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Navy Littoral Combat Ship (LCS) Program: Background and Issues for Congress

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Summary

The Littoral Combat Ship (LCS) is a relatively inexpensive surface combatant equipped with modular mission packages. Navy plans call for procuring a total of 32 LCSs. The first LCS was procured in FY2005, and the Navy's proposed FY2018 budget requested the procurement of the 30th and 31st LCSs. As part of its action on the Navy's proposed FY2018 budget, Congress procured three LCSs—one more than the two that were requested. Thus, a total of 32 LCSs have been procured through FY2018.

The Navy's proposed FY2019 budget, which was submitted to Congress before Congress finalized action on the Navy's FY2018 budget, requests $646.2 million for the procurement of one LCS. If Congress had procured two LCSs in FY2018, as requested by the Navy, the LCS requested for procurement in FY2019 would have been the 32nd LCS. With the procurement of three LCSs in FY2018, the LCS requested for procurement in FY2019 would be the 33rd LCS.

The Navy's plan for achieving and maintaining a 355-ship fleet includes a goal for achieving and maintaining a force of 52 small surface combatants (SSCs). The Navy's plan for achieving that goal is to procure 32 LCSs, and then procure 20 new frigates, called FFG(X)s, with the first FFG(X) to be procured in FY2020. Multiple industry teams are now competing for the FFG(X) program. The design of the FFG(X) is to be based on either an LCS design or a different existing hull design. The FFG(X) program is covered in another CRS report.

The LCS program includes two very different LCS designs. One was developed by an industry team led by Lockheed; the other was developed by an industry team that was then led by General Dynamics. LCS procurement has been divided evenly between the two designs. The design developed by the Lockheed-led team is built at the Marinette Marine shipyard at Marinette, WI, with Lockheed as the prime contractor; the design developed by the team that was led by General Dynamics is built at the Austal USA shipyard at Mobile, AL, with Austal USA as the prime contractor.

The LCS program has been controversial over the years due to past cost growth, design and construction issues with the first LCSs, concerns over the survivability of LCSs (i.e., their ability to withstand battle damage), concerns over whether LCSs are sufficiently armed and would be able to perform their stated missions effectively, and concerns over the development and testing of the modular mission packages for LCSs. The Navy's execution of the program has been a matter of congressional oversight attention for several years.

Issues for Congress for the LCS program for FY2019 include the following:

- the number of LCSs to procure in FY2019;
- the Navy's proposal to procure a final LCS in FY2019 and then shift to procurement of FFG(X)s starting in FY2020; and
- survivability, lethality, technical risk, and test and evaluation issues relating to LCSs and their mission packages.

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Introduction

This report provides background information and issues for Congress on the Navy's Littoral Combat Ship (LCS) program. A total of 32 LCSs have been procured through FY2018. For FY2019, the Navy is requesting the procurement of the 33rd LCS.

The LCS program presents several oversight issues for Congress. Congress's decisions on the program will affect Navy capabilities and funding requirements, and the shipbuilding industrial base.

Starting in FY2020, the Navy wants to shift from procuring LCSs to procuring guided-missile frigates called FFG(X)s whose design may or may not be based on one of the two LCS designs. The FFG(X) program is covered in CRS Report R44972, *Navy Frigate (FFG[X]) Program: Background and Issues for Congress*, by (name redacted) .

For an overview of the strategic and budgetary context in which the LCS program and other Navy shipbuilding programs may be considered, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by (name redacted) .[1]

Background

Navy's Force of Small Surface Combatants (SSCs)

SSC Definition

In discussing its force-level goals and 30-year shipbuilding plans, the Navy organizes its surface combatants into *large surface combatants* (LSCs), meaning the Navy's cruisers and destroyers, and *small surface combatants* (SSCs), meaning the Navy's frigates, Littoral Combat Ships, mine warfare ships, and patrol craft.[2] SSCs are smaller, less capable in some respects, and individually less expensive to procure, operate, and support than LSCs. SSCs can operate in conjunction with LSCs and other Navy ships, particularly in higher-threat operating environments, or independently, particularly in lower-threat operating environments.

SSC Force-Level Goal

In December 2016, the Navy released a goal to achieve and maintain a Navy of 355 ships, including 52 SSCs. Although patrol craft are SSCs, they do not count toward the 52-ship SSC force-level goal, because patrol craft are not considered battle force ships, which are the kind of ships that count toward the quoted size of the Navy and the Navy's force-level goal.[3]

[1] See also CRS Report R43838, *A Shift in the International Security Environment: Potential Implications for Defense—Issues for Congress*, by (name redacted) , and CRS Report R44891, *U.S. Role in the World: Background and Issues for Congress*, by (name redacted) and (name redacted) .

[2] See, for example, CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by (name redacted) .

[3] For additional discussion of battle force ships, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by (name redacted) .

SSC Force at End of FY2017

At the end of FY2017, the Navy's force of SSCs totaled 22 battle force ships, including

- 0 frigates;
- 11 LCSs; and
- 11 mine warfare ships.

Navy Plan for Achieving 52-Ship SSC Force

The Navy's plan for achieving the 52-ship force-level goal for SSCs is to procure 32 LCSs, with FY2019 being the final year of LCS procurement, and then procure 20 new frigates, called FFG(X)s, with the first FFG(X) to be procured in FY2020. Multiple industry teams are now competing for the FFG(X) program. The design of the FFG(X) is to be based on either an LCS design or a different existing hull design.

Under the Navy's FY2019 30-year (FY2019-FY2048) shipbuilding plan, the SSC force is to grow from 31 ships in FY2019 to 51 ships in FY2035, reach a peak of 59 ships FY2040, and then decline to 49 ships by FY2048.

LCS Program

Overview

The Navy announced the start of the LCS program on November 1, 2001.[4] The LCS is a relatively inexpensive Navy surface combatant that is to be equipped with modular "plug-and-fight" mission packages, including unmanned vehicles (UVs).[5] The LCS program has been modified or restructured several times over the years. Current Navy plans call for procuring a total of 32 LCSs and 44 LCS modular mission packages. The first LCS was procured in FY2005, and a total of 32 LCSs have been procured through FY2018.

