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

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Summary

The Navy's Littoral Combat Ship (LCS)/Frigate program is a program to procure 52 LCSs and frigates. The first LCS was funded in FY2005, and a total of 23 have been funded through FY2015. The Navy's proposed FY2016 budget requests the procurement of three more LCSs. The Navy estimates the combined procurement cost of these three ships at \$1,437.0 million, or an average of \$479.0 million each. The three ships have received a total of \$80 million in prior-year advance procurement (AP) funding, and the Navy's FY2016 budget requests the remaining \$1,357.0 million that is needed to complete their combined procurement cost.

From 2001 to 2014, the program was known simply as the Littoral Combat Ship (LCS) program, and all 52 planned ships were referred to as LCSs. In 2014, at the direction of Secretary of Defense Chuck Hagel, the program was restructured. As a result of the restructuring, the Navy now wants to build the final 20 ships in the program (ships 33 through 52) to a revised version of the baseline LCS design. The Navy intends to refer to these 20 ships, which the Navy wants to procure in FY2019 and subsequent fiscal years, as frigates rather than LCSs.

The Navy has indicated that it may also want to build ships 25 through 32 with at least some of the design changes now intended for the final 20 ships. The Navy wants to procure ships 25 through 32 in FY2016-FY2018.

Two very different baseline LCS designs are being built. One was developed by an industry team led by Lockheed; the other was developed by an industry team that was led by General Dynamics. The Lockheed design is built at the Marinette Marine shipyard at Marinette, WI; the General Dynamics design is built at the Austal USA shipyard at Mobile, AL. Ships 5 through 24 in the program are being procured under a pair of 10-ship block buy contracts that were awarded to the two LCS builders in December 2010. The 24th LCS—the first of the three LCSs expected to be requested for procurement in FY2016—is the final ship to be procured under these block buy contracts.

The LCS program has been controversial due to past cost growth, design and construction issues with the lead ships built to each design, concerns over the ships' survivability (i.e., ability to withstand battle damage), concerns over whether the ships are sufficiently armed and would be able to perform their stated missions effectively, and concerns over the development and testing of the ships' modular mission packages. The Navy's execution of the program has been a matter of congressional oversight attention for several years. The program's restructuring in 2014 raises additional oversight issues for Congress.

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Introduction

This report provides background information and issues for Congress on the Navy's Littoral Combat Ship (LCS)/Frigate program, a program to procure 52 LCSs and frigates. The first ship in the program was procured in FY2005, and a total of 23 have been procured through FY2015. The Navy's proposed FY2016 budget requests the procurement of three more LCSs. The Navy estimates the combined procurement cost of these three ships at \$1,437.0 million, or an average of \$479.0 million each. The three ships have received a total of \$80 million in prior-year advance procurement (AP) funding, and the Navy's FY2016 budget requests the remaining \$1,357.0 million that is needed to complete their combined procurement cost.

The Navy's execution of the program has been a matter of congressional oversight attention for several years. In 2014, at the direction of Secretary of Defense Chuck Hagel, the program was restructured. The program's restructuring in 2014 raises additional oversight issues for Congress. Congress's decisions on the LCS/Frigate program will affect Navy capabilities and funding requirements, and the shipbuilding industrial base.

Background

Strategic and Budgetary Context

For an overview of the strategic and budgetary context in which this and other Navy shipbuilding programs may be considered, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

Program in General

Ships

A Program for 52 LCSs and Frigates

The Navy's Littoral Combat Ship (LCS)/Frigate program is a program to procure 52 LCSs and frigates. These 52 ships would account for 17%, or about one-sixth, of the Navy's planned fleet of about 306 ships of all types.¹

The establishment of the program was announced on November 1, 2001.² From 2001 to 2014, the program was known simply as the Littoral Combat Ship (LCS) program, and all 52 planned ships

¹ For more on the Navy's planned fleet, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

² On November 1, 2001, the Navy announced that it was launching a Future Surface Combatant Program aimed at acquiring a family of next-generation surface combatants. This new family of surface combatants, the Navy stated, would include three new classes of ships: a destroyer called the DD(X)—later redesignated the DDG-1000—for the precision long-range strike and naval gunfire mission; a cruiser called the 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. The DDG-1000 was truncated to a total of three ships in 2009, and the CG(X) program was terminated in 2010. For more on the DDG-1000 program, see CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke. For more on the CG(X) program, see CRS Report RL34179, *Navy CG(X) Cruiser Program: Background for Congress*, by Ronald O'Rourke.

were referred to as LCSs. In 2014, at the direction of Secretary of Defense Chuck Hagel, the program was restructured. As a result of the restructuring, the Navy now wants to build the final 20 ships in the program (ships 33 through 52) to a revised version of the LCS design. The Navy intends to refer to these 20 ships, which the Navy wants to procure in FY2019 and subsequent fiscal years, as frigates rather than LCSs.

