-51s in FY2006 could require roughly $2,500 million in additional funding.

Opponents of this option could argue that the Navy does not have an urgent operational need for any DDG-51s beyond those already planned for procurement, and that funding should not be spent to procure expensive Navy ships solely for the purpose of bolstering the industrial base. Supporters could argue that the additional cost of procuring these ships will be offset by avoiding the inefficiencies and resulting cost penalties on the DD(X) program of putting the industrial base through

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[89] (...continued)
would be able to employ helicopter detachments and unmanned vehicle detachments, or both, in a maritime AD [area-denial] environment — and in larger numbers than could be carried by an LCS. These detachments would operate from roll-on, roll-off container vans. In lower threat environments, or once maritime AD threats had been rolled back, they could then perform important logistics functions in support of the sea base, serving as high speed ship-to-shore delivery craft.... (*Meeting the Anti-Access and Area-Denial Challenge*, op cit, page 59; emphasis as in the original.)

a roller coaster in FY2005-FY2007; that the uncertainty over the planned size and composition of the Navy implies that the Navy might indeed have an operational need for additional DDG-51s; and that the Navy in any event would make good use of any additional DDG-51s that are procured. They might also argue that the Navy originally planned on procuring a total of about 57 DDG-51s, and that bolstering the defense industrial base consequently is already an important reason, if not the primary reason, for procuring most of the DDG-51s that the Navy plans to procure in FY2004 and FY2005.

Accelerate Procurement of Amphibious Assault Ships. This option would involve accelerating the procurement of 4 amphibious assault ships that the Navy currently envisions procuring in FY2008, FY2010, FY2013, and FY2016. These ships are intended as one-for-one replacements for 4 aging amphibious assault ships called LHA-2, LHA-3, LHA-4, and LHA-5.[90]

The four aging LHAs have expected service lives of 35 years. Assuming a five-year construction period, which would be consistent with the construction periods for recently built amphibious assault ships, the four replacement ships under the Navy's plan would enter service in 2013, 2015, 2018, and 2021, at which point LHA-2 through -5 would be 36, 37, 39, and 41 years old, respectively.

One option would be to accelerate the procurement of the first replacement ship to FY2007, and procure the other three ships at two-year intervals — that is, in FY2009, FY2011, and FY2013. Again assuming five-year construction periods, the four replacement ships under this option would enter service in 2012, 2014, 2016, and 2018, at which point LHA-2 through -5 would be 35, 36, 37, and 38 years old, respectively.

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[90] Amphibious assault ships, sometimes called "big deck" amphibious ships, are large amphibious ships with a flight deck that runs the length of the ship, as on an aircraft carrier. The Navy's 12 amphibious assault ships have full load displacements of about 40,000 tons, making them about 40% as large as the Navy's aircraft carriers on that basis, and light displacements of roughly 30,000 tons. Amphibious assault ships each embark about 1,700 Marines, amphibious landing craft, 2 to 3 dozen Marine Corps helicopters and AV-8B Harrier STOVL (short take-off, vertical landing) "jump jets," and other Marine Corps equipment. In the future, Navy amphibious assault ships are to embark V-22 Osprey tilt-rotor aircraft and the STOVL version of the F-35 Joint Strike Fighter (JSF).

The Navy's fleet of 12 amphibious assault ships includes 5 aging Tarawa (LHA-1) class ships (LHA-1 through -5) that were procured in FY1969-FY1971 and entered service between 1976 and 1980, and 7 newer Wasp (LHD-1) class ships (LHD-1 through 7) that were procured between FY1984 and FY1996 and entered service between 1989 and 2001. An eighth Wasp-class ship (LHD-8) was procured in FY2002 and is scheduled to replace LHA-1 in 2007.

The envisioned procurement dates for the 4 replacement ships are shown in U.S. Department of the Navy. *A Report to Congress on Annual Long-Range Plan For The Construction Of Naval Vessels*. Washington, 2003. (Prepared by: Director of Surface Warfare [OPNAV N76], Washington, DC) p. 15. The report shows the first replacement ship being procured in FY2007, but the Navy's FY2005 budget submission deferred the procurement of this ship one year, to FY2008.

Another potential option would be to accelerate the procurement of the first replacement ship by two years, to FY2006, and then procure the other three ships at two-year intervals — that is, in FY2008, FY2010, and FY2012. Under this option, the 4 replacement ships would enter service in 2011, 2013, 2015, and 2017, at which point LHA-2 through -5 would be 34, 35, 36, and 37 years old, respectively. It is not clear, however, whether the design for the first replacement ship could be made ready in time to support a procurement in FY2006; the issue could depend in part on the amount of design difference between the first replacement ship and LHD-8.

Given LHD-8's estimated procurement cost of $2.0 billion,[91] the 4 replacement ships would likely cost more than $2 billion each to procure. Accelerating the procurement of the 4 replacement ships could reduce their cost somewhat compared to the Navy's current plan due to avoided inflation (i.e., the ships would be procured in earlier years) and reduced loss of learning at the shipyard in moving from one ship to the next over a two-year period rather than a three-year period.

In terms of the amount of shipyard work provided, a new amphibious assault might be roughly equivalent to 3 or 4 DDG-51s.

Northrop Grumman's Ingalls shipyard has been the sole builder of the Navy's LHAs and LHDs and is generally considered the leading contender for building any similar ships for the Navy in the future. General Dynamics' Bath Iron Works (BIW) shipyard, however, might also be capable of building ships of this type, though this may require investments (perhaps substantial ones) in new production facilities at the yard.[92]

Accelerate and Expand Cutter Portion of Deepwater Program. This option would involve accelerating procurement of new cutters to be procured under the Coast Guard Deepwater acquisition program.[93] It could also involve expanding the total number of cutters to be procured under the program. This option could be used to help maintain surface combatant construction workloads, particularly if a decision is made to procure DD(X)s at annual rates lower than the Navy plans, or to terminate the DD(X) program and procure no large surface combatants until the advent of the CG(X).

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[91] LHD-8's estimated procurement cost is $2,014 million. At the direction of Congress, the procurement of the ship is being funded incrementally, with the final $73.5-million increment of funding programmed for FY2006.

[92] A 1996 CRS report stated that BIW could be made capable of building LHD-type ships with $100 million to $500 million in capital improvements. (CRS Report 96-785 F, *Navy Major Shipbuilding Programs and Shipbuilders: Issues and Options for Congress*, by Ronald O'Rourke. In 2001, BIW completed a roughly $300-million in yard modernization project that included a new land-level ship construction facility and a new large floating dry dock capable of holding 28,000 tons.

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

The Coast Guard Deepwater program is a 20-year program for replacing and modernizing the Coast Guard's aging fleet of deepwater-capable cutters, patrol boats, and aircraft. The program envisages procuring, among other things,

- **8 new National Security Cutters, or NSCs,** nominally 421 feet long and displacing about 3,900 tons (i.e., ships roughly analogous to the Coast Guard's current high-endurance cutters), to be delivered between 2006 and 2013; and

- **25 new Offshore Patrol Cutters, or OPCs**, nominally 341-feet long and displacing about 2,900 tons (i.e., ships roughly analogous to today's medium-endurance cutters), to be delivered between 2012 and 2022.

Some observers of the Deepwater program are interested in the idea of compressing the Deepwater acquisition period from 20 years to 10 years. This idea, which would accelerate into earlier years the procurement of cutters (and aircraft) now planned for later years, would increase the annual funding requirements of the Deepwater program in the nearer term but reduce its total cost by permitting the acquisition of new cutters (and aircraft) at more efficient annual rates. In March 2003, the Coast Guard submitted a report to Congress stating that compressing the Deepwater acquisition period to 10 years was feasible, that it would increase Deepwater acquisition costs over the five-year period FY2005-FY2011 by about $4.7 billion in then-year dollars, and that it would reduce total Deepwater acquisition costs from $16.022 billion in then-year dollars to $11.473 billion in then-year dollars — a reduction of $4.549 billion in then-year dollars, or 28.4%.[94]

Supporters of the Coast Guard may also be interested in expanding the number of cutters to be procured under the Deepwater program. They could argue that the current planned procurement totals, shown above, reflect projections of future Coast Guard mission loads that were made prior to the terrorist attacks of September 11, 2001. Following the terrorist attacks, they could argue, the Coast Guard's homeland security responsibilities have been significantly expanded while requirements for performing non-homeland security missions (such as fisheries enforcement) have not decreased. As a result, they could argue, the number of cutters to be procured under the Deepwater is now insufficient and should be increased, perhaps substantially.

A September 2003 report on the Deepwater program by the RAND Corporation states:

> The Coast Guard's ambitious effort to replace and modernize many of its ships and air vehicles — conceived and put in motion before the September 11, 2001 terrorist attacks and officially known as the Integrated Deepwater System program — will not provide the USCG [U.S. Coast Guard] with adequate assets and capabilities to fulfill traditional and emerging mission demands. To satisfy these demands, the USCG will need the capabilities of twice the number of cutters and 50 percent more air vehicles than it has been planning to acquire over

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[94] U.S. Coast Guard, *Report to Congress on the Feasibility of Accelerating the Integrated Deepwater System*, 2003, 31 pp.