[4] On November 1, 2001, the Navy stated that it was replacing a destroyer-development effort called the DD-21 program, which the Navy had initiated in the mid-1990s, with a new Future Surface Combatant Program aimed at developing and acquiring a family of three 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 air defense and ballistic missile mission; and
- a smaller combatant called the Littoral Combat Ship (LCS) to counter submarines, small surface attack craft, and mines in heavily contested littoral (near-shore) areas.

For more on the DD(X) program, which was subsequently renamed the DDG-1000 program, see CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by (name r edacted) . For more on the CG(X) program, which was subsequently terminated, see CRS Report RL34179, *Navy CG(X) Cruiser Program: Background for Congress*, by (name redacted) .

[5] Rather than being a fully multimission ship like the Navy's larger surface combatants, the LCS is to be a focused-mission ship, meaning a ship equipped to perform one primary mission at any given time. The ship's primary mission orientation can be changed by changing out its mission package, although under the Navy's latest plans for operating LCSs, that might not happen very frequently, or at all, for a given LCS.

The LCS displaces about 3,000 tons, making it about the size of a corvette (i.e., a light frigate) or a Coast Guard cutter. It has a maximum speed of more than 40 knots, compared to something more than 30 knots for the Navy cruisers and destroyers. The LCS has a shallower draft than Navy cruisers and destroyers, permitting it to operate in certain coastal waters and visit certain shallow-draft ports that are not accessible to Navy cruisers and destroyers.

The LCS's primary missions are antisubmarine warfare (ASW), mine countermeasures (MCM), and surface warfare (SUW) against small boats (including so-called "swarm boats"), particularly in littoral (i.e., near-shore) waters.[6] The LCS program includes the development and procurement of ASW, MCM, and SUW modular mission packages. Additional potential missions for LCSs include peacetime engagement and partnership-building operations; intelligence, surveillance, and reconnaissance (ISR) operations; maritime security and intercept operations (including anti-piracy operations); support of Marines or special operations forces; and homeland defense operations. An LCS might perform these missions at any time, regardless of its installed mission package, although an installed mission package might enhance an LCS's ability to perform some of these missions.

The LCS program has been controversial over the years due to past cost growth, design and construction issues with the first LCSs, concerns over the survivability of LCSs (i.e., their ability to withstand battle damage), concerns over whether LCSs are sufficiently armed and would be able to perform their stated missions effectively, and concerns over the development and testing of the modular mission packages for LCSs. Past modifications and restructurings of the LCS program were intended in part to address these issues. The Navy's execution of the program has been a matter of congressional oversight attention for several years.

Annual Procurement Quantities

Table 1 shows past (FY2005-FY2018) and requested (FY2019) annual procurement quantities for LCSs under the Navy's FY2018 budget submission. The Navy wants the LCS requested for procurement in FY2019 to be the final ship in the program.

Table 1. Annual LCS Procurement Quantities

FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13
1	1	0	0	2	2	2	4	4
FY14	**FY15**	**FY16**	**FY17**	**FY18**	***FY19***	***FY20***	***FY21***	***FY22***
4	3	3	3	3	*1*	*0*	*0*	*0*

Source: Prepared by CRS based on FY2018 DOD appropriations act and FY2019 Navy budget submission.

Notes: The two ships shown in FY2005 and FY2006 were funded through Navy's research and development account rather than the Navy's shipbuilding account. Figures for FY2006-FY2008 do not include five LCSs (two in FY2006, two in FY2007, and one in FY2008) that were funded in those years but later canceled by the Navy.

Two Designs Built by Two Shipyards

The LCS program includes two very different LCS designs. One was developed by an industry team led by Lockheed; the other was developed by an industry team that was then led by General Dynamics. The design developed by the Lockheed-led team is based on a steel semi-planing monohull (with an aluminum superstructure), while the design developed by the team that was led by GD is based on an all-aluminum trimaran hull (see **Figure 1**). The two LCS designs also use different built-in combat systems (i.e., different collections of built-in sensors, computers,

[6] These three primary missions appear oriented toward countering, among other things, some of the littoral anti-access/area-denial (A2/AD) capabilities that have been fielded in recent years by Iran, although they could also be used to counter similar A2/AD capabilities that might be fielded by other countries. For a discussion of Iran's littoral A2/AD capabilities, including submarines, mines, and small boats, see CRS Report R42335, *Iran's Threat to the Strait of Hormuz*, coordinated by (name redacted) and (name redacted) .

software, and tactical displays) that were designed by each industry team. The Navy states that both LCS designs meet the Key Performance Parameters (KPPs) for the LCS program.

Figure 1. Lockheed Design (Top) and General Dynamics Design (Bottom)

Source: U.S. Navy file photo accessed by CRS at http://www.navy.mil/list_all.asp?id=57917 on January 6, 2010.

LCS procurement has been divided evenly between the two designs. The LCS design developed by the Lockheed-led team is built at the Fincantieri/Marinette Marine shipyard at Marinette, WI,[7] with Lockheed as the prime contractor; these ships are designated LCS-1, LCS-3, LCS-5, and so on. The design developed by the team that was led by GD is built at the Austal USA shipyard at Mobile, AL, with Austal USA as the prime contractor;[8] these ships are designated LCS-2, LCS-4, LCS-6, and so on.