The Navy has indicated that it may also want to build ships 25 through 32 in the program with at least some of the design changes now intended for the final 20 ships. The Navy wants to procure ships 25 through 32 in FY2016-FY2018. It is also possible that some of the design changes might be backfitted onto some of the first 24 ships in the program sometime after those ships enter service. Accordingly, the Navy has suggested that, eventually, it might refer to not just the final 20 ships in the program, but to some or all of the first 32 ships as well, as frigates.

Baseline LCS Design for First 24 to 32 Ships in the Program

The baseline LCS design, to be used for the first 24 to 32 ships in the program, is known as the Flight 0+ design.³ The baseline LCS is a relatively inexpensive Navy surface combatant that is to be equipped with modular “plug-and-fight” mission packages, including unmanned vehicles (UVs). Rather than being a multimission ship like the Navy’s larger surface combatants, the baseline LCS is to be a focused-mission ship, meaning a ship equipped to perform one primary mission at any given time. The ship’s mission orientation can be changed by changing out its mission packages. The baseline LCS design, without any mission packages, is referred to as the LCS sea frame.

The baseline 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. The LCS/Frigate program includes the development and procurement of ASW, MCM, and SUW mission packages for use by LCS sea frames. 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,⁴ although they could also be used to counter similar A2/AD capabilities that might be fielded by other countries.

Additional potential missions for baseline 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 module, although an installed mission module might enhance an LCS’s ability to perform some of these missions.

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.

³ The first two ships in the program were built to an earlier and slightly different design known as the Flight 0 design.

⁴ 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 Kenneth Katzman.

Revised Design for Final 20 Ships (Ships 33 Through 52)

The revised design that the Navy wants to use for the final 20 ships in the program includes additional or improved built-in equipment for SUW, ASW, and anti-air warfare (AAW), as well as changes to make the ship harder for adversaries to detect and changes to improve the ship's ability to withstand battle damage. These ships would be a little heavier than the baseline LCS design, and would have a slightly lower maximum sustained speed. They would have less capacity than the baseline LCS design for accepting LCS mission packages. The Navy does not intend to use the final 20 ships as MCM platforms; their primary missions would be SUW and ASW. The final 20 ships could also perform the additional potential missions listed above for the baseline LCS design.

Procurement Quantities

Table 1 shows past (FY2005-FY2015) and projected (FY2016-FY2019) annual procurement quantities for LCS sea frames under the Navy's FY2015 budget submission. As shown in the table, a total of 23 baseline LCSs have been procured through FY2015.

Table 1. Past (FY2005-FY2015) and Projected (FY2016-FY2020) Annual LCS Sea Frame Procurement Quantities

(As shown in the Navy's FY2015 budget submission)

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		
4	3	3	3	3	2	3		

Source: Prepared by CRS based on FY2016 Navy budget submission.

Notes: (1) The two ships shown in FY2005 and FY2006 were funded through Navy's research and development account rather than the Navy's shipbuilding account. (2) The 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 Baseline LCS Designs Built By Two LCS Shipyards

On May 27, 2004, the Navy awarded contracts to two industry teams—one led by Lockheed Martin, the other by General Dynamics (GD)—to design two baseline versions of the LCS, with options for each team to build up to two LCSs each. The baseline LCS designs developed by the two teams are quite different—the Lockheed team's design is based on a steel semi-planing monohull (with an aluminum superstructure), while the GD team's design is based on an all-aluminum trimaran hull (see **Figure 1**). The two ships also use different built-in combat systems (i.e., different collections of built-in sensors, computers, software, and tactical displays) that were designed by each industry team. The Navy states that both baseline LCS designs meet the Key Performance Parameters (KPPs) for the first 24 to 32 ships in the program. The Lockheed baseline LCS design is built at the Marinette Marine shipyard at Marinette, WI.⁵ The GD baseline LCS design is built at the Austal USA shipyard at Mobile, AL.⁶ Odd-numbered LCSs (i.e., LCS-

⁵ Marinette Marine is a division of the Fincantieri Marine Group, an Italian shipbuilding firm. In 2009, Fincantieri purchased Manitowoc Marine Group, the owner of Marinette Marine and two other shipyards. Lockheed is a minority investor in Marinette Marine.

⁶ 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.

1, LCS-3, LCS-5, and so on) use the Lockheed design; even-numbered LCSs (i.e., LCS-2, LCS-4, LCS-6, and so on) use the GD design.

Figure 1. Lockheed Baseline LCS Design (Top) and General Dynamics Baseline LCS 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.

Two Block Buy Contracts for Procuring Ships 5-24

Ships 1 through 4 in the program were procured with single-ship contracts. The next 20 ships in the program (ships 5 through 24) have been procured under two 10-ship block buy contracts that the Navy awarded to the two LCS builders in December 2010. The Navy sought and received legislative authority from Congress to award these block buy contracts.⁷ Under the contracts, each builder is to build 10 ships to be procured during the six-year period FY2010-FY2015, in annual quantities of 1-1-2-2-2-2. Thus, the Navy's combined procurement quantities across both builders for FY2010-FY2015 were to be 2-2-4-4-4-4. These annual procurement quantities were realized until FY2015. For FY2015, the Navy requested, and Congress funded, three ships rather than four. Consequently, 23 (rather than 24) LCSs have been funded through FY2015, and the final ship to be procured under the two block buy contracts—the 24th ship in the program—has been deferred from FY2015 to FY2016.