> the next two decades. It cannot gain these capabilities merely by buying the assets in the current program over 10 or 15 years instead of over 20. Rather, it can only gain these capabilities by acquiring significantly more cutters, unmanned air vehicles and helicopters than are in the current acquisition program, or by mixing into the program other platforms and technologies that provide the same or additional capabilities.[95]

Table 6 below compares quantities of NSCs and OPCs to be procured under the Coast Guard's current Deepwater plan with RAND's estimate (based in part on work done by the Center for Naval Analyses, or CNA) of the number of NSCs and OPCs that would need to be procured to fully meet traditional and emerging Coast Guard mission demands:

Table 6. Coast Guard Deepwater Cutter Procurement Quantities

Type	Current Deepwater plan	RAND Estimate for Traditional Missions[a]	CNA Estimate for Emerging Missions[b]	Total (RAND + CNA)
NSC	8	35	9	44
OPC	25	36	10	46

Source: *The U.S. Coast Guard's Deepwater Force Modernization Plan: Can It Be Accelerated? Will It Meet Changing Security Needs?* Op cit, Table 4-2.
a. RAND estimate of numbers needed to fully meet traditional mission demands.
b. CNA estimate of additional numbers needed to fully meet emerging mission demands.

The 90 NSCs and OPCs shown in the final column of **Table 6** have a combined light-ship displacement equal to that of 20.7 DD(X)s.[96] Similarly, about four NSCs or about five OPCs would have a light-ship displacement comparable to that of 1 DD(X). Procuring 4 or 5 NSCs and OPCs per year might thus generate about as much shipyard construction work as procuring 1 DD(X) per year, and procuring 8 to 10 NSCs and OPCs per year might generate about as much shipyard construction work as procuring 2 DD(X)s per year. Building NSCs and OPCs, however, would likely require a somewhat different mix of shipyard construction skills than building DD(X)s.

The Coast Guard estimates that NSCs will cost roughly $210 million each to procure. Based on this figure and on the relative light-ship displacements of the NSC and OPC, OPCs might cost roughly $152 million each to procure. Using these figures, procuring four or five NSCs and OPCs would cost less than procuring a single DD(X).

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[95] John 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.

[96] The NSCs have a light-ship displacement of 3,290 tons; the OPCs have a light-ship displacement of 2,350 tons. Forty-four NSCs and 46 OPCs would thus have a combined light-ship displacement of 251,000 tons, which is equivalent to the light-ship displacement of 20.7 DD(X)s.

Northrop Grumman's Ship Systems (NGSS) division, which includes Ingalls, is the co-leader, along with Lockheed Martin, of the team selected by the Coast Guard as the prime contractor for the Deepwater program. Accelerating and expanding procurement of Deepwater cutters could thus provide significant amounts of additional shipbuilding work to Ingalls. If the total number of cutters to be procured is expanded beyond the currently planned figure, it might also be possible to award some cutter construction contracts to GD/BIW, if the various parties now involved in the Deepwater program could agree to the idea.

The Coast Guard is part of the new Department of Homeland Security (DHS). Coast Guard programs are therefore funded primarily through the DHS budget rather than the DOD budget. Accelerating and expanding the cutter portion of the Deepwater program as a means of compensating for a reduced DD(X) procurement rate or the termination of the DD(X) program could therefore require close coordination between DHS and DOD, and between the various congressional committees that oversee the Coast Guard and Navy budgets.

Legislative Activity on DD(X) and LCS Programs

To date, the defense-oversight committees of Congress have expressed support for the DD(X) and LCS concepts, but have also expressed concerns about the programs, posed a number of questions, requested reports, and recommended changes to the Administration's funding requests. Below are excerpts on the DD(X) and LCS programs from committee and conference reports on the FY2003 and FY2004 defense authorization and appropriation bills.

DD(X) Program

FY2003 Defense Authorization. Section 1025 of the conference report (H.Rept. 107-772 of November 12, 2002) on the FY2003 defense authorization bill (P.L. 107-314/H.R. 4546) requires DOD to submit a report to Congress by March 31, 2003 on

> the effect of the contract award announced on April 29, 2002, for the lead design agent for the DD(X) ship program on the industrial base for ship combat system development, including the industrial base for each of the following: ship systems integration, radar, electronic warfare, and launch systems.... The report shall include the following: (1) The Secretary's assessment of the effect of the contract award referred to in that subsection on ship combat system development and on the associated industrial base. (2) A description of any actions that the Secretary proposes to ensure future competition in the ship combat system development and industrial base.

FY2004 Defense Authorization. In its report (H.Rept. 108-106 of May 16, 2003) on the FY2004 defense authorization bill (H.R. 1588), the House Armed Services Committee recommended increasing the Administration's request for development funding for the DD(X) program by $4 million, to $1,042 million (pages 160, 175, and 182). The committee noted that the Navy is currently reviewing the ship's operational requirements and key performance parameters, which will affect

the design and size of the ship, and asked to be kept informed of the review and its impact on the ship's capabilities and design (page 175).

In its report (S.Rept. 108-46 of May 13, 2003) on the FY2004 defense authorization bill (S. 1050), the Senate Armed Services Committee recommended approving the Administration's request for $1,038 million in development funding for the DD(X) destroyer (page 165). The committee stated that it was aware of the debate within DOD and the Navy over the ship's size, and that key performance parameters for the ship are under review. The committee noted its support for the Marine Corps' requirements for naval surface fire support, and directed the Navy to ensure that these requirements are taken into account in reviewing operational requirements for the DD(X) (page 241). The committee stated that it believed that demands for surface combatants are expanding beyond the 116-ship surface combatant force called for in the 2001 Quadrennial Defense Review (QDR). The committee stated that it remained concerned about the surface combatant industrial base, particularly during the transition from DDG-51 procurement to DD(X) procurement in FY2006-FY2008, and directed the Navy to submit an updated report on the surface combatant industrial base by March 1, 2004 (page 126).

FY2004 Defense Appropriation. In its report (H.Rept 108-187 of July 2, 2003) on the FY2004 defense appropriations bill (H.R. 2658), the House Appropriations Committee stated:

> The Committee is highly supportive of the Navy's concept of DD(X), but is concerned by the lack of a final decision on such elemental things as design requirements, including weight, size, and armament. In addition, the Navy's stated mission for DD(X) continues to evolve, making it difficult for the Committee to match the appropriation request to tasks the Navy desires to accomplish in fiscal year 2004. Although funds requested will be used to initiate Phase IV of DD(X), the Committee is not convinced the Navy has a clear acquisition strategy for this next phase.
>
> The Committee is also concerned that the Navy and the Office of the Secretary of Defense (OSD) appear to have "withheld" a significant level of funds previously appropriated for DD(X). While the Committee recognizes a Navy and OSD tradition of not releasing all funds appropriated for programs for management flexibility and the application of certain financial adjustments, the percentage withheld from the DD(X) program appears greater than that applied to other programs.
>
> The Committee recommends a reduction of $100,000,000 for DD(X) design. The Committee's recommendation is based on the lack of a definitive requirement, lack of a final decision on design, low execution of previously appropriated funds, and a lack of an acquisition strategy for Phase IV of DD(X).
>
> The Committee recommends an increase of $20,000,000 for DD(X) which is only for developing an alternative engine as the prime power source. The Committee's intent is that the Navy pursue a risk mitigation strategy for the engine which could deliver overall program cost savings in a potential competitive scenario. (Page 255)

In its report (S.Rept. 108-87 of July 10, 2003) on the FY2004 defense appropriation bill (S. 1382), the Senate Appropriations Committee commented on the Navy's proposal to fund the first DD(X) and the first LCS in the Navy's research and development account rather than in the Navy's ship-procurement account:

> The Committee is aware that the Department of the Navy plans to fund the purchase of ships in fiscal year 2005 within the Research and Development, Navy account. These ships — the first in their class — the DD(X) next-generation destroyer and the Littoral Combat Ship [LCS] are currently planned to be procured with research and development dollars with the second ship in each class to be procured with Shipbuilding and Conversion, Navy [SCN] funds in fiscal year 2006.
>
> The Committee understands that there are seeming advantages to this approach — reducing prior year shipbuilding costs and providing these programs with the additional flexibility that is inherent in research and development funding. The Committee is concerned, however, that the Department will not reap the benefits it seeks. Central to the argument that supports building the first ship in a class with research and development funding is the necessity to learn lessons from the research, development and testing being done. If the Navy plans, as it currently does, to fund the second ship in each of these classes in fiscal year 2006 in SCN before actual construction even begins on the research and development-funded ships, the distinction between funding in research and development and SCN only becomes one of full-funding.
>
> Therefore, the Committee directs that if these ships — the DD(X) and LCS — are funded in research and development, all research and development acquisition rules will apply, including technology readiness reviews, milestone decisions, and test and evaluation before these ships may enter Shipbuilding and Conversion, Navy for procurement.
>
> If the Navy chooses not to follow the acquisition policies required of research and development programs before they enter procurement, funding for these first ships in their class shall be requested in Shipbuilding and Conversion, Navy, as has been the tradition. (Pages 154-155)

The conference report (H.Rept. 108-283 of September 24, 2003) on the FY2004 defense appropriations bill (H.R. 2658/P.L. 108-87 of September 30, 2003) stated:

> The conferees agree with the Senate concerning the Navy's plans to fund the purchase of ships — DD(X) and LCS — in fiscal year 2005 within the Research, Development, Test and Evaluation (RDT&E) appropriation. The conferees believe that the use of research and development funding to procure first ships of a class is not in keeping with budgetary guidelines regarding full-funding. The conferees agree that should the fiscal year 2005 request include these ships — DD(X) and LCS — within RDT&E, all research and development acquisition rules shall apply, including technology readiness reviews, milestone decisions, and test and evaluation before these ships may transition to procurement. (Page 292)

FY2005 Defense Authorization. The House Armed Services Committee, in its report (H.Rept. 108-491 of May 14, 2004) on the FY2005 defense authorization bill (H.R. 4200), recommended disapproval of the $221.1 million in the DD(X)

program's FY2005 funding request for beginning detailed design, non-recurring engineering work, and construction of the lead DD(X). The committee recommended deferring the initiation of construction of the lead DD(X) to FY2006. The report stated:

> The committee has strongly supported the DD(X) program since its inception....
>
> In its report, ''Defense Acquisitions — Assessments of Major Weapons Programs,'' dated March 2004, the General Accounting Office (GAO) assessed the DD(X) as entering system development with none of its 12 critical technologies fully mature (and thereby subject to a higher risk of completing development at the planned cost and schedule). The program manager is pursuing risk mitigation by constructing and testing engineering development models for the critical technologies; however, the acquisition strategy calls for engineering development model construction and testing to be done concurrently with system design. The decision to reduce the weight of the ship prompted redesign of the advanced gun system and hull form engineering development models. Because of schedule slippage, only two engineering development models (the hull form and the integrated power system) would be mature by the award of the lead ship construction contract, currently planned for September 2005. Current testing schedules call for the integrated power system, dual band radar suite, total ship computing environment, and peripheral vertical launching system to continue development beyond the lead ship production decision. In the GAO's view, should any of these innovative technologies encounter challenges that cannot be accommodated within the current design margins, redesign of other technologies and of the integrated ship system may be needed. Redesign would likely result in additional costs and schedule delays and affect the planned installation schedule. In addition, because the DD(X) acquisition strategy focuses on developing and maturing technologies that could be leveraged across multiple ship classes, delay in the maturation of critical technologies would increase the risk for other development programs.
>
> The committee notes that the engineering development models of the integrated power system and the advanced gun system are scheduled to complete land-based testing by the end of fiscal year 2005 and the multi-function radar will have completed two-thirds of its land-based and at-sea testing by that date. The committee believes that it would be prudent to delay the award of the contract for construction of the first ship of the class from fiscal year 2005 to fiscal year 2006 in order to accommodate any results from the testing of these critical systems in the design of the ship prior to beginning construction. The committee recommends that the DD(X) program be restructured to reduce concurrency and develop technology "off-ramps" for technologies that do not mature.
>
> Accordingly, the committee recommends a decrease of $221.1 million in PE 64300N and deferring the initiation of construction of the lead ship from fiscal year 2005 to fiscal year 2006. (Pages 174-175).

The committee recommended a $10-million increase in funding for developing the DD(X)'s AGS (page 166) and a $2-million increase for developing and demonstrating improvements in manufacturing methods and process technology for high power switches and conversion equipment to be used in the DD(X) program (page 191).

The report also stated:

> The committee has observed the increasing use of funds designated for research and development (R&D) purposes to acquire operational platforms. The fiscal 2005 budget proposal would take the practice to unprecedented levels, with three DD(X) and two LCS ships, three E — 2C aircraft, and eleven VH-XX helicopters proposed for acquisition with R&D funds.
>
> The use of R&D funds for prototypes and truly developmental items is both proper and prudent. This practice also makes sense when, following the completion of testing, a test asset still has useful capability to bring to the operational fleet. However, it is difficult to believe that nearly half of the VH-XX fleet, for example, qualifies as prototypes or dedicated test assets. The fact that the platforms may occasionally be used for some testing purposes does not, in the committee's view, qualify them as research craft. Indeed, the committee would be surprised were the department actually proposing to regularly carry the President on prototype aircraft.
>
> While the committee recognizes the increased flexibility of R&D funds in acquiring platforms, there is concern that placing acquisition programs in the R&D budget, particularly at their early, least stable stage, threatens other programs, particularly in science and technology. The R&D budget is a very small pool from which to fund acquisitions of large items like ships, and as procurements are must-pay bills, typical procurement cost-growth would put the rest of the R&D budget at risk.
>
> The committee's action with regard to particular programs funded in R&D should therefore be seen not only as a reflection of the merits of those items, but also as an expression of concern over the rapidly expanding portion of the R&D budget being used for purposes other than R&D. (Pages 248-249)

The Senate Armed Services Committee, in its report (S.Rept. 108-260 of May 11, 2004) on the FY2005 defense authorization bill (S. 2400), approved the start of construction of the lead DD(X) in FY2005 and increased the program's FY2005 funding request by $99.4 million to begin design work on the second DD(X) (page 173). The committee included a provision in the bill (Section 211) authorizing the use of FY2005 funds for the second DD(X) and stating that $99.4 million shall be available in FY2005 for the detail design of the second DD(X). In discussing Section 211, the committee's report stated:

> The Committee on Armed Services of the Senate, in its report (S.Rept. 108-46) to accompany the National Defense Authorization Act for Fiscal Year 2004, directed the Secretary of the Navy to provide a report on the viability of the surface combatant industrial base, with specific focus on the transition from the DDG — 51 Arleigh Burke-class destroyers to the DD(X). This report was delivered to the congressional defense committees in March 2004. The report included a workload analysis that showed that if the DD(X) schedule slips, the shipyard that is scheduled to build the follow ship, the second destroyer of the DD(X)-class, could experience significant workload issues which, depending on the length of the schedule slip, could affect the financial viability of the this shipyard. This is exacerbated by the fact that this shipyard's workload and resultant viability is solely dependent on the design and construction of surface combatants.

The committee remains concerned about the viability of the competitive industrial base for the design and construction of surface combatants for the Navy. According to the Future Years Defense Program (FYDP), there will be no surface combatants in the budget request for fiscal year 2006. The budget request for fiscal year 2005 includes $3.5 billion for the construction of the last three DDG — 51 Arleigh Burke-class destroyers, bringing the inventory to 62 of these multi-mission ships. The next class of destroyers will use the DD(X) design. The first of these ships is being funded with incremental RDTE,N funding starting with $221.1 million of construction money in fiscal year 2005. If the current schedule is maintained, the contract for the second ship of the DD(X)-class will not be awarded for about eighteen months, and is expected in fiscal year 2007 using Shipbuilding and Conversion, Navy (SCN), funding. This gap could jeopardize the design and production capability of the shipyard scheduled for the second ship.

The Navy had originally planned to compete the construction phase of the first DD(X), but recently made a decision to award that contract on a sole-source basis to the shipyard with lead design responsibility. The committee expects the Navy to take all actions necessary to ensure the viability of the second shipyard in order to maintain a healthy and competitive industrial base for surface combatants. The committee believes that the Navy is responsible for ensuring that both shipyards share equitably in the DD(X) design effort from this point forward to facilitate a smooth transition from design to fabrication to construction of DD(X).

The committee believes that if the flexibility provided by using RDTE,N funds for the lead ship at the lead shipyard is justified, that same flexibility is necessary for the follow ship at the second shipyard as well.

The budget request included $1.4 billion in PE 64300N for DD(X) total ship engineering. The committee recommends an increase of $99.4 million in PE 64300N to accelerate design efforts at the follow shipyard for the second DD(X)-class destroyer, for the purpose of sustaining a competitive industrial base for surface combatant ships. (Pages 130-131)

The conference report (H.Rept. 108-767 of October 8, 2004) on H.R. 4200 states:

The conferees have strongly supported both the DD(X) program and the Navy's acquisition strategy, which uses the construction and test of engineering development models (EDMs) to mitigate technical risk.

The conferees are aware of the assessment by the Government Accountability Office (GAO) of the maturity of 12 technologies critical to DD(X), as the program entered the system development and demonstration (SDD) phase, and the GAO's further assessment that DD(X) technology maturity and design stability will not be demonstrated before the Milestone B decision scheduled for March 2005. Many of the tests to demonstrate technical maturity will occur around the time of the critical design review (CDR) late in fiscal year 2005. Program officials acknowledge the risks associated with the advanced technologies, but the conferees believe that taking such risks is warranted to ensure that the DD(X) technologies are not obsolete, and that the Navy has taken adequate steps to mitigate the risks before ship construction begins. These steps

include the identification of fall back options if new technologies are not available.

In particular, the conferees note the concerns expressed in the House report (H.Rept. 108 — 491) regarding the schedule for land-based testing of the integrated power system and advanced gun system EDMs. These two system EDMs are not scheduled to complete land-based testing until late in fiscal year 2005, coincident with the DD(X) CDR.

The conferees agree that the integrated power system and advanced gun system are key elements which drive much of the DD(X) design, and that land-based testing of these systems should be essentially complete prior to the DD(X) CDR. The conferees direct the Secretary of the Navy, in coordination with the Under Secretary of Defense for Acquisition, Technology and Logistics, to report to the congressional defense committees following completion of the DD(X) CDR. That report should include the results of the CDR and an assessment of the readiness of the program to proceed beyond the SDD phase of the program.