Two Block Buy Contracts for Procuring Ships 5-26

Ships 1 through 4 in the program were procured with single-ship contracts. The next 22 ships in the program (ships 5 through 26) were procured under two 10-ship block buy contracts that the Navy awarded to the two LCS builders in December 2010, and which were later extended in each case to include an 11th ship. The Navy sought and received legislative authority from Congress in 2010 to award these block buy contracts.[9]

Number in Service

The Navy states that 11 LCSs were in service at the end of FY2017, that 16 will be in service by the end of FY2018, and that 20 will be in service by the end of FY2019.[10]

Modular Mission Packages

Years ago, when the Navy planned on procuring a total of 52 LCSs, the Navy planned to procure 64 LCS mission packages (16 ASW, 24 MCM, and 24 SUW). As a consequence of reducing the LCS program to a planned total of 32 ships, the planned number of LCS mission packages has now been reduced to 44 (10 ASW, 24 MCM, and 10 SUW).[11]

LCS mission packages have been under development since the early days of the LCS program. The Navy's plan is to develop and deploy initial versions of these packages, followed by development and procurement of more capable versions. The Navy states that

> The LCS MP [mission package] program continues the development of the SUW, MCM, ASW capabilities, delivering individual mission systems incrementally as they become available. This past year LCS 4 deployed with the first installation of an over-the-horizon missile capability added to the SUW MP. The Surface-to-Surface Missile Module with Longbow Hellfire will add more lethality to the SUW MP. It is currently in testing with Initial Operational Capability (IOC) planned for FY 2019.

[7] In 2009, Fincantieri Marine Group, an Italian shipbuilding firm, purchased Manitowoc Marine Group, the owner of Marinette Marine and two other shipyards. Lockheed is a minority investor in Marinette Marine.

[8] Austal USA was created in 1999 as a joint venture between Austal Limited of Henderson, Western Australia, and Bender Shipbuilding & Repair Company of Mobile, AL, with Austal Limited as the majority owner.

[9] Congress granted the authority for the block buy contracts in Section 150 of H.R. 3082/P.L. 111-322 of December 22, 2010, an act that, among other things, funded federal government operations through March 4, 2011. For more on block buy contracts, see CRS Report R41909, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, by (name redacted) and (name redacted) .

[10] Department of the Navy, *Highlights of the Department of the Navy FY 2019 Budget*, February 12, 2018, Figure 17 on p. 3-3.

[11] U.S. Navy, *Report to Congress for the Littoral Combat Ship Mission Modules Program, Annual Report With the President's Budget Fiscal Year 2019*, February 8, 2018, with cover letters dated February 12, 2018, posted at USNI News April 4, 2018, p. 3.

The ASW MP Escort Mission Module (EMM) uses a continuously active Variable Depth Sonar, integrated with a Multi-Function Towed Array to provide a revolutionary surface ship anti-submarine capability. Development and integration of the EMM, Light Weight Tow, and Torpedo Defense Module are ongoing. The ASW EMM and is on track to fully integrate with the LCS to support IOC with the ASW MP in FY 2019.

The Navy has scheduled three MCM systems for developmental tests (DT) and two for operational assessments (OA) this year, with Milestone C production decisions of the first two expected before the end of FY 2018. The MCM Unmanned Surface Vehicle (USV) is the tow platform for minehunting operations, and is based on the USV already used in the Unmanned Influence Sweep System program. The Navy's plan is to conduct MCM MP DT/OA in FY 2020 and achieve IOC in FY 2021.[12]

Manning and Deployment

The LCS employs automation to achieve a reduced-sized crew. An LCS with an embarked MCM mission package and an aviation detachment to operate the ship's embarked aircraft might total about 88 sailors, compared to more than 200 for a Navy frigate and more than 300 for a Navy cruiser or destroyer.[13]

[12] Statement of the Honorable James F. Geurts, Assistant Secretary of the Navy for Research, Development and Acquisition ASN(RD&A) and Lieutenant General Robert S. Walsh, Deputy Commandant, Combat Development and Integration & Commanding General, Marine Corps Combat Development Command and Vice Admiral William R. Merz, Deputy Chief of Naval Operations for Warfare Systems (OPNAV N9) before the Subcommittee on Seapower and Projection Forces of the House Armed Services Committee on Department of the Navy Seapower and Projection Forces Capabilities, March 6, 2018, p. 9. See also U.S. Navy, *Report to Congress for the Littoral Combat Ship Mission Modules Program, Annual Report With the President's Budget Fiscal Year 2019*, February 8, 2018, with cover letters dated February 12, 2018, posted at USNI News April 4, 2018, pp. 6, 9-10, 13, 16, 19-21, 25-26. See also Megan Eckstein, "LCS Mission Package Testing on Track to Support IOC Dates in 2019, 2021," *USNI News*, April 25, 2018.

[13] The Navy originally planned to maintain three crews for each two LCSs, and to keep one of those two LCSs continuously underway—an approach Navy officials referred to as the 3-2-1 plan. Under this plan, LCSs were to be deployed at forward station (such as Singapore) for 16 months at a time, and crews were to rotate on and off deployed ships at 4-month intervals. The 3-2-1 plan was intended to permit the Navy to maintain 50% of the LCS force in deployed status at any given time—a greater percentage than would be possible under the traditional approach of maintaining one crew for each LCS and deploying LCSs for seven months at a time. The Navy planned to forward-station three LCSs in Singapore and additional LCSs at another Western Pacific location, such as Sasebo, Japan, and at Bahrain.

In September 2016, the Navy announced a new plan for crewing and operating the first 28 LCSs. Key elements of the new plan include the following:

- the first four LCSs (LCSs 1 through 4) will each by operated by a single crew and be dedicated to testing and evaluating LCS mission packages (though they could be deployed as fleet assets if needed on a limited basis);
- the other 24 LCSs (LCSs 5 through 28) will be divided into six divisions (i.e., groups) of four ships each;
- three of the divisions (i.e., 12 of the 24 ships), all of them built to the LCS-1 design, will be homeported at Mayport, FL;
- the other three divisions (i.e., the remaining 12 ships), all of them built to the LCS-2 design, will be homeported at San Diego, CA;
- among the three divisions on each coast, one division will focus on MCM, one will focus on ASW, and one will focus on SUW;
- in each of the six divisions, one ship will be operated by a single crew, and will focus on training the crews of the other three ships in the division;
- the other three ships in each division will each be operated by dual crews (i.e., Blue and Gold crews), like the Navy's ballistic missile submarines;
- the crews for the 24 ships in the six divisions will be unified crews—the distinction between core crew and mission package crew will be eliminated;

(continued...)