LCSs in Service

As of early 2015, the first four LCSs had entered service—LCS-1 on November 8, 2008; LCS-2 on January 16, 2010; LCS-3 on August 6, 2012; and LCS-4 on January 27, 2014.

Mission Packages

Planned Procurement Quantities

The Navy prior to the program's 2014 restructuring had planned to procure 64 LCS mission packages (16 ASW, 24 MCM, and 24 SUW) for the 52 LCSs. As of January 2015, the Navy had not announced how, if at all, the program's 2014 restructuring might change one or more of those figures.

Deliveries and Initial Operational Capability (IOC) Dates

Initial increments (i.e., versions) of LCS mission packages are undergoing testing. The Navy stated in its FY2015 budget submission that Increments I and II of the SUW mission package are scheduled to achieve IOC in the fourth quarter of FY2014, that Increment I of the MCM mission package is scheduled to achieve IOC in the fourth quarter of FY2015, and that Increment II of the ASW mission package is scheduled to achieve IOC in the fourth quarter of FY2016.⁸ At a February 25, 2015, hearing on Department of the Navy acquisition programs before the Seapower and Projection Forces subcommittee of the House Armed Services Committee, Department of the Navy officials testified that

In November 2014, the program declared Initial Operational Capability (IOC) for the Surface Warfare (SUW) MP after successful testing onboard USS Fort Worth (LCS 3) in April 2014. The Mine Countermeasure (MCM) MP completed its final Increment 1 Developmental Test event in October 2014. The MCM MP is currently scheduled for Technical Evaluation and Initial Operational Test & Evaluation (IOT&E) in 2015. The

⁷ 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 Ronald O'Rourke and Moshe Schwartz.

⁸ Department of Defense, *Department of Defense Fiscal Year (FY) 2015 Budget Estimates, Navy Justification Book Volume 2, Research, Development, Test & Evaluation, Navy, Budget Activity 4*, March 2014, pages 405-406 (pdf pages 467-468 of 770). See also pages 403-404 (pdf pages 465-466 of 770).

ASW MP successfully completed its initial integration test onboard USS Freedom (LCS 1) in September 2014, with operational testing scheduled to begin in 2016. This early operational test event will reduce integration risk through real-world, at-sea testing of the Advanced Development Model (ADM). A subsequent early deployment of the ASW MP ADM aboard USS Freedom (LCS 1) in 2016 will further prove out the capabilities of the ASW MP. Operational testing will culminate in IOT&E in 2017. Significant developmental and operational testing has already been accomplished on both variants, with embarked ASW, MCM and SUW MPs. The LCS and ASW MP performed as predicted and marked the first time an LCS has tracked a submarine with variable depth sonar and a multi-function towed array. USS Freedom (LCS 1) also served as the test platform for the Surface Electronic Warfare Improvement Program Block Two-Lite engineering development model (EDM) installation and testing. The FY 2016 President's Budget requests funding for five MPs (two MCM, two SUW, and one EDM for ASW.) The LCS, with a MP, provides capability that is equal to or exceeds the current capability of the ships that it is replacing.⁹

Manning and Deployment

Reduced-Size Crew

The baseline LCS employs automation to achieve a reduced-sized core crew (i.e., sea frame crew). The aim was to achieve a core crew of 40 sailors; the Navy has now decided to increase that number to about 50. Another 38 or so additional sailors are to operate the ship's embarked aircraft (about 23 sailors) and its embarked mission package (about 15 sailors in the case of the MCM package), which would make for a total crew of about 88 sailors (for a baseline LCS equipped with an MCM mission package), compared to more than 200 for the Navy's frigates and about 300 (or more) for the Navy's current cruisers and destroyers.¹⁰ The crew size for the final 20 ships in the program may differ from that of the baseline LCS design.

"3-2-1" Plan

The Navy plans to maintain three crews for each two baseline LCSs, and to keep one of those two baseline LCSs continuously underway—a plan Navy officials refer to as "3-2-1." Under the 3-2-1 plan, baseline LCSs are to be deployed for 16 months at a time, and crews are to rotate on and off deployed ships at 4-month intervals.¹¹ The 3-2-1 plan will permit the Navy to maintain a greater percentage of the baseline LCS force in deployed status at any given time than would be possible under the traditional approach of maintaining one crew for each baseline LCS and deploying baseline LCSs for six to eight months at a time. The Navy plans to forward-station up to four LCSs in the Western Pacific at Singapore, and up to eight LCSs in the Persian Gulf at Bahrain. The Navy might also apply the 3-2-1 plan to the final 20 ships in the program.

⁹ Statement of the Honorable Sean J. Stackley, Assistant Secretary of the Navy (Research, Development and Acquisition) and Vice Admiral Joseph P. Mulloy, Deputy Chief of Naval Operations for Integration of Capabilities and Resources and Lieutenant General Kenneth J. Glueck, Jr., Deputy Commandant, Combat Development and Integration & Commanding General, Marine Corps Combat Development Command, Before the Subcommittee on Seapower and Projection Forces of the House Armed Services Committee on Department of the Navy Seapower and Projection Forces Capabilities, February 25, 2015, p. 11.