The conferees share the concerns raised in the Senate Report (S.Rept. 108 — 260) regarding maintaining the viability of a competitive industrial base for the design and construction of Navy surface combatants. As noted in that report, the Navy had originally planned to compete the construction phase of the DD(X), but made a decision to award that contract on a sole-source basis to the shipyard with lead design responsibility. The conferees expect the Navy to take all actions necessary to ensure the viability of the second shipyard in order to maintain a healthy and competitive industrial base for surface combatants. (Pages 590-591)

FY2005 Defense Appropriation. The House Appropriations Committee, in its report (H.Rept. 108-284 of June 24, 2004) on the FY2005 defense appropriations bill (H.R. 4613), recommended deferring the initiation of construction of the lead DD(X) from FY2005 to a future year and reducing the program's FY2005 funding request by a net $248.8-million. The report stated:

The Committee believes the DD(X) development schedule does not provide sufficient time for the proper maturation and testing of transformational technologies prior to initiating construction of the first ship, presenting a potential ''rush to failure.'' According to the Navy's schedule, detailed design drawings necessary for the construction of the ship will not be completed prior to the award of this initial construction contract. It is the Committee's view that it is not prudent to proceed with the construction of a ship without first completing detailed design drawings and concluding basic testing of the technologies that will be integrated into the ship. According to the General Accounting Office, none of the twelve critical technologies for DD(X) will reach maturity prior to entering product development. Further, based on the Navy's schedule, land based testing of two critical technologies will not be complete prior to the conclusion of the Critical Design Review (CDR).

Accordingly, the Committee recommends eliminating the $221,000,000 requested for the first increment for construction of the first DD(X) ship. This recommendation is based on the Committee's judgment that the highly concurrent, extremely aggressive DD(X) development program does not support a fully informed acquisition decision in fiscal year 2005, making a request for construction funding premature. The Committee believes that additional time for

development prior to the construction contract award will provide time for the program to stabilize and for the maturation and testing of critical technologies.

The Committee also recommends a reduction of $43,800,000 from the $191,400,000 requested for Critical Design Review (CDR), scheduled for the last quarter of fiscal year 2005. This recommendation reflects the Committee's conclusion that the CDR schedule must slip in order to complete land-based testing of critical components of the leading technologies prior to completion of CDR. The Committee directs the Navy to extend the time frame for the CDR to ensure that land-based testing has been completed on all twelve DD(X) critical technologies prior to the completion of CDR.

Finally, the Committee recommends an increase of $13,000,000 only for the completion of the DD(X) alternative engine construction and its delivery to the Navy for testing, an increase of $1,000,000 for Floating Area Networks, and an increase of $2,000,000 for smart ships that anticipate and manage. (Pages 287-288. See also page 278.)

The report also stated:

The Committee recommends an increase of $125,000,000 to initiate advance procurement of materiel necessary for the construction of an additional DDG — 51 Guided Missile Destroyer in the 2006 or 2007 budget.

This recommendation is based on the Committee's view that the additional system development and testing required for the DD(X), the next generation destroyer, will lead to a delay in the Initial Operating Capability of the DD(X). With this delay, the Committee believes operational requirements of the Navy necessitate the construction of at least one more DDG — 51.

The Committee expects the Navy to fully fund the construction of this DDG — 51 in a future budget request. (Pages 164-165)

The Senate Appropriations Committee, in its report (S.Rept. 108-284 of June 24, 2004) on the FY2005 defense appropriations bill (S. 2559), supported the program's research and development funding request but stated that it believes that construction of the lead ship should be funded in the Navy's shipbuilding account. The committee approved the total amount requested for the program, but transferred the $221 million intended for initiating lead ship detailed design and construction to the Navy's shipbuilding account. The committee also recommended an additional $99.4 million in the shipbuilding account as advance procurement funding for the second DD(X), which the report stated is to be built at a second-source shipyard. The report stated:

The Committee recommends supporting the President's budget request for the DD(X) Destroyer program but holds that construction of the ship should be funded within the shipbuilding and conversion account in a manner consistent with prior shipbuilding programs. The Committee is encouraged by the Navy's willingness to propose nontraditional means of overcoming the enormous financial burden that ship cost overruns and prior year bills place upon the shipbuilding budget, but finds that such costs would not be eliminated but rather obscured by funding ship construction in the research and development account. Therefore, the Committee recommends transferring $221,116,000 of research

> and development funding to the Shipbuilding and Conversion, Navy account and directs the Navy to fund future ship construction programs within the shipbuilding and conversion account. In addition, the Committee recommends providing $99,400,000 in advance procurement funding for the second DD(X) ship to be constructed at a second source shipyard. (Page 83. See also page 157.)

The conference report (H.Rept. 108-622 of July 20, 2004) on H.R. 4613 provides $350.5 million in advance procurement (AP) funding in the SCN account for the DD(X) program — $221.1 million for the lead DD(X) (transferred from the Navy's research and development account), and $84.4 million for the second DD(X). The designation of this funding as AP funding implies that the nominal year of procurement for both ships is not FY2005, but rather a future fiscal year. The report stated:

> The conferees agree to provide a total of $305,516,000 for advance procurement for the DD(X) class of ships instead of $320,516,000 as proposed by the Senate and no appropriation as proposed by the House. The conferees direct the Navy to include future funding requests for the DD(X) in the Shipbuilding and Conversion, Navy appropriation.
>
> Within the funds provided, $221,116,000 is only for design and advance procurement requirements associated with the first ship of the DD(X) class and $84,400,000 is only for design and advance procurement requirements associated with construction of the second ship at an alternative second source shipyard. The conferees direct that no funds shall be available for the procurement of long lead time material for items that are dependent upon delivery of a DD(X) key technology unless that technology has undergone testing, thereby reducing risk to overall program costs.
>
> The conferees direct that full funding of the remaining financial requirement for these ships, not including traditional advance procurement requirements, shall be included in a future budget request. (Page 188; see also pages 185 and 187.)

The conference report also provides $1,176.5 million in research and development funding for the DD(X) program. After accounting for the $221.1 million transferred to the SCN account, this equates to a $34-million reduction from the request. The report stated:

> The conferees agree to provide $1,176,469,000 for the DD(X) program instead of $1,182,785,000 as proposed by the House and $1,210,469,000 as proposed by the Senate.
>
> The conferees agree that prior to the completion of the Critical Design Review (CDR), the Navy should complete land-based testing of the Advanced Gun System (AGS) and the Integrated Power System (IPS). The conferees believe it is not advisable to complete CDR prior to ensuring that at least two of the 12 key technologies have completed testing due to historical trends of ship cost growth based on re-design to accommodate changes in technological requirements.

> The conferees direct the Navy to submit a report to the congressional defense committees that addresses the Navy's plan to transition DD(X) key technologies through development, testing, acquisition, and installation. This report should also address "back up" technologies that could be inserted into the DD(X) program should the maturity of the planned technology not materialize within a timeline necessary to meet the stated DD(X) schedule. (Page 310; see also pages 278 and 300)

LCS Program

FY2003 Defense Authorization. Section 218 of the conference report (H.Rept. 107-772 of November 12, 2002) on the FY2003 defense authorization bill (P.L. 107-314/H.R. 4546) authorized $4 million for requirements development for the LCS, and stated that the Navy may not obligate any funds for the construction of an LCS until the Navy submitted a detailed report on the LCS program's acquisition strategy that "address[es] the plan and schedule for fulfilling the requirements of Department of Defense Instruction 5000-series for a major defense acquisition Milestone A decision for initiation of concept and technology development for" the LCS. The LCS acquisition strategy must also include a "robust" concept and technology demonstration phase. The conferees stated:

> An LCS program may be necessary to provide capabilities to carry out the National Military Strategy. However, neither the Office of the Secretary of Defense, the Joint Chiefs of Staff, nor the Navy has provided any indication that they have completed sufficient work on any number of prerequisites that the Department of Defense (DOD) is required to meet before concluding that new development is required to provide the capabilities inherent in an LCS. These include requirements in title 10, United States Code, and internal DOD directives, such as DOD 5000.2-R Mandatory Procedures for Major Defense Acquisition Programs and Chairman, Joint Chiefs of Staff (CJCS) Instruction 3170.01B.
>
> The LCS has not been vetted through the Joint Requirements Oversight Council (JROC) process, particularly regarding possible alternatives and the relative priority to meet valid requirements. This should be completed prior to initiation of any program which is intended to support joint combat operations.
>
> The conferees believe that the Navy needs to assess the adequacy of existing and planned platforms to test the littoral combat ship concept and how these platforms will be used in the development, test, and evaluation of the LCS and its mission modules. The conferees strongly believe that the Navy must capitalize on ongoing and planned experiments, demonstrations, and evaluations of existing, prototype, and experimental hull forms and platforms to better inform the Navy's decisions on the LCS. Some of these have been completed, but others are planned and await modification or construction of the hull form and platform demonstrators.
>
> The conferees are also concerned that the Navy's strategy for the LCS does not clearly identify the plan and funding for development and evaluation of the mission modules upon which the operational capability of the LCS will depend. The conferees believe that the strategy for LCS development must provide for the identification, transition, and integration of the component technologies and

subsystems to be included in the several mission modules and for the evaluation of each mission module as a system before its deployment on the LCS.

The conferees expect the JROC and the Navy to specifically deal with a number of concerns in fulfilling the requirements in the LCS provision. These include:

(1) Assessing the extent to which unmanned systems could be capable of completing the missions instead of a manned LCS vessel. Briefings on the LCS indicate that an LCS would be used for operations determined to be "too risky" for larger surface combatants. This raises questions about the level of risk the Navy has determined to be acceptable for an LCS that is unacceptable for larger surface combatants.