Potential Foreign Sales

Industry has marketed various modified versions of the LCS to potential foreign buyers. Saudi Arabia has purchased four modified LCSs.[14]

FY2019 Funding Request

The Navy's proposed FY2018 budget requested the procurement of the 30th and 31st LCSs. As part of its action on the Navy's proposed FY2018 budget, Congress procured three LCSs—one more than the two that were requested. Thus, a total of 32 LCSs have been procured through FY2018.

The Navy's proposed FY2019 budget, which was submitted to Congress before Congress finalized action on the Navy's FY2018 budget, requests $646.2 million for the procurement of one LCS. If Congress had procured two LCSs in FY2018, as requested by the Navy, the LCS requested for procurement in FY2019 would have been the 32nd LCS. With the procurement of three LCSs in FY2018, the LCS requested for procurement in FY2019 would be the 33rd LCS.

The Navy's proposed FY2019 budget also requests $103.2 million in so-called "cost-to-complete" procurement funding to cover cost growth on LCSs procured in previous fiscal years, $254.1 million for procurement of LCS mission module equipment, and $70.5 million in procurement funding for LCS in-service modernization.

(...continued)

- the 24 ships in the six divisions will experience changes in their mission packages (and thus in their mission orientations) infrequently, if at all; and
- 13 of the 24 ships in the six divisions (i.e., more than 50%) are to be forward stationed at any given point for periods of 24 months, with 3 at Singapore, 3 at another Western Pacific location, such as Sasebo, Japan, and 7 at Bahrain.

(Source: Navy briefing on new LCS crewing and operating plan given to CRS and CBO, September 26, 2016. See also "Navy Adjusts LCS Class Crewing, Readiness and Employment," *Navy News Service*, September 8, 2016; Sam LaGrone, "Results of New LCS Review is Departure from Original Vision," *USNI News*, September 8, 2016; Sydney J. Freedberg Jr., "Navy Sidelines First 4 LCS; Overhauls Deployment, Crewing," *Breaking Defense*, September 8, 2016; Justin Doubleday, "Navy Introduces Major Change to Littoral Combat Ship Operations," *Inside the Navy*, September 9, 2016; David B. Larter, "Rebooting LCS: Hundreds More Sailors Needed in Sweeping Overhaul," *Navy Times*, September 9, 2016; Justin Doubleday, "Navy Begins Implementing Changes to Littoral Combat Ship Program," *Inside the Navy*, October 10, 2016.)

The Navy states that this crewing and operating plan is intended to

- reduce disruptions to the deployment cycles of the 24 LCSs in the six divisions that under the 3-2-1 plan would have been caused by the need to test and evaluate LCS mission packages;
- improve training and proficiency of LCS crews;
- enhance each LCS crew's sense of ownership of (and thus responsibility for taking good care of) the ship on which it operates; and
- achieve a percentage of LCSs in deployed status, and numbers of forward-stationed LCSs, similar to or greater than what the Navy aimed to achieve under the 3-2-1 plan.

The Navy further states that as the fleet continues to accumulate experience in operating and maintaining LCSs, elements of this new plan might be modified. (See, for example, Sydney J. Freedberg Jr., "Navy Sidelines First 4 LCS; Overhauls Deployment, Crewing," *Breaking Defense*, September 8, 2016.)

[14] See "Saudi Ships," *Defense Daily*, March 12, 2018: 3; Lee Hudson, "Navy Establishes LCS Program Office to Support Saudi Arabia Buy," *Inside the Navy*, December 11, 2017; Sam LaGrone, "Lockheed Martin Awarded First Contract for New Saudi Frigates," *USNI News*, November 30, 2017; Aaron Mehta, "Revealed: Trump's $110 Billion Weapons List for the Saudis," *Defense News*, June 8, 2017; Anthony Capaccio and Margaret Talev, "Saudis to Make $6 Billion Deal for Lockheed's Littoral Ships," *Bloomberg*, May 18, 2017.

Issues for Congress for FY2019

Number of LCSs to Procure in FY2019

One issue for Congress for FY2019 is how many LCSs to procure in FY2019. Potential arguments on this issue might be summarized as follows:

- **Supporters of procuring no LCSs in FY2019** might argue that the Navy does not have a requirement for a 33rd LCS; that the funding the Navy has requested for a 33rd LCS (and the funding that the Navy might need to request for any additional LCS mission packages for a 33rd LCS) could instead be used to meet other Navy program requirements; and that the backlogs of LCSs procured in previous years will provide substantial amounts of work to the two LCS shipyards as they compete between now and FY2020 for the FFG(X) program.
- **Supporters of procuring one LCS in FY2019** might argue that even though the Navy does not have a requirement for a 33rd LCS, the Navy could still make good use of the ship; that a single LCS procured in FY2019, combined with the three LCSs procured in FY2018, make for a total of four ships in FY2018 and FY2019 that could be divided evenly between the two LCS builders, giving them equal amounts of newly added work as they compete for the FFG(X) program; and that funding a 33rd LCS in FY2019 could help accelerate the attainment of the Navy's 52-ship force-level goal for SSCs.
- **Supporters of procuring two or more LCSs in FY2019** might argue that even though the Navy does not have a requirement for more than 32 LCSs, the Navy could still make good use of the ships; that it could help accelerate (even more than the previous option could) the attainment of the Navy's 52-ship force-level goal for SSCs; and that maintaining a procurement rate of at least two SSCs per year could help provide a hedge against the possibility of a delay in the start of FFG(X) procurement or in getting the FFG(X) program up to its eventual planned procurement rate of two ships per year.

Perspectives on the issue of how many LCSs to procure in FY2019 could also be affected by perspectives on issue discussed in the next section.