¹⁰ See *Report to Congress, Littoral Combat Ship Manning Concepts*, Prepared by OPNAV—Surface Warfare, July 2013 (with cover letters dated August 1, 2013), posted at USNI News on September 24, 2013, at <http://news.usni.org/2013/09/24/document-littoral-combat-ship-manning-concepts>.

¹¹ See, for example, Grace Jean, "Buying Two Littoral Combat Ship Designs Saves the Navy \$600 Million, Official Says," *NationalDefenseMagazine.org*, January 12, 2011.

Procurement Cost

Unit Procurement Cost Cap

LCS sea frames procured in FY2010 and subsequent years are subject to a unit procurement cost cap that can be adjusted to take inflation into account.¹² The Navy states that after taking inflation into account, the unit procurement cost cap as of December 2010 was \$538 million per ship. In awarding the two LCS block buy contracts in December 2010, the Navy stated that LCSs to be acquired under the two contracts are to have an average unit cost of about \$440 million, a figure well below this \$538 million figure.¹³

Program Procurement Costs

Sea Frames

The Navy's proposed FY2016 budget requests \$1,437.0 million for the procurement of three more LCSs, or an average of \$479.0 million each.

¹² The legislative history of the cost cap is as follows:

The cost cap was originally established by Section 124 of the FY2006 National Defense Authorization act (H.R. 1815/P.L. 109-163 of January 6, 2006). Under this provision, the fifth and sixth ships in the class were to cost no more than \$220 million each, plus adjustments for inflation and other factors.

The cost cap was amended by Section 125 of the FY2008 National Defense Authorization Act (H.R. 4986/P.L. 110-181 of January 28, 2008). This provision amended the cost cap to \$460 million per ship, with no adjustments for inflation, and applied the cap to all LCSs procured in FY2008 and subsequent years.

The cost cap was amended again by Section 122 of the FY2009 Duncan Hunter National Defense Authorization Act (S. 3001/P.L. 110-417 of October 14, 2008). This provision deferred the implementation of the cost cap by two years, applying it to all LCSs procured in FY2010 and subsequent years.

The cost cap was amended again by Section 121(c) and (d) of the FY2010 National Defense Authorization Act (H.R. 2647/P.L. 111-84 of October 28, 2009). The provision adjusted the cost cap to \$480 million per ship, excluded certain costs from being counted against the \$480 million cap, included provisions for adjusting the \$480 million figure over time to take inflation and other events into account, and permitted the Secretary of the Navy to waive the cost cap under certain conditions. The Navy states that after taking inflation into account, the \$480 million figure equates, as of December 2010, to \$538 million.

Section 121(d)(1) states that the Secretary of the Navy may waive the cost cap if:

(A) the Secretary provides supporting data and certifies in writing to the congressional defense committees that—

(i) the total amount obligated or expended for procurement of the vessel-

(I) is in the best interest of the United States; and

(II) is affordable, within the context of the annual naval vessel construction plan required by section 231 of title 10, United States Code; and

(ii) the total amount obligated or expended for procurement of at least one other vessel authorized by subsection (a) has been or is expected to be less than \$480,000,000; and

(B) a period of not less than 30 days has expired following the date on which such certification and data are submitted to the congressional defense committees.

¹³ Source: Contract-award information provided to CRS by navy office of Legislative Affairs, December 29, 2010. The 20 ships to be acquired under the two contracts have a target cost and a higher ceiling cost. Any cost growth above the target cost and up to the ceiling cost would be shared between the contractor and the Navy according to an agreed apportionment (i.e., a "share line"). Any cost growth above the ceiling cost would be borne entirely by the contractor. The Navy states that, as a worst case, if the costs of the 20 ships under the two FPI contracts grew to the ceiling figure and all change orders were expended, the average cost of the ships would increase by about \$20 million, to about \$460 million, a figure still well below the adjusted cost cap figure of \$538 million.

Mission Packages

A March 2014 GAO report states that for a January 2014 Milestone B acquisition event, the LCS program office estimated the total acquisition cost of the LCS program's mission packages at \$7.24 billion.¹⁴ This figure does not account for any changes in planned LCS mission package procurement that might result from the program's 2014 restructuring.

In August 2013, the Navy had stated that

The estimated Average Production Unit Cost (APUC) for all 59 OPN-funded mission packages [the other five mission packages were funded through the Navy's research, development, test and evaluation (RDT&E) account] is \$69.8M in Constant Year (CY) Fiscal Year 2010 dollars. This is the most accurate answer for "How much does it cost to buy a mission package?" These mission packages are production-representative assets for Operational Test and deployment. The LCS Mission Modules program will use OPN to procure 23 MCM mission packages, 21 SUW mission packages, 15 ASW mission packages, and 59 sets of common mission package equipment.

The APUC can be broken down into the estimated average initial procurement cost of the three types of mission packages and common mission package equipment. None of the figures in this paper represent budget values.