(2) Identifying the threat or threats that have negated the Navy's previous investments in multi-mission ships and made the missions of anti-submarine warfare, anti-surface warfare, and antimine warfare "too risky" for these ships. The Navy has invested heavily in providing combatants of all types and displacements with onboard and offboard sensors, weapons, and information connectivity. This investment was directed to ensure that multimission ships could operate at any time and in any place.

(3) Determining the level of support from other combatants and auxiliaries that LCS vessels will require, and whether this will lead to altered planning assumptions for sizing the force. An open question regarding a "focused mission" vessel such as an LCS is whether the vessel will be able to operate with impunity in the presence of threats outside its focused mission warfare area. If not, the Navy may have to adjust operating and support concepts in more significant ways than merely adding LCS vessels to the current battle group.

(4) Identifying the appropriate level of helicopter support in the baseline LCS vessel. The naval helicopter has been a proven key capability for combatant surface ships when conducting the three primary warfare areas stated for LCS. Navy briefings indicate that the LCS will require a helicopter capability to carry out its missions and will operate forward of the battle group. Nevertheless, the Navy appears to have forgotten the lessons learned from the first flight of *Arleigh Burke*-class destroyers and has not included a naval helicopter hangar as a key requirement for the LCS.

(5) Assessing the implications of using and supporting nonmarinized systems as component capabilities on LCS vessels. For example, the Navy has indicated the desire for using OH-58D helicopters on LCS. Although these Army helicopters have flown from Navy ships for short periods, they have limited capabilities for LCS mission areas. Naval helicopters, however, have the durability and system integration required to provide joint and battle group synergism for LCS missions.

(6) Identifying whether there are changes in tactics and procedures which the Navy could apply to current platforms and concepts of operations that would accomplish the envisioned LCS missions without putting additional pressure on an already underfunded ship acquisition plan.

(7) Assessing the assignment of LCS-unique missions to the U.S. Coast Guard, close allies, or coalition partners. If we are to continue assuming joint and

> coalition warfare, perhaps the U.S. Navy could count on the Coast Guard or smaller navies of allies to contribute more effectively by performing ''small ship'' mission[s]. (Pages 562-564)

(In response to this section, the Navy submitted a report on February 10, 2003.)

FY2004 Defense Authorization. In their reports (H.Rept. 108-106 of May 16, 2003 and S.Rept. 108-46 of May 13, 2003, respectively) on the FY2004 defense authorization bill (H.R. 1588/S.1050), the House and Senate Armed Services Committees recommended increasing the FY2004 funding request for the LCS program by $35 million to fund additional development of LCS mission modules (pages 158 and 183-184 in the House report, and page 162 in the Senate report).

The House report noted that the Navy did not perform an analysis of alternatives prior to announcing the LCS program. The report noted the various issues about the program that were raised in the conference report on the FY2003 defense authorization bill (see above), and stated that the February 2003 Navy report submitted in response to Section 218 of the FY2003 defense authorization bill

> was a brief, summary document that provided little detail with regard to the analysis performed by the Navy in developing the requirement and the concept for the LCS. The committee expects that the Secretary of the Navy will address more completely the issues raised in the [conference report] prior to proceeding to an Acquisition Program Initiation decision in mid-fiscal year 2004. (Page 183)

The committee noted concerns about the Navy's strategy for developing LCS mission modules that were expressed in the FY2003 conference report and stated that it was recommending a $35-million increase to reduce development risk in this area. (Pages 183-184)

The Senate report stated:

> The committee is concerned that the analysis underpinning the LCS requirement is not sufficient. Section 218 of the National Defense Authorization Act for Fiscal Year 2003 (Public Law 107-314) required the Secretary of the Navy to submit a report on LCS which addressed in detail the analytical process to examine alternatives, and establish relative priorities to meet valid requirements. The committee believes that the report, which was delivered pursuant to last year's requirement, did not provide the necessary analysis.
>
> The Navy believes that this ship would offer a way to achieve a fleet size of 375 ships, a number that the Chief of Naval Operations has said is required to support the Sea Power 21 vision. The committee is concerned that the larger surface combatant force [included in the 375-ship plan] will decline to a number even below that which is projected in the near term as a result of the acquisition of LCS. While the cost of the LCS seaframe has been estimated, and is included in the preliminary design interim requirements document, there is no firm estimate of what LCS will cost with its focused mission modules. Overall Navy affordability constraints may well lead to a fleet with the number of Navy ships close to the number now in commission, only of lesser capability.

> The committee directs the Comptroller General to submit a report to the committee by March 1, 2005, that (1) details the Navy's progress in further defining the concept of operations for the LCS; (2) assesses the analytical basis for the establishment of LCS requirements; (3) assesses the technical maturity of the focused mission modules for flight zero ships, and, to the extent possible, for flight one ships; and, (4) estimates the recurring LCS weapons system cost, to include seaframe and focused mission modules, at a production rate similar to that in the Navy plan.
>
> The committee believes that the Navy will have to conduct significant experimentation to determine the utility of the LCS concept. The focused mission modules are required to enable that experimentation, yet the Navy failed to fully fund focused mission modules in the budget request. The committee believes that before committing to production of more than a few ships, the Navy should have determined, through analysis and experimentation, that this ship will deliver the Navy's expected capabilities. To accelerate this process, the committee recommends an increase of $35.0 million ... for LCS modules. (Pages 179-180)

FY2004 Defense Appropriation. In its report (H.Rept. 108-187 of July 2, 2003) on the FY2004 defense appropriation bill (H.R. 2658), the House Appropriations Committee recommended reducing funding for the ship portion of the LCS program by $15 million and increasing funding for the development of LCS mission modules by $25 million. The report states:

> The Committee is very supportive of the Navy's concept of the LCS. It is an innovative approach to meeting the threats and through the use of "mission modules" will be able to quickly transform to meet emerging threats. Future enhancements include the use of unmanned aerial vehicles and unmanned undersea vehicles. The spiral development approach will provide sufficient flexibility to implement the LCS in "flights", providing increasing levels of warfighting capability.
>
> The Committee is concerned, however, with the lack of final requirements documentation and a spiral development plan for LCS. It is clear that the initial system will not provide all of the warfighting capabilities promised with LCS, but there is no definition of the requirement and no "roadmap" of how the Navy will achieve the system required. It is also of concern that LCS capabilities will overlap those of existing systems operating in the littoral battlespace, an issue that the Navy has not fully addressed.
>
> The Committee requests the Navy submit by March 1, 2004, a final requirements document and a spiral development plan for advancing the LCS through its development and acquisition. Additionally, the Navy should continue to refine its concept of operations in the littoral battlespace to ensure no duplication of effort.
>
> The Committee recommends an increase of $25,000,000 for LCS only to accelerate mission module development and the integration of these modules into LCS Flight 0. These funds may not be obligated or expended until the submission of the March 1, 2004 report previously requested.

> The Committee recommends a reduction of $15,000,000 for the LCS. The Committee's recommendation is based on the lack of a final design or development plan for LCS. (Pages 254-255)

In its report (S.Rept. 108-87 of July 10, 2003) on the FY2004 defense appropriation bill (S. 1382), the Senate Appropriations Committee recommended approving the Administration's funding request for research and development work on the LCS program, but recommended increasing the portion of this funding that is to be used for developing LCS mission modules. The report states:

> The Committee is supportive of the Navy's Littoral Combat Ship [LCS] program, but is concerned that the Navy has underestimated the technological challenges the development of this ship may face. While considerable effort has been made and careful thought has been taken regarding plans for the sea frame, the Committee remains unconvinced that similar efforts have been taken regarding the ship's mission modules. Unfortunately, of the $158,071,000 the Department of Navy requested for LCS research and development, the Department only requested $41,000,000 for sea frame-related mission module activities. The Committee, therefore, has earmarked $76,000,000 of the request for LCS and directs the Navy to establish a fully-funded mission module research and development program for the Flight 0 LCS that extends beyond the patchworked mine warfare plan. (Page 156)

As noted in the section on legislative action concerning the DD(X), the committee also commented on the Navy's proposal to fund the first DD(X) and the first LCS in the Navy's research and development account rather than in the Navy's ship-procurement account. This report language appears in the section on legislative activity concerning the DD(X).

The conference report (H.Rept. 108-283 of September 24, 2003) on the FY2004 defense appropriations bill (H.R. 2658/P.L. 108-87 of September 30, 2003) stated:

> The conferees have included $168,071,000 for continued research and development of the Littoral Combat Ship (LCS), the amount recommended by the House and $10,000,000 above the amount recommended by the Senate.
>
> The conferees agree with the House language regarding the need to refine the Navy's concept of operations in the littoral battlespace to ensure that there is no duplication of effort between LCS and other platforms. To this end, the conferees direct the Navy to provide a report to the House and Senate Committees on Appropriations, no later than March 1, 2004 that details the missions LCS will conduct in the littoral battle space, which platforms and systems currently conduct these missions, and what changes, if any, will be made to future years' budgets to eliminate any duplication of effort.
>
> In addition, in order to maintain focus on the LCS' mission module development and integration, the conferees agree that $51,000,000 of the funds provided for LCS is available only for these efforts. (Pages 291-292)

(In response to this language, the Navy submitted a report on March 3, 2004.)