Navy's Plan for Shifting Procurement from LCS to FFG(X)

Another issue for Congress is whether to approve, reject, or modify the Navy's plan to procure a final LCS in FY2019 and shift to procurement of FFG(X)s starting in FY2020. As noted above, perspectives on this issue could affect perspectives on the previous issue of how many LCSs to procure in FY2019.

As noted earlier, the Navy's plan to end LCS procurement in FY2019 and shift to FFG(X) procurement starting in FY2020 would achieve the Navy's 52-ship SSC force-level goal by about 2035. The Navy's plan would also have implications for workloads and employment levels at the two LCS shipyards and their supplier firms:

- If a modified LCS is chosen as the winner of the FFG(X) competition, then other things held equal (e.g., without the addition of new work other than building LCSs), workloads and employment levels at the *other* LCS shipyard (the one whose modified LCS design is *not* chosen for the FFG(X) program), as well as supplier firms associated with that other LCS shipyard, would decline over time

as the other LCS shipyard's backlog of prior-year-funded LCSs is completed and not replaced with new FFG(X) work.

- If a modified LCS is not chosen as the FFG(X)—that is, if the winner of the FFG(X) competition is a proposal based on a hull design other than the two existing LCS designs—then other things held equal, employment levels at both LCS shipyards and their supplier firms would decline over time as their backlogs of prior-year-funded LCSs are completed and not replaced with FFG(X) work.

There are many possible alternatives to the Navy's plan to end LCS procurement in FY2019 and shift to FFG(X) procurement starting in FY2020. One of these, for example, would be to select a winner in the FFG(X) competition and begin procuring that design in FY2020, as the Navy currently plans, but also produce FFG(X)s at one or both of the LCS yards. Under this option, if the winner of the FFG(X) competition is one of the LCS builders, that builder might build more than half of the FFG(X)s to its winning design, and the other LCS yard would build less than half of the FFG(X)s to its own nonwinning (but presumably still-capable) FFG(X) design. Alternatively, if the winner of the FFG(X) competition is neither of the LCS builders, the winning bidder build might build the largest share of the FFG(X)s to its winning design, and the two LCSs yards would each build a smaller number of FFG(X)s to their own nonwinning (but presumably still-capable) designs.

Supporters of this option might argue that it could

- boost FFG(X) production from the currently planned two ships per year to as many as many as four to six ships per year, substantially accelerating the date for attaining the Navy's 52-ship SSC force-level goal;
- permit the Navy to use competition (either competition for quantity at the margin, or competition for profit [i.e., Profit Related to Offers, or PRO, bidding])[15] to help restrain FFG(X) prices and ensure production quality and on-time deliveries; and
- complicate adversary defense planning by presenting potential adversaries with multiple FFG(X) designs, each with its own specific operating characteristics.

Opponents of this plan might argue that it could

- weaken the FFG(X) competition by offering the winner a smaller prospective number of FFG(X)s and essentially guaranteeing the LCSs yard that they will build some number of FFG(X)s;
- substantially increase annual FFG(X) procurement funding requirements so as to procure as many as four to six FFG(X)s per year rather than two per year, which in a situation of finite DOD funding could require offsetting reductions in other Navy or DOD programs; and
- reduce production economies of scale in the FFG(X) program by dividing FFG(X) among two or three designs, and increase downstream Navy FFG(X) operation and support (O&S) costs by requiring the Navy to maintain two or three FFG(X) logistics support systems.

[15] For more on PRO bidding, see Statement of Ronald O'Rourke, Specialist in Naval Affairs, Congressional Research Service, before the House Armed Services Committee on Case Studies in DOD Acquisition: Finding What Works, June 24, 2014, p. 7.

Another possible alternative to the Navy's plan to end LCS procurement in FY2019 and shift to FFG(X) procurement starting in FY2020 would be would be to select a winner in the FFG(X) competition and begin procuring that design in FY2020, as the Navy currently plans, but shift Navy shipbuilding work at one of the LCS yards (if the other wins the FFG(X) competition) or at both of the LCS yards (if neither wins the FFG(X) competition) to the production of sections of larger Navy ships (such as DDG-51 destroyers or amphibious ships) that undergo final assembly at other shipyards. Under this option, in other words, one or both of the LCS yards would be converted into feeder yards supporting the production of larger Navy ships that undergo final assembly at other shipyards. This option might help maintain workloads and employment levels at one or both of the LCS yards, and might alleviate capacity constraints at other shipyards, permitting certain parts of the Navy's 355-ship force-level objective to be achieved sooner.

The concept of feeder yards in naval shipbuilding was examined at length in a 2011 RAND report.[16] The Navy in recent years has made some use of the concept

- All Virginia-class attack submarines have been produced jointly by General Dynamics' Electric Boat division (GD/EB) and Huntington Ingalls Industries' Newport News Shipbuilding (HII/NNS), with each yard in effect acting as a feeder yard for Virginia-class boats that undergo final assembly at the other yard.[17]
- Certain components of the Navy's three Zumwalt (DDG-1000) class destroyers were produced by HII's Ingalls Shipyard (HII/Ingalls) and then transported to GD's Bath Iron Works (GD/BIW), the primary builder and final assembly yard for the ships.
- San Antonio (LPD-17) class amphibious ships were built at the Ingalls shipyard at Pascagoula, MS, and the Avondale shipyard near New Orleans, LA. These shipyards were owned by Northrop and later by HII. To alleviate capacity constraints at Ingalls and Avondale caused by damage from Hurricane Katrina in 2005, Northrop subcontracted the construction of portions of LPDs 20 through 24 (i.e., the fourth through eighth ships in the class) to other shipyards on the Gulf Coast and East Coast, including shipyards not owned by Northrop.[18]

The above options are only two of many possible alternatives to the Navy's plan to end LCS procurement in FY2019 and shift to FFG(X) procurement starting in FY2020.

[16] Laurence Smallman, et al., *Shared Modular Build of Warships, How a Shared Build Can Support Future Shipbuilding*, RAND, Santa Monica, CA, 2011 (report TR-852), 81 pp.