- Mine Countermeasures (MCM) Mission Packages (23): \$97.7M
- Surface Warfare (SUW) Mission Packages (21): \$32.6M
- Anti-Submarine Warfare (ASW) Mission Packages (15): \$20.9M
- Sets of Common Mission Package Equipment (59): \$14.8M...

These estimates do not include the RDT&E expenditures that are associated with mission package development, integration, and test. These RDT&E expenditures include the five RDT&E-funded mission packages intended for use as development, training, and testing assets. Those five mission packages are not production-representative items. Including all prior RDT&E expenditures results in an average Program Acquisition Unit Cost of \$99.7M for all 64 mission packages. This not an accurate answer for "How much does it cost to buy a mission package?" as past RDT&E expenditures are not relevant to the purchase price of a mission package today.¹⁵

¹⁴ Government Accountability Office, *Defense Acquisitions[:] Assessments of Selected Weapon Programs*, GAO-14-340SP, March 2013, p. 96. See also Jason Sherman, "Navy Sets \$7.2B Price Tag For Littoral Combat Ship Mission Modules," *Inside the Navy*, March 31, 2014.

The December 31, 2012, SAR for the sea frame portion of the LCS program does not contain estimated acquisition costs for the planned total of 64 LCS mission packages. The December 31, 2010, SAR for the LCS program stated:

On February 18, 2011, USD(AT&L) [the Under Secretary of Defense (Acquisition, Technology, and Logistics)—DOD's acquisition executive] conducted a Milestone B (MS B) Defense Acquisition Board (DAB) for the seaframe portion of the LCS program. The decision of the DAB was to separate the program into two separate and distinct programs with separate reporting requirements. The Seaframe portion of the program is reported in this SAR as approved at MS B. The Mission Module portion of the program will begin reporting when it receives its Milestone B decision.

(Department of Defense, *Selected Acquisition Report (SAR), LCS*, as of December 31, 2010, p. 4.)

¹⁵ Navy information paper on LCS program dated August 26, 2013, and provided to CRS and CBO on August 29, 2013.

Controversy and Proposals to Truncate Program

The LCS program has been controversial due to past cost growth, design and construction issues with the lead ships built to each design, concerns over the ships' survivability (i.e., ability to withstand battle damage), concerns over whether the ships are sufficiently armed and would be able to perform their stated missions effectively, and concerns over the development and testing of the ships' modular mission packages. Prior to the program's restructuring in 2014, some observers, citing one or more of these issues, had proposed truncating the LCS program to either 24 ships (i.e., stopping procurement after procuring all the ships covered under the two block buy contracts) or to some other number well short of 52.¹⁶ In response to criticisms of the LCS program, the Navy prior to the program's 2014 restructuring acknowledged certain problems and stated that it was taking action to correct them, and disputed other arguments made against the program. The LCS is by no means the only Navy shipbuilding program to have encountered controversy over the years; several others have experienced controversy for one reason or another.

Program's 2014 Restructuring

February 2014 DOD Announcement of Restructuring Effort

February 24, 2014, Secretary of Defense Address and DOD Background Briefing

On February 24, 2014, in an address previewing certain decisions incorporated into DOD's FY2015 budget submission, Secretary of Defense Chuck Hagel stated:

Regarding the Navy's littoral combat ship [LCS], I am concerned that the Navy is relying too heavily on the LCS to achieve its long-term goals for ship numbers. Therefore, no new contract negotiations beyond 32 ships will go forward. With this decision, the LCS line will continue beyond our five-year budget plan with no interruptions.

The LCS was designed to perform certain missions—such as mine sweeping and anti-submarine warfare—in a relatively permissive environment. But we need to closely examine whether the LCS has the independent protection and firepower to operate and survive against a more advanced military adversary and emerging new technologies, especially in the Asia Pacific. If we were to build out the LCS program to 52 ships, as previously planned, it would represent one-sixth of our future 300-ship Navy. Given continued fiscal restraints, we must direct shipbuilding resources toward platforms that can operate in every region and along the full spectrum of conflict.

Additionally, at my direction, the Navy will submit alternative proposals to procure a capable and lethal small surface combatant, generally consistent with the capabilities of a frigate. I've directed the Navy to consider a completely new design, existing ship designs,

¹⁶ For example, a May 2012 report by the Center for a New American Security (CNAS) recommended stopping the LCS program in FY2017 after procuring a total of 27 ships (David W. Barno, et al., *Sustainable Pre-eminence[:]* *Reforming the U.S. Military at a Time of Strategic Change*, Center for a New American Security, May 2012, pp. 35, 67), and an April 2011 report by the Heritage Foundation recommended a future Navy fleet with a total of 28 small surface combatants—a category that appears to include both Oliver Hazard Perry (FFG-7) frigates (which are being phased out of service) and LCSs (*A Strong National Defense[:]* *The Armed Forces America Needs and What They Will Cost*, Heritage Foundation, April 5, 2011, pp. 25-26). CNAS made a similar recommendation in a report it published in October 2011 (David W. Barno, et al., *Hard Choices[:]* *Responsible Defense in an Age of Austerity*, Center for a New American Security, October 2011, pp. 13, 14, 15, 16, 18, 20, 21, 34, 35). The report recommends procuring a total of 27 LCSs under three DOD budget scenarios, or a total of 12 LCSs under a fourth DOD budget scenario).