As noted in the section on legislative action concerning the DD(X), the conference report also commented on the Navy's proposal to fund the first DD(X) and the first LCS in the Navy's research and development account rather than in the Navy's ship-procurement account. This report language appears in the section on legislative activity concerning the DD(X).

FY2005 Defense Authorization. The House Armed Services Committee, in its report (H.Rept. 108-491 of May 14, 2004) on the FY2005 defense authorization bill (H.R. 4200), recommended disapproval of the $107.7 million requested for FY2005 to begin building the lead LCS. The committee recommended that construction of the lead ship be delayed until FY2006. The committee recommended approval of the remainder of the program's FY2005 funding request. The report stated:

> Prior to announcing the LCS program, the Navy did not conduct a formal analysis of alternatives to demonstrate that a ship like the LCS would be more cost-effective for performing the stated missions than potential alternative approaches. In the statement of managers accompanying the conference report on H.R. 4546 (H.Rept. 107-772), the conferees raised a number of issues with respect to the development of LCS. The Secretary of the Navy's report on those issues was a brief, summary document that provided little detail with regard to the analysis performed by the Navy in developing the requirement and the concept for LCS. The Navy's March 2004 report on LCS requirements, concepts of operations, acquisition strategy, and systems that would be replaced by LCS was also a relatively brief summary document that provided little new information about the LCS program. Congress has directed the General Accounting Office to report by March 1, 2005, on the LCS program's analytical justification, concept of operations, technical maturity, and potential costs.
>
> The committee continues to have concerns about the lack of a rigorous analysis of alternative concepts for performance of the LCS mission, the justification for the force structure sought by the Navy, and whether the program's acquisition strategy is necessary to meet an urgent operational need. In view of continued unfunded requirements for mission module development and experimentation and what the committee believes is the need for more thorough evaluation program, the committee is concerned about the Navy's ability to resolve these issues before committing to the design for the LCS and beginning construction of the first ship. Finally, the committee is concerned about whether the program schedule provides sufficient time and capabilities for experimentation and evaluation of the operational concepts for LCS before committing to major serial production of the ship.
>
> Consequently, the committee recommends $244.4 million in PE 63581N for the LCS, a decrease of $107.7 million for LCS construction. The committee also recommends that the construction of the first Flight 0 LCS be delayed until fiscal year 2006. (Page 184-185)

The Senate Armed Services Committee, in its report (S.Rept. 108-260 of May 11, 2004) on the FY2005 defense authorization bill (S. 2400), recommended approval of the program's funding request for FY2005 (page 170) but otherwise did not discuss the program.

The conference report (H.Rept. 108-767 of October 8, 2004) on H.R. 4200 stated:

> The conferees note the concerns expressed in the House report accompanying H.R. 4200 (H.Rept. 108 — 491) regarding whether the LCS program schedule provides sufficient time and opportunities for experimentation and evaluation of the operational concepts for LCS in Flight Zero before committing to major serial production of the ship with Flight One. The program plan provided with the fiscal year 2005 budget request had construction starting on Flight One ships before delivery and evaluation of Flight Zero ships. This concurrency could require expensive retrofit to Flight One ships after lessons have been learned from operating Flight Zero ships.
>
> The conferees are concerned with a potential industrial impact induced by making fiscal year 2006 a gap year in LCS production, which could lead to increased ship costs or technology insertion challenges. However, the conferees agree with the rationale of section 8092 of the Department of Defense Appropriations Act for Fiscal Year 2005 (section A of Public Law 108 — 287), which directs that no funds be obligated for construction of a third vessel in the fiscal year 2006 budget request. The conferees expect that the Navy will include a plan that reduces the risk of concurrency in the LCS justification submitted as part of the fiscal year 2006 budget request. (Page 540)

FY2005 Defense Appropriation. The House Appropriations Committee, in its report (H.Rept. 108-553 of June 18, 2004) on the FY2005 defense appropriations bill (H.R. 4613), recommended a net $57-million increase in funding for the LCS program, consisting of a $107-million increase to fully fund the lead LCS in FY2005 at a total cost of $214 million, and a $50-million decrease for Phase I pre-design/concept studies for a subsequent improved version of the LCS design. The committee stated that it views the lead LCS as a prototype and that design and construction of the next version of the LCS should not proceed until the prototype is completed and tested. The report stated:

> The Committee remains impressed with the Navy's initiative in pursuing the LCS program, which promises to address significant operational gaps in Navy capability while presaging new ways of developing and fielding technology to the Fleet. The Committee has agreed to the Navy's request to fund construction of LCS in the research, development, test and evaluation appropriation, recognizing the Navy's desire to more readily accommodate potential changes to the program. The Committee approves this request because it views the Flight 0 ship as a prototype of a completely new class of ship. Once the Navy has completed and tested the prototype, it should proceed with the preliminary design and construction of the first Flight 1 ship.
>
> The Committee recommendation includes increasing the budget request for the construction of the first Flight 0 LCS by $107,000,000, fully funding this construction effort at $214,000,000. The fiscal year 2005 request included only $107,000,000 for the first increment of the LCS construction. Budget documentation indicates the Navy plans to request an additional $107,000,000 for the second and final increment for the first ship in fiscal year 2006. The Committee strongly opposes incremental funding of ship construction and therefore has provided a total of $214,000,000 in 2005 for construction of the first LCS, fully funding the construction requirement in one year.

> The Committee recommendation reduces the LCS request by $50,000,000 for Phase I pre-design/concept studies for the development of a request for proposal for the preliminary design of the Flight 1 ship. This recommendation is based on the Committee's judgment that the preliminary design of the first Flight 1 ship should commence after test and evaluation of the Flight 0 prototype to avoid potential costly re-design efforts. (Page 288-289. See also page 274.)

The Senate Appropriations Committee, in its report (S.Rept. 108-284 of June 24, 2004) on the FY2005 defense appropriations bill (S. 2559), recommended approval of the FY2005 funding request for the program. The committee stated that it views the lead LCSs as prototypes and directed the Navy to include no funding in its FY2006 budget request for construction of a second ship of either prototype design. The report stated:

> The Committee supports the budget request for the Littoral Combat Ship [LCS] and consents to the Navy's request to fund construction of the first prototype ship for each of two ship designs in the Research and Development, Navy account. Approval for funding LCS in the research and development account is strictly based on the acknowledgment of the prototypical nature and high level of technical risk inherent in this program. The Committee finds LCS to be unique and unlike any other shipbuilding program the Navy has previously pursued; and therefore, grants the Navy's request for the increased flexibility that funding within the research and development account affords. However, the Committee directs that all follow-on ships beyond one prototype for each LCS ship design be fully funded in the Shipbuilding and Conversion, Navy account. The Committee also believes that substantial testing of the LCS and the associated mission modules is required to evaluate each ship design and validate operational requirements. Therefore, the Committee directs that no funds shall be obligated to prepare a fiscal year 2006 budget request for construction of the second ship of either prototype design. This directive is intended to provide for a ''gap'' year between the construction of the first prototype ship and second ship of each design, thereby ensuring that design problems discovered during the construction of each ship design are identified and fixed before construction of the follow-on ships. In addition, the consent to build the LCS prototype ships with research and development funding should in no way be interpreted as approval for other ship construction programs to be funded within the Research and Development, Navy account.
>
> The Committee is also concerned that the development of various LCS mission modules, which will be procured independently from the vessel, will obscure the actual cost of the weapon system. Therefore, the Committee directs the Navy to identify LCS mission module funding separately within the Research and Development, Navy and Other Procurement, Navy accounts. (Page 156-157)

The report also stated:

> A central feature of the LCS design is modular Mission Packages. The planned Mission Packages may consist of a combination of modules, manned and unmanned off-board vehicles, deployable sensors, and other support equipment. The Navy plans to begin funding Mission Modules, which will be procured independently from Seaframe development, in the fiscal year 2006 budget request under the "Other Procurement, Navy" account. The Committee feels strongly about creating an appropriate level of visibility to ensure an accurate

> accounting of total program costs. The Committee, therefore, directs the Navy to establish a "LCS Mission Packages" line within the account and to request all items (modules, vehicles, sensors, etc.) related to the development of LCS Mission Packages in this line as part of the fiscal year 2006 budget request. (Page 93.)

The conference report (H.Rept. 108-622 of July 20, 2004) on H.R. 4613 includes a provision (Section 8092) that provides $214.7 million in the Navy's research and development account for construction of the lead LCS. The provision also states:

> None of the funds provided in this Act may be obligated to prepare a fiscal year 2006 budget request for a third vessel under the Littoral Combat Ship program in fiscal year 2006: Provided, That funds for the second vessel shall be for a second source supplier: Provided further, That all subsequent ships shall be purchased with "Shipbuilding and Conversion, Navy" funds beginning in fiscal year 2007.