[17] For more on the Virginia-class joint production arrangement, see CRS Report RL32418, *Navy Virginia (SSN-774) Class Attack Submarine Procurement: Background and Issues for Congress*, by (name redacted) .

[18] See Laurence Smallman, et al., *Shared Modular Build of Warships, How a Shared Build Can Support Future Shipbuilding*, RAND, Santa Monica, CA, 2011 (report TR-852), pp. 45-48. See also David Paganie, "Signal International positions to capture the Gulf," *Offshore*, June 1, 2006; Peter Frost, "Labor Market, Schedule Forces Outsourcing of Work," *Newport News Daily Press*, April 1, 2008; Holbrook Mohr, "Northrop Gets LPD Help From General Dynamics," *NavyTimes.com*, April 1, 2008; and Geoff Fein, "Northrop Grumman Awards Bath Iron Works Construction Work On LPD-24," *Defense Daily*, April 2, 2008.

Survivability, Lethality, Technical Risk, and Test and Evaluation Issues

A broad oversight area for Congress for the LCS program for the past several years concerns survivability, lethality, technical risk, and test and evaluation issues relating to LCSs and their mission packages. Each year for the past several years, the annual report from DOD's Director, Operational Test and Evaluation (DOT&E) has contained extensive comments, many of them very critical, regarding numerous aspects of LCSs and LCS mission packages. DOT&E's most recent annual report—its January 2018 report for FY2017—once again contains such comments.[19] Similarly, over the years, GAO has provided numerous reports and testimony about the LCS program that have raised a variety of issues with the program.[20] GAO also provides a summary assessment of risk in the LCS program in an annual report it publishes that surveys selected DOD weapon acquisition programs.[21]

LCS Deployments in 2018

Another potential oversight issue for Congress for the LCS program concerns the number of LCSs that will be deployed in 2018. An April 11, 2018, press report states:

> The Navy may not deploy any of its Littoral Combat Ships this year despite previous plans to deploy one to the Middle East and two to Singapore in 2018, due to a confluence of maintenance availabilities that has most of the LCS fleet sidelined this year.
>
> Three of the Navy's four original LCSs are in maintenance now, and four of the eight block-buy ships that have commissioned already are undergoing their initial Post Shakedown Availabilities (PSA), Cmdr. John Perkins, spokesman for Naval Surface Force Pacific, told USNI News.
>
> In addition to the deploying ships themselves being in maintenance, so too are the training ships that will be required to help train and certify the crews. The Navy upended its LCS training and manning plans in 2016 when then-SURFOR commander Vice Adm. Tom Rowden announced a change to a blue-gold crewing model and a ship reorganization: hulls 1 through 4 serve in San Diego as a test division, to help test mission module components and get them fielded; the remaining ships are divided into

[19] See Department of Defense, Director, Operational Test & Evaluation, *FY 2017 Annual Report*, January 2018, pp. 187-191.

[20] Recent examples include Government Accountability Office, *Littoral Combat Ship and Frigate[:] Slowing Planned Frigate Acquisition Would Enable Better-Informed Decisions*, GAO-17-279T, December 8, 2016, 22 pp. (Testimony Before the Subcommittee on Oversight and Investigations, Committee on Armed Services, House of Representatives, Statement of Michele Mackin, Director, Acquisition and Sourcing Management); Government Accountability Office, *Littoral Combat Ship and Frigate[:] Congress Faced with Critical Acquisition Decisions*, GAO-17-262T, December 1, 2016, 18 pp. (Testimony Before the Committee on Armed Services, U.S. Senate, Statement of Paul L. Francis, Managing Director, Acquisition and Sourcing Management); Government Accountability Office, *Littoral Combat Ship[:] Need to Address Fundamental Weaknesses in LCS and Frigate Acquisition Strategies*, GAO-16-356, June 2016, 56 pp.; Government Accountability Office, *Littoral Combat Ship[:] Knowledge of Survivability and Lethality Capabilities Needed Prior to Making Major Funding Decisions*, GAO-16-201, December 2015, 39 pp.; Government Accountability Office, *Littoral Combat Ship[:] Navy Complied with Regulations in Accepting Two Lead Ships, but Quality Problems Persisted after Delivery*, GAO-14-827, September 2014, 35 pp.; Government Accountability Office, *Littoral Combat Ship[:] Additional Testing and Improved Weight Management Needed Prior to Further Investments*, GAO-14-749, July 2014, 54 pp.; and Government Accountability Office, *Littoral Combat Ship[:] Deployment of USS Freedom Revealed Risks in Implementing Operational Concepts and Uncertain Costs*, GAO-14-447, July 2014, 57 pp.

[21] Government Accountability Office, W*eapon Systems Annual Assessment[:] Knowledge Gaps Pose Risks to Sustaining Recent Positive Trends*, GAO-18-360SP, April 2018, pp. 92-95.