and a modified LCS. These proposals are due to me later this year in time to inform next year's budget submission.¹⁷

Also on February 24, 2014, in a background briefing associated with Hagel's address, a senior defense official stated:

On the LCS, we clearly do need the LCS capabilities of the minesweeps, the ASW [Anti-Submarine Warfare] module for example is looking very promising, and we absolutely need those capabilities. But as we look at our adversary growing capabilities, we also need to make certain that our fleet has enough capabilities, enough survivability and lethality that they can go up against those adversaries, so we want to look at what—what is out there for the future of the small surface combatants beyond LCS? And we—and we want to start that now.¹⁸

February 24, 2014, Secretary of Defense Memorandum to Navy Leadership

A February 24, 2014, memorandum from Secretary of Defense Hagel to Secretary of the Navy Ray Mabus and Chief of Naval Operations Admiral Jonathan Greenert stated:

I have given careful consideration to the Littoral Combat Ship (LCS) program, and I wanted to get back to you on my decision. I have consulted with Naval Surface Commanders, acquisition officials, policy and evaluation experts and reviewed preliminary assessments and evaluations of the LCS.

If we build out the LCS program to 52 ships it would represent one-sixth of our future 300-ship Navy. Given the emerging threat environment of the future, I have considerable reservations as to whether that is what our Navy will require over the next few decades. I recognize the importance of presence, which is tied to the number of ships. But I also believe that capability and power projection is the foundation of our Navy's effectiveness.

Therefore, no new contract negotiations beyond 32 ships will go forward. The Department of the Navy is directed to provide me the following information:

- Provide regular updates on LCS performance based on test results and experience from recent deployments. These assessments should consider survivability, performance, sustainment cost, materiel readiness, lethality and growth potential.
- Submit to me, in time to inform the PB 2016 [President's Budget for FY2016] budget deliberations, alternative proposals to procure a capable and lethal small surface combatant, generally consistent with the capabilities of a frigate. Options considered should include a completely new design, existing ship designs (including the LCS), and a modified LCS. Include target cost, mission requirements, sensors and weapon requirements and required delivery date.

If a modified LCS is an acceptable option for a more capable small surface combatant, negotiations for LCS beyond the 24 ships currently on contract should seek to incorporate the upgraded LCS as soon as possible. Should the aforementioned assessments provide dispositive against the LCS, I retain the right to modify the program.

¹⁷ DOD News Transcript, "Remarks by Secretary Hagel and Gen. Dempsey on the fiscal year 2015 budget preview in the Pentagon Briefing Room," February 24, 2014, accessed February 25, 2014, at <http://www.defense.gov/transcripts/transcript.aspx?transcriptid=5377>. Brackets as in original.

¹⁸ DOD News Transcript, "Background Briefing on Fiscal 2015 Budget Recommendations," February 24, 2014, accessed February 25, 2014, at <http://www.defense.gov/transcripts/transcript.aspx?transcriptid=5376>. Brackets as in original.

As we both agree, smart investments in our future ships will be required as we continue to face limited resources over the next few years. We need to focus on what the Navy will require in the years ahead to meet our Nation's security needs and future missions.¹⁹

Navy Work to Identify Ships to Follow First 32 LCSs

Following Secretary Hagel's February 24, 2014, announcement, the Navy conducted an internal study of options for small surface combatants to be procured following the first 32 LCSs.²⁰ The study was completed on July 31, 2014, as required. The results of the study were then reviewed for several months within the Office of the Secretary of Defense.

December 2010 DOD And Navy Announcement of Restructured Plan

December 10, 2014, Secretary of Defense Memo

A December 10, 2014, memorandum from Secretary of Defense Chuck Hagel to Secretary of the Navy Ray Mabus and Chief of Naval Operations Jonathan Greenert on the subject of "Littoral Combat Ship Program Way Ahead" states:

I want to thank you and your staff for the timely, thorough, and professional work conducted in response to my memorandum from February 24, 2014, which directed you to submit to me alternate proposals for a capable small surface combatant that is more lethal and survivable than the current Flight 0+ Littoral Combat Ship (LCS) now in serial production. After giving careful thought to your briefing on options, I approve your plan to procure a small surface combatant (SSC) based on an upgraded Flight 0+ LCS, and direct the following actions to be taken:

— Develop an Acquisition Strategy to support design and procurement of new SSCs no later than Fiscal Year 2019 (FY 19), and sooner if possible. Provide this Acquisition Strategy to the USD(AT&L) for review and approval no later than May 1, 2015. As this strategy is developed, the Navy should continue to identify further opportunities to

¹⁹ Memorandum dated February 24, 2014, from the Office of the Secretary of Defense to the Secretary of the Navy and Chief of Naval Operations on Littoral Combat Ship (LCS) program, posted at InsideDefense.com (subscription required) February 28, 2014.