The conference report stated:

> The conferees agree to provide $457,089,000 for the Littoral Combat Ship (LCS) program instead of $409,089,000 as proposed by the House and $352,089,000 as requested and proposed by the Senate.
>
> The conferees agree with the Senate that all follow-on ships, beyond one of each prototype design, should be fully funded in the Shipbuilding and Conversion, Navy appropriation. The conferees also agree that substantial testing of the LCS and associated mission modules is required to evaluate each ship design and validate operational requirements. Therefore, the conferees direct that no funds shall be obligated to prepare a fiscal year 2006 budget request for construction of a third vessel, as reflected in the conference agreement including Section 8092 as originally proposed by the Senate. This directive is intended to provide for a "gap" year between construction of the prototype ships and the follow-on construction of a second ship of each design, thereby ensuring that design problems discovered during the prototype phase of each ship design are identified and corrected before construction of follow-on ships. The conferees also agree with the Senate that beginning in the fiscal year 2006 budget request, the Navy should identify LCS mission module funding separately within the Research, Development, Test and Evaluation, Navy and Other Procurement, Navy appropriations. (Pages 310-311)

Appendix A. Acronyms

AAW	Anti-air warfare
AGS	Advanced Gun System
AMC	Analysis of multiple concepts
AOA	Analysis of alternatives
ASuW	Anti-surface warfare
ASW	Antisubmarine warfare
AUV	Autonomous underwater vehicle
BIW	Bath Iron Works shipyard of Bath, ME
CBO	Congressional Budget Office
COEA	Cost and operational effectiveness analysis
CSBA	Center for Strategic and Budgetary Assessments
DOD	Department of Defense
DON	Department of the Navy
EA/SD	Evolutionary acquisition with spiral development
EDM	Engineering development model
FYDP	Future Years Defense Plan
GD	General Dynamics Corporation
ISR	Intelligence, surveillance, and reconnaissance
LCS	Littoral Combat Ship
LSC	Littoral support craft
LSC-X	Littoral support craft — experimental
MIW	Mine warfare
NOC	Northrop Grumman Corporation
O&S	Operating and support
OPN	Other Procurement, Navy appropriation account
OSD	Office of the Secretary of Defense
PANMC	Procurement of Ammunition, Navy and Marine Corps appropriation account
R&D	Research and development
SCN	Shipbuilding and Conversion, Navy appropriation account — the Navy's ship-procurement account
SOF	Special operations forces
UAV	Unmanned Air Vehicle
UV	Unmanned vehicle
VLS	Vertical launch system
WPN	Weapons Procurement, Navy appropriation account

Appendix B. Navy Testimony Supporting LCS as Best Approach

Navy Testimony

In written testimony to the Senate Armed Services Committee on April 1, 2003, the Navy stated the following in support of the LCS as the best or most promising approach to perform its stated missions:

> The Littoral Combat Ship is our most transformational effort and number one budget priority. It will capitalize on emerging unmanned vehicle technologies and deliver the focused Sea Shield missions of Mine Warfare (MIW), Surface Warfare (SUW) and Anti-Submarine Warfare (ASW). It will provide the fast, affordable, focused-mission capability that will *sustain* our access and enhance our ability to establish sea superiority not just for our Carrier Strike Groups and Expeditionary Strike Groups, but for all the joint logistics, command and control and pre-positioned ships that must transit the critical littoral threat area to move and support forces ashore.
>
> Our modeling and wargaming with smaller, fast, highly maneuverable ships that simulate LCS capabilities have produced results that show LCS increases our warfighting effectiveness in the littoral environment. LCS achieved 70% of the "kills" during simulated choke-point transits and reduced the vulnerability — and losses — of our other carrier and expeditionary strike group ships to submarine torpedo attack in the littorals. Additionally, LCS ships modeled with mine warfare capability provided more effective organic mine warfare support than similarly equipped DDGs — especially during opposed scenarios.
>
> Numerous real-world tests have also been conducted with experimental craft to gather tangible data to determine the optimal hull form for the LCS.... The Integrated Requirements Document has been completed and we anticipate beginning construction of the first LCS in 2005.[97]

In written testimony to the House Armed Services Committee on April 3, 2003, the Navy stated:

> Our number one budget priority, the Littoral Combat Ship is the next member [following the DD(X)] of our surface combatant "family of ships." The FY 2004 budget includes $158 million to accelerate development and construction of 9 LCS[s] in the FYDP, [which is] key to ramping surface force structure to Global CONOPs levels[98] outside the FYDP. It will be the first Navy ship to separate capability from hull form [through use of modular payload packages] and provide a robust, affordable, focused-mission warship to enhance

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[97] Statement of U.S. Navy Chief of Naval Operations Admiral Vern Clark, in U.S. Congress, Senate Armed Services Committee, Seapower Subcommittee, *Navy and Marine Corps Development and Procurement*, Apr. 1, 2003, pp. 7-8. Emphasis as in the original.

[98] "Global CONPS levels" refers to the Navy's proposal for a force level of about 375 ships, which the Navy believes is the approximate fleet size required to implement the Navy's Global Concept of Operations (CONOPS), a concept that involves using a variety of naval formations to respond to future mission requirements around the world.

our ability to establish sea superiority. A networked, lethal, small, fast, stealthy, and highly maneuverable ship, LCS will be designed from the keel up as a focused mission ship capable of employing manned and unmanned mission modules to counter some of the most challenging anti-access threats our naval forces may encounter close to shore — mines, quiet diesel submarines and swarming small boats.

LCS will be self-deploying and self-sustaining. It will have the size, speed, endurance, and connectivity to deploy as a member of Carrier Strike Groups and Expeditionary Strike Groups, or in smaller groups of surface combatants. LCS will have full underway replenishment capabilities and will be a FORCEnet node.[99]

The Preliminary Design Interim Requirements Document (IRD) has been approved, and a Request For Proposals has been released for LCS Preliminary Designs. The requirements that supported the formulation of the IRD were derived from the SC-21 Mission Needs Statement (MNS) and the Future Surface Combatant Requirements Document. A number of analyses directly supported the IRD including the Naval War College's Focused Mission Ship Characteristics Study, Focused Mission Ship Technologies Opportunities Study and the LCS Analysis of Multiple Concepts (AMC). AMC analysis is continuing, along with other studies and analysis. As the analysis continues, IRD requirements will be refined and will be released in a second IRD to support Flight 0[100] Final Designs.

LCS will use modular mission packages in an open-systems architecture. The mission packages are the central feature of the LCS design and will provide the main warfighting capability. LCS will be configured for one mission package at a time. A mission package will consist of modules, manned aircraft, unmanned vehicles, offboard sensors, and mission manning detachments.

Mission module development will focus on identifying and integrating systems with technical maturity that will provide proven war fighting capability for the first Flight LCS. These potentially include offboard systems that will increase LCS sensor and weapons reach such as Vertical Takeoff UAV, Remote Minehunting System, Spartan Scout ACTD, Long-term Mine Reconnaissance System and Advanced Deployable System. Integration of these systems, in addition to the installed core systems, will provide LCS combat capability in the focused mission areas of Mine Warfare, Anti-Submarine Warfare and Anti-Surface Warfare. Through the spiral development process, we will combine improved legacy systems and next generation systems to provide ever-increasing capability for follow on LCS Flights.

Lessons learned from Navy experimentation with small, high speed ships and innovative hull forms such as Hybrid Deep Vee Demonstrator (HDV(D)-

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[99] FORCEnet is the Navy's emerging overall architecture for deploying networking technology through the fleet to achieve a capability for conducting network-centric operations. In a networked force, ships, aircraft, and ground vehicles act as "nodes" (i.e., constituent elements of) the network.

[100] "Flight 0" is the first version of the LCS that would be built, comprised of the first ship that is to be requested in FY2005, and the second ship that is to be requested in FY2006. Subsequent versions of the LCS design would be referred to as Flight 1, Flight 2, etc.

> 100), High Speed Vessel (HSV), Coastal Waters Interdiction Platform (CWIP), TRITON, and SLICE has proven invaluable in reducing program risk. Collaboration between the Navy and the U.S. Coast Guard *Deepwater* program facilitates cost effective development and procurement of the LCS and its associated mission capability modules....
>
> The Littoral Combat Ship (LCS) will be a multi-mission platform that will add significant robustness and flexibility to ASW operations. LCS will be able to operate in conjunction with our Carrier and Expeditionary Strike Groups, or they may operate as independent squadrons at the theater level. When equipped with the ASW Mission Package, LCS will conduct multi-sensor ASW detection, classification, localization, tracking and engagement of submarines throughout the littoral operating environment. LCS will have the capability to embark ASW/multi-mission helicopters and unmanned vehicles, and will utilize Undersea Surveillance Systems, environmental models and databases. In all mission configurations, LCS shall have core systems that provide the capability to detect threat torpedoes at sufficient range to permit initiation of effective countermeasure and/or maneuver action to defeat the threat....
>
> LCS will become the focal point of efforts to transform mine warfare. It will provide an enhanced mine warfare capability as one of its focused mission capabilities. When equipped with the MCM Mission Package, LCS will conduct mine warfare missions along its intended track and in operational areas as assigned from deep water through the shore. The potential for modernization through its modular, multi-mission design will allow LCS to incorporate new unmanned vehicle technologies as they mature. Within the FY 2004 request for LCS Mission Modules, $18 million contributes to the development of the MIW [mine warfare] Mission Modules.[101]

Journal Articles

Similar arguments in favor of the LCS as the best or most promising approach for performing the LCS's stated missions have been made in journal articles.[102]

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[101] Statement of U. S. Deputy Chief of Naval Operations (Warfare Requirements and Programs) Vice Admiral John Nathman, in U.S. Congress, House Committee on Armed Services, Subcommittee on Projection Forces, *Navy Transformation and Future Naval Capabilities*, Apr. 3, 2003, pp. 3-4, 12-13, 16.