> divisions of four ships each, responsible for either surface warfare, mine countermeasures or anti-submarine warfare. Within each division, the first ship has a more experienced crew that is responsible for training and certifying the rest of the crews, and the other three ships are deployable assets. Due to this model, not only does the deployable ship have to be in the water and ready for operations, but so does the training ship.
>
> Previously, the Program Executive Office for Unmanned and Small Combatants (formerly PEO LCS) had told USNI News that the program was preparing to deploy one Lockheed Martin-built Freedom-variant LCS from Mayport, Fla., to Bahrain this year, as the first LCS deployment to U.S. 5th Fleet; and that it was also preparing to send two Austal-built Independence-variant LCSs from San Diego to Singapore, in the first dual-ship deployment to stretch the Navy's ability to support multiple LCS operations in theater.
>
> Now, the Bahrain deployment has definitely been pushed to 2019. The Navy would not state that the Singapore deployments have been delayed until 2019, but given the task of getting ships through maintenance and then getting the crews trained and certified and ready to deploy, it is unlikely that even one LCS would be able to deploy this year.
>
> "LCS deployments on both coasts are event-based vice time-based. As such, deployments from both coasts will occur when the deploying hulls are fully prepared and the assigned Blue/Gold crews are fully trained and certified," Perkins told USNI News.
>
> "Training and certification of the Blue/Gold deploying crews require availability of the first LCS Surface Warfare Training Ships on the east and west coasts, respectively. At present, the projected deploying units and their respective training ships are all undergoing their initial Post Shakedown Availabilities (PSAs). Repairs and technical enhancements resulting from the lessons learned during construction of follow-on Freedom and Independence class hulls warranted extended timeframes for these PSAs, ensuring maximum material readiness in support of training, certification, and deployments. The completion of these identified shipyard events will ultimately yield platforms on which training and operations can commence in support of the next set of deployments."
>
> USNI News understands several things are creating longer-than-intended PSAs for these LCSs. First, the ships now entering PSA are the block-buy ships, which are somewhat different than the first four ships of the class and therefore come with their own set of lessons learned for the maintenance yards. Second, as Perkins said, the ships continue to get new capabilities backfit into them during PSA, which adds time. And third, USNI News understands that, in the aftermath of last year's fatal destroyer collisions, the Navy is being more diligent than before about ensuring the best possible material condition of ships coming out of maintenance – additional quality assurance steps are being taken, which keeps the ships tied up in the yards a bit longer than before.
>
> Additionally, on the West Coast, where all the Independence-variant ships are homeported, the trimaran hulls require a drydock for virtually any kind of maintenance availability, and the drydocks are in short supply as the Navy faces a high workload in the coming years.[22]

At an April 17, 2018, hearing on Navy shipbuilding programs before the Seapower subcommittee of the Senate Armed Services Committee, the following exchange occurred:

> SENATOR COTTON (continuing):

[22] Megan Eckstein, "Navy May Not Deploy Any Littoral Combat Ships This Year," *USNI News*, April 11, 2018.

> Admiral Merz, we have 11 littoral combat ships [in service]. A story recently in Naval Institute said that zero of those will deploy this year in 2018. Could you talk about why that's the case?
>
> VICE ADMIRAL WILLIAM MERZ, DEPUTY CHIEF OF NAVAL OPERATIONS FOR WARFARE SYSTEMS (OPNAV N9):
>
> Yes, sir. So, we're still—total numbers [of LCSs planned] is 32. They have a third of the class [in service?], particularly deploying models [sic: the typical deployment model is] three to five ships [in service] to one to keep deployed, so this is really just math and there's going to be gaps [in deployments]. That will fill in over time. We're not—we're not concerned about it.
>
> We're learning a lot about the maintenance of the ship. We're going to a dual crew model over the next several years, so we feel like it's on track. We're not concerned about not deploying in [20]'18. That's going to catch up over time as we fill in the rest of the class.
>
> COTTON:
>
> Was that anticipated? Pretty sure, OK.
>
> MERZ:
>
> Yes, sir, absolutely.[23]

At an April 19, 2018, hearing on the Department of the Navy's proposed FY2019 budget before the Senate Armed Services Committee, the following exchange occurred:

> SENATOR COTTON (continuing):
>
> Admiral Richardson, I want to discuss the littoral combat ship and what I view as some concerning news. According to a U.S. Naval Institute story published this week, the Navy will not deploy an LCS in 2018. Eleven LCS ships have been delivered to the Navy [as of] yesterday (ph), but we'll have none deployed (ph).
>
> Two days ago, at a Seapower [subcommittee] hearing, Admiral Merz testified, quote, "The typical deployment model is three to five ships to one, to keep one deployed. So this is really just math. There's going to be gaps that will fill in over time. We're not concerned about that," end quote.
>
> However, in September, just eight months ago, the commander of Naval Surface Forces in the Pacific Fleet said that (ph) you can maintain three to four littoral combat ships deployed when you take on the blue-gold crew system.
>
> What is the answer here to the actual deployment ratio?
>
> ADMIRAL JOHN RICHARDSON, CHIEF OF NAVAL OPERATIONS:
>
> Senator, I'll tell you, as you know, the littoral combat ship has been a program that has been through some troubled times. And I would say that, in the past, we probably pushed that ship out forward deployed a little bit ahead of its time, before the system had—the program had stabilized and we'd done the appropriate testing and gained the confidence.
>
> As soon as I got in as the Chief of Naval Operations, I directed the commander of Naval Surface Forces to take a look at that program, rationalize it and make it look a—a lot more like a normal shipbuilding program and a ship-operating program.

[23] Source: CQ transcript of hearing.

So this is what led to changes in the maintenance approach, changes in the blue-gold crewing, the way that we are going to homeport these squadrons and forward deploy them.

2018 is really a reflection of that shift, and so it is—well (ph), starting in 2019, we're going to start forward deploying those. They'll be sustainable. They'll be more lethal by virtue of the enhancements we're putting on those littoral combat ships.

We have 24 [LCS] deployments planned between [20]'19 and [20]'24. And so, you know, it—it really—[20]'18 is a—is a reset year to get maintenance and manning in place so that we can deploy this in a sustainable fashion.

COTTON:

So -- so, starting in 2019, then, which of those ratios will be correct? Will we be able to keep three out of four ships deployed, or one-fifth to one-third of those ships deployed?

RICHARDSON:

Sir, I'll tell you what: There's a little bit more to the math. If I could get back to you, for the record, on exactly how that ratio works out, I'll be happy to show you the—the way this all manifests itself.

COTTON:

I would—I would appreciate that for the record.

There's a second question I want to ask, as well. Even by Admiral Merz's statement of one-fifth to one-third of ships deployed, we should still have two or three LCS ships deployed this year.

I think you may have just answered that question, though, by saying this is a reset year to try to get to your future model.

RICHARDSON:

This—this is part of that plan that Surface Forces put together.

COTTON:

We've spent $6 billion, now, on these ships. I think the taxpayer deserves to have them out, performing their job.

RICHARDSON:

Could not agree more.