²⁰ For more on the Navy's internal study, see Statement of The Honorable Sean J. Stackley, Assistant Secretary of the Navy (Research, Development and Acquisition) and Vice Admiral Joseph P. Mulloy, Deputy Chief of Naval Operations for Integration of Capabilities and Resources and Vice Admiral William H. Hilarides, Commander, Naval Sea Systems Command, Before the Subcommittee on Seapower of the Senate Armed Services Committee on Department of the Navy Shipbuilding Programs, April 10, 2014, pp. 11-12; joint letter dated March 13, 2014, from the Chief of Naval Operations and the Assistant Secretary of the Navy (Research, Development, and Acquisition) on Small Surface Combatant Task Force, posted at InsideDefense.com (subscription required) March 18, 2014; Kris Osborn, "Navy Starts Study to Re-Examine LCS Mission," *DoD Buzz* (www.dodbuzz.com), March 7, 2014; Christopher P. Cavas, "CNO: Group Will Study New LCS Designs," *DefenseNews.com*, March 10, 2014; Olga Belogolova, "Top Navy Official: New Design For A Small Surface Combatant Unlikely," *Inside the Navy*, April 14, 2014; Christopher P. Cavas, "Ship Study Should Favor Existing Designs," *DefenseNews.com*, April 19, 2014; Michael Fabey, "LCS Template Colors Small Surface Combatant Development," *Aerospace Daily & Defense Report*, May 2, 2014: 1-2; Philip Ewing, "CNO: Navy Could've Been Clearer About LCS," *Politico Pro Defense*, May 21, 2014; Sandra Erwin, "Navy Chief: We Will Lay Out Clear Plan for Littoral Combat Ship," *National Defense* (www.nationaldefensemagazine.org), May 21, 2014; Mike McCarthy, "Up-gunned LCSs, Coast Guard's Cutter Among Ideas Proposed For Navy's Small Surface Combatant," *Defense Daily*, May 23, 2014: 2-3; Mike McCarthy, "LCS Follow-On Will Have To Be 'Very Close' In Price, Admiral Says," *Defense Daily*, June 2, 2014: 4-5; Michael Fabey, "Robust Air Defense Not Needed In New Frigates, Studies Show," *Aerospace Daily & Defense Report*, January 30, 2015: 4; Mike McCarthy, "Modifying An LCS And Calling It A Frigate—How The Navy Got There," *Defense Daily*, February 2, 2015: 4-7.

increase ship survivability and lethality as it proceeds to the next phase of SSC design. Competition for the SSC should be sustained to the maximum extent possible within available resources.

— Provide the Director, CAPE and USD(AT&L) with a Service Cost Position in support of the FY17 POM submission and provide the USD(AT &L) with your plan for controlling overall program cost. Cost control should be a major emphasis of the program. I am particularly interested in ensuring that the Navy addresses operations and support (O&S) cost projections, and takes actions to reduce them.

— Provide to me no later than May 1, 2015, an assessment of the cost and feasibility of back-fitting SSC survivability and lethality enhancements on earlier Flight 0+ LCSs already under contract, as well as those built before production of new SSCs commences. The intent should be to improve the lethality and survivability of Flight 0+ ships as much as practical. Your assessment should be coordinated with Deputy Secretary Work, USD (AT&L), and Director, CAPE.

Your strategy, plans, and assessments should assume a total buy of up to 52 Flight 0+ LCSs and SSCs, with the final number and mix procured dependent on future fleet requirements, final procurement and O&S costs, and overall Department of the Navy resources.

By executing the above guidance, I am confident we will procure the most lethal, survivable and capable small surface combatant given our available resources.

Thank you and the men and women of the world's finest Navy for your daily efforts to defend this Nation.²¹

December 11, 2014, DOD News Release

A December 11, 2014, DOD news release stated:

Statement by Secretary Hagel on the Littoral Combat Ship

Earlier this year, expressing concern that the U.S. Navy was relying too heavily on the littoral combat ship (LCS) to meet long-term targets for the size of its fleet, I announced that the Defense Department would not undertake new contract negotiations beyond 32 littoral combat ships, and directed the Navy to submit alternative proposals to identify and procure a more lethal and survivable small surface combatant, with capabilities generally consistent with those of a frigate. I specifically asked the Navy to consider completely new designs, existing ship designs, and modified LCS designs; and to provide their recommendations to me in time to inform the president's fiscal year 2016 defense budget.

After rigorous review and analysis, today I accepted the Navy's recommendation to build a new small surface combatant (SSC) ship based on upgraded variants of the LCS. The new SSC will offer improvements in ship lethality and survivability, delivering enhanced naval combat performance at an affordable price.

The LCS was designed to be a modular and focused-mission platform individually tailored for mine-sweeping, surface warfare, and anti-submarine warfare. Given today's fiscal climate and an increasingly volatile security environment, I concluded the Navy must direct its future shipbuilding resources toward more multi-mission platforms that can operate in every region and across the full spectrum of conflict.