[102] See H. G. Ulrich III, and Mark J. Edwards, " The Next Revolution At Sea, *U.S. Naval Institute Proceedings*, Oct. 2003: 65-69; Scott C. Truver, "LCS Moves Out Of The Shadows, *Jane's Navy International*, Sept. 2003: 14-16, 19-21, 23; Sam J. Tangredi, "Rebalancing the Fleet, Round 2," *U.S. Naval Institute Proceedings*, May 2003: 36-40 (this article presents both arguments for and against the LCS); Scott C. Truver, "Navy Plans to Develop LCS Fleet with 'Lightning Speed,'" *Sea Power*, May 2003: 15-20; Donald P. Loren, "'Plug-and-Fight' Combatant — The Littoral Combat Ship (LCS) Assures Access, Persistent Presence," *Naval Forces*, No. 2, 2003: 74-78; Henry C. Mustin and Douglas J. Katz, " All Ahead Flank for LCS," *U.S. Naval Institute Proceedings*, Feb. 2003: 30-33; Hunter Keeter, " Balisle: LCS Concept Based On Sound Reasoning," *Defense Daily*, Jan. 22, 2003: 2.

Appendix C. CBO and CSBA Studies Questioning LCS as Best Approach

CBO Report

The March 2003 CBO report on the Navy's surface combatant force raises certain questions regarding whether a ship like the LCS would represent the best or most promising approach to performing its stated missions:

> Of the many uncertainties surrounding the LCS, the biggest question is whether the tactical concept of operations for that ship makes sense. The Navy describes the LCS as the "transformational" leg of the DD(X) [family of ships] program be cause it is designed to provide "assured access" in the face of future naval antiaccess networks. The theory is that the smaller, speedier, and more stealthy LCS would enter an enemy's littoral waters and eliminate mine, submarine, and boat threats, allowing larger and less stealthy ships to move closer to shore at acceptable levels of risk. Yet if an enemy had over-the-horizon targeting capability and antiship cruise missiles effective enough to compel larger combatants to remain far out at sea, could it not engage smaller ships closer to its own shore and overwhelm their small loads of short-range self-defense missiles and guns?
>
> Conversely, if the larger combatants had to move closer to shore to provide longer range air and missile defense for the LCSs, why could they not perform the antisubmarine warfare, antiboat, and countermine missions themselves? Indeed, the three missions now assigned to the LCS appear heavily dependent on helicopters (and, in the future, unmanned systems); it is not clear why larger combatants could not use those systems to similar effect.[103]

May 2003 CSBA Report

The May 2003 report from the non-governmental Center for Strategic and Budgetary Assessments on DOD programs for countering enemy anti-access and area-denial forces raises similar questions:[104]

> Even if future adversaries do not attempt to outflank DON [Department of the Navy] transformation plans and decide to construct the maritime AD [area-denial] networks that US naval planners expect, it is not yet clear that building crewed combatants with crews of up to 75 officers and sailors [i.e., ships like the LCS] is the best way to tackle the "dead zone" threats of submarines, mines, and swarming boats. For the near to mid-term, helicopters would appear to be the dominant weapon system in the dead zone. From a submariner's perspective, "no (anti-submarine warfare) platform is more feared than the helicopter." The Navy's mine countermeasures plan relies on a variety of systems to be employed

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[103] U.S. Congressional Budget Office, *Transforming the Navy's Surface Combatant Force*, Mar. 2003, pp. 16-17.

[104] For additional — and generally more supportive — discussion of the LCS program from CSBA, see Robert O. Work, *Naval Transformation and the Littoral Combat Ship*, Center for Strategic and Budgetary Assessments, 2003.

by the MH-60S medium helicopter. Additionally, missile and gun-firing helicopters are the scourge of small boats. In the mid- to long term, unmanned systems may vie for primacy as the dominant warfighting platforms in shallow littoral waters. Indeed, the threat of mines and small boats can already be mitigated, to a large degree, by networked unmanned systems, and "track and trail" of enemy submarines in littoral waters by unmanned underwater vehicles is expected to be demonstrated by FY 2007. It is therefore unsurprising that the LCS will rely on both helicopters and unmanned systems to accomplish its missions. What is not clear, however, is why a small, focused-mission combatant is required to employ them.

Helicopters and unmanned surface and air systems, employed by large multi-mission combatants or sea base support ships operating within the protected confines of the sea base, and augmented by submarines and unmanned underwater vehicles, would appear to be a viable, lower risk option than those outlined in DON plans....

Even if LCS is conceived as a true small *combatant*, it is not yet clear that a focused-mission approach (larger numbers of single-mission ships) is the right answer for the deployment patterns preferred by the Navy. Given the fact that the LCS may be the target of a wide variety of surprise attacks, a more attractive approach might be the multi-mission approach preferred by the Israelis (fewer numbers of multi-purpose ships). Indeed, given the wide array of missions now contemplated for the LCS, perhaps [a] multi-mission corvette or frigate would be the better answer....

Under any circumstances, however, the DON's inside-out approach to the A2/AD [anti-access, area-denial] threat — that is, continuously operating crewed combatants inside the heart of potential maritime AD networks, even in times of heightened tension — should be re-examined and debated. Although naval planners now assert that maritime AD networks built around coastal submarines, mines, and swarming boats are increasingly dangerous and pose higher risks to US naval forces, they refuse to change their operational approach to fighting for access and organizing the fleet for an outside-in roll back of maritime AD networks. Instead, the DON continues to pursue its traditional peacetime deployment pattern, and has concluded that the best way to handle increasingly dangerous A2/AD threats is to create a new manned combatant designed to operate in the areas of highest risk so as to assure continued access.

This type of thinking is eerily reminiscent of pre-World War II Army Air Corps thinking that "the bomber will always get through." It rests on shaky operational assumptions such as the LCS will always have the dominant battlespace awareness to avoid threats, or that its signature reduction will make it virtually invisible, or that its speed and maneuverability will allow it to generate misses. However, a strong counter-argument can be made that at the ranges from the shore that these ships will operate, their location and targeting in a future sensor rich environment is virtually assured, and the likelihood that they will be engaged is very high.

Proponents of the LCS would counter that their smaller crew and lower costs make these risks acceptable. However, this assertion rests on a key, unproven assertion: that the loss of several small $400 million crewed

combatants[105] with 75-person crews in surprise first salvos would be more politically and operationally palatable than the loss of a $1 billion crewed combatant with a 350-person crew. On the surface, this assumption appears attractive, especially on the basis of a cost-benefit analysis. However, what of the inherent political risks? It is by no means certain that a political or even an operational war leader would consider the employment of three smaller, less well-protected ships, each with crews of 75 officers and sailors, to be less risky than employing a larger, better-protected ship with a crew of 350. After all, a larger ship is more difficult to sink than a smaller vessel; the hits sustained by the *Stark* (two Exocet missiles), the *Samuel B. Roberts, Princeton,* and *Tripoli* (mine explosions), and the USS *Cole* (waterline suicide boat explosion) would all likely have destroyed or sunk a LCS outright. Moreover, what would a terrorist or potential adversary prefer: putting one multi-mission combatant out of action temporarily, or sinking three $400 million combatants outright? The psychological impact of being able to claim the first sinking of a US combatant in battle since the Korean War would likely be significant on both enemy and US populations. Moreover, any subsequent order to withdraw LCSs from a littoral joint operating area to assess their operations and tactics would likely be viewed as serious reversal for the US Navy and the Joint Force.

Even if one ignores these political and operational risks, further problems remain. For example, advocates of the LCS emphasize that their combat systems will rely to a great degree on unmanned systems. But much of the fleet value of pursuing unmanned naval systems will be obviated by creating *new* crewed combatants to employ them. Moreover, introducing a large class of new crewed combatants to employ unmanned systems, rather than exploiting unmanned systems to reduce the number of crewed combatants, or to improve the performance of a similar number of combatants, is fraught with its own risk. If the LCS turns out to be either an ineffective or non-survivable combat platform, much of the potential combat contribution of unmanned naval systems will be lost to the sustained access fleet.

In sum, the LCS component of the DON transformation plan appears to be its weakest operational link, and one that needs to be more fully considered before embarking on a 56-ship class production run.[106]

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[105] The $400-million figure used here may have been an earlier Navy estimate of the cost of an LCS, including a representative payload package. As discussed in the background section, the Navy states that the cost of an LCS, including a representative payload package, is to be no more than $250 million in FY2005 dollars.

[106] Andrew Krepinevich, et al., *Meeting the Anti-Access and Area-Denial Challenge,* op cit., pp. 58-61. Emphasis as in the original. The excerpted passage is from the chapter of the report focusing on Navy programs, which was written by Robert Work, CSBA's naval issues analyst.

Journal Articles

Similar arguments questioning whether the LCS represents the best or most promising approach for performing the LCS's stated missions have been made in journal articles.[107]

[107] See Sam J. Tangredi, "Rebalancing the Fleet, Round 2," *U.S. Naval Institute Proceedings*, May 2003, pp. 36-40 (this article presents both arguments for and against the LCS); Norman Friedman, "New Roles for Littoral Combat Ships," *U.S. Naval Institute Proceedings*, Jan. 2003, pp. 4, 6; Stephen H. Kelley, "Small Ships and Future Missions," *U.S. Naval Institute Proceedings*, Sept. 2002, pp. 42-44.