COTTON:

I hope that's the case, starting next year.[24]

Legislative Activity for FY2019

Summary of Congressional Action on FY2019 Funding Request

Table 2 summarizes congressional action on the Navy's FY2019 procurement funding request for the LCS program.

[24] Source: CQ transcript of hearing.

Table 2. Congressional Action on FY2019 Procurement Funding Request

Figures in millions, rounded to nearest tenth

		Authorization			Appropriation		
	Request	HASC	SASC	Conf.	HAC	SAC	Conf.
Shipbuilding and Conversion, Navy (SCN) appropriation account							
Procurement of LCSs	646.2	1,596.2					
(Procurement quantity)	*(1)*	*(3)*					
Cost-to-complete funding for prior-year LCSs	103.2	103.2					
Other Procurement, Navy (OPN) appropriation account							
Line 31: LCS common mission modules equipment	46.7	46.7					
Line 32: LCS MCM mission modules	124.1	124.1					
Line 33: LCS ASW mission modules	57.3	7.4					
Line 34: LCS SUW mission modules	26.0	15.0					
Line 35: LCS in-service modernization	70.5	70.5					

Source: Table prepared by CRS based on FY2019 Navy budget submission, committee and conference reports, and explanatory statements on the FY2018 National Defense Authorization Act and the FY2018 DOD Appropriations Act.

Notes: HASC is House Armed Services Committee; **SASC** is Senate Armed Services Committee; **HAC** is House Appropriations Committee; **SAC** is Senate Appropriations Committee; **Conf.** is conference agreement.

FY2019 National Defense Authorization Act (H.R. 5515)

House

The House Armed Services Committee's report (H.Rept. 115-676 of May 15, 2018) on H.R. 5515 recommends the funding levels for the LCS program shown in **Table 2**. The recommended increase of $950 million in SCN procurement funding is for two additional LCSs, for a total procurement in FY2019 of three LCSs. (Page 345) The recommended reduction of $49.9 million in OPN funding for line 33 is for "Late test event for VDS [variable depth sonar] and MFTA [multi-function towed array]." (Page 347) The recommended reduction of $11.0 million in OPN funding for line 34 is for "Surface to Surface MM [mission module] Early to need." (Page 347)

Appendix. Defense-Acquisition Policy Lessons

In reviewing the LCS program, one possible question concerns what defense-acquisition policy lessons, if any, the program may offer to policymakers, particularly in terms of the rapid acquisition strategy that the Navy pursued for the LCS program, which aimed at reducing acquisition cycle time (i.e., the amount of time between starting the program and getting the first ship into service).

One possible perspective is that the LCS program demonstrated that reducing acquisition cycle time can be done. Supporters of this perspective might argue that under a traditional Navy ship acquisition approach, the Navy might have spent five or six years developing a design for a new frigate or corvette, and perhaps another five years building the lead ship, for a total acquisition cycle time of perhaps 10 to 11 years. For a program announced in November 2001, this would have resulted in the first ship entering service in between late 2011 and late 2012. In contrast, supporters of this perspective might argue, LCS-1 entered service on November 8, 2008, about seven years after the program was announced, and LCS-2 entered service on January 16, 2010, a little more than eight years after the program announced. Supporters of this perspective might argue that this reduction in acquisition cycle time was accomplished even though the LCS incorporates major innovations compared to previous larger Navy surface combatants in terms of reduced crew size, "plug-and fight" mission package modularity, high-speed propulsion, and (in the case of LCS-2) hull form and hull materials.

Another possible perspective is that the LCS program demonstrated the risks or consequences of attempting to reduce acquisition cycle time. Supporters of this perspective might argue that the program's rapid acquisition strategy resulted in design-construction concurrency (i.e., building the lead ships before their designs were fully developed), a practice long known to increase risks in defense acquisition programs. Supporters of this perspective might argue that the cost growth, design issues, and construction-quality issues experienced by the first LCSs were due in substantial part to design-construction concurrency, and that these problems embarrassed the Navy and reduced the Navy's credibility in defending other acquisition programs. They might argue that the challenges the Navy faces today in terms of developing an LCS concept of operations (CONOPS),[25] LCS manning and training policies, and LCS maintenance and logistics plans were increased by the rapid acquisition strategy, because these matters were partly deferred to later years (i.e., to today) while the Navy moved to put LCSs into production. Supporters of this perspective might argue that the costs of the rapid acquisition strategy are not offset by very much in terms of a true reduction in acquisition cycle time, because the first LCS to be equipped with a mission package that had reached IOC (initial operational capability) did not occur until late FY2014—almost 13 years after the LCS program was announced. Supporters of this perspective could argue that the Navy could have avoided many of the program's early problems and current challenges—and could have had a fully equipped first ship enter service in 2011 or 2012—if it had instead pursued a traditional acquisition approach for a new frigate or corvette. They could argue that the LCS program validated, for defense acquisition, the guideline from the world of business management that if an effort aims at obtaining something fast, cheap, and good, it will succeed in getting no more than two of these things,[26] or, more simply, that the LCS program validated the general saying that haste makes waste.

[25] A CONOPS is a detailed understanding of how to use the ship to accomplish various missions.

[26] The guideline is sometimes referred to in the business world as "Fast, cheap, good—pick two."

A third possible perspective is that the LCS program offers few if any defense-acquisition policy lessons because the LCS differs so much from other Navy ships and the Navy (and DOD generally) consequently is unlikely to attempt a program like the LCS in the future. Supporters of this perspective might argue that the risks of design-construction concurrency have long been known, and that the experience of the LCS program did not provide a new lesson in this regard so much as a reminder of an old one. They might argue that the cost growth and construction delays experienced by LCS-1 were caused not simply by the program's rapid acquisition strategy, but by a variety of factors, including an incorrectly made reduction gear[27] from a supplier firm that forced the shipbuilder to build the lead ship in a significantly revised and suboptimal construction sequence.

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[27] A ship's reduction gear is a large, heavy gear that reduces the high-speed revolutions of the ship's turbine engines to the lower-speed revolutions of its propulsors.