²¹ Memorandum dated December 10, 2014, from the Secretary of Defense to the Secretary of the Navy and the Chief of Naval Operations on Littoral Combat Ship Program Way Ahead, accessed December 24, 2014, at <http://www.defense.gov/pubs/SD%20Signed%20Memo%20to%20SECNAV%20&%20CNO%2010DEC2014.pdf>.

My decision today follows consultations with DoD's senior leadership and careful review of the Navy's recommendation and underlying analysis, which included detailed evaluation of 192 design concepts as well as consultation with fleet commanders, industry, surface warfare officers, engineers, program managers, and analysts.

The more lethal and survivable SSC will meet a broader set of missions across the range of military operations, and addresses the Navy's top war-fighting priorities. It will feature an improved air defense radar; air defense decoys; a new, more effective electronic warfare system; an over-the-horizon anti-ship missile; multi-function towed array sonar; torpedo defenses; and additional armor protection.

I have directed the Navy to assume a total buy of 52 LCSs and SSCs, with the final number and mix dependent on future fleet requirements, final procurement costs, and overall Navy resources. Production of the new SSC will begin no later than fiscal year 2019, and there will be no gap between production of the last LCS and the first SSC. A significant advantage to this approach is the ability to enhance naval combat performance by back-fitting select SSC improvements to the LCS fleet.

The Navy's new proposal, like the LCS, will continue to have its critics, but considering the context of our broader naval battle force and the current strategic and fiscal environment, I believe it represents our best and most cost effective option. By avoiding a new class of ships and new system design costs, it also represents the most responsible use of our industrial base investment while expanding the commonality of the Navy's fleet.

Going forward, I have issued three directives to the Navy. First, by next May, the Navy will provide the secretary of defense with an acquisition strategy to support design and procurement of the SSC no later than fiscal year 2019, while continuing to identify further opportunities to enhance the new ship's survivability and lethality. Second, also by next May, the Navy will provide a detailed assessment of the cost and feasibility of back-fitting the SSCs enhancements onto LCSs already under contract. Finally, in advance of fiscal year 2017 budget preparations, the Navy will provide the undersecretary of defense for acquisition, technology, and logistics and the director of cost analysis and program evaluation with detailed cost estimates as well as a plan for controlling those costs.

I want to thank the Navy for its rigorous analysis, as well as Deputy Secretary of Defense Bob Work; Vice Chairman of the Joint Chiefs of Staff Admiral Sandy Winnefeld; Undersecretary of Defense for Acquisition, Technology, and Logistics Frank Kendall; Director of Cost Assessment and Program Evaluation Jamie Morin; and Director of Operational Test and Evaluation Michael Gilmore for leading a task force to analyze the Navy's recommendations. We look forward to working with Congress to ensure that our nation's fleet remains unrivaled for many decades to come.²²

December 11, 2014, Navy News Story

A December 11, 2014, Navy News story reprinting a statement from the office of the Secretary of the Navy stated:

Secretary of Defense Chuck Hagel has directed the Navy "to move forward with a multi-mission small surface combatant based on modified Littoral Combat Ship (LCS) hull designs."

²² DOD news release, "Statement by Secretary Hagel on the Littoral Combat Ship," December 11, 2014, accessed December 24, 2014, at <http://www.defense.gov/Releases/Release.aspx?ReleaseID=17073>.

Consistent with the Fleet's views on the most valued capabilities delivered by a small surface combatant, the modified LCS ship will be more lethal and survivable. It will provide multi-mission anti-surface warfare (SUW) and anti-submarine warfare capabilities (ASW), as well as continuous and effective air, surface and underwater self-defense. Adding to current LCS Flight 0+ baseline configurations, which include the 57mm gun and SeaRAM missile system, this ship will be equipped with over-the-horizon surface-to-surface missiles, air defense upgrades (sensors and weapons), an advanced electronic warfare system; advanced decoys; a towed array system for submarine detection and torpedo defense, two 25mm guns, an armed helicopter capable of engaging with either Hellfire missiles or MK-54 torpedoes, and an unmanned FireScout helicopter for surveillance, reconnaissance, and targeting.

Modularity design features will also be retained to augment SUW and ASW capabilities as directed by the Fleet Commanders. Available mission modules include Longbow Surface to-Surface Missiles (Hellfire), two MK46 30mm guns, and two 11M RHIBs for Surface Warfare, or a variable depth sonar for submarine warfare which, when added to the ship's organic multi-function towed array and embarked helicopter, make this an extremely effective anti-submarine warfare platform.

In addition to the improved weapon systems capabilities for this ship, which reduce its susceptibility to being hit by a threat weapon, the small surface combatant will also include improved passive measures - measures that will reduce the ship's signature against mine threats, and measures that will harden certain vital spaces and systems against potential damage caused by weapon impact - to further enhance its overall survivability.

From an operational perspective, the sum of these improvements will increase the ship's capability and availability to participate in SUW Surface Action Groups, ASW Search and Attack Units; escort of High Value Units, and support of Carrier Strike Group (CSG) SUW and ASW operations.

With increased lethality and survivability, the modified LCS will provide the flexibility to operate both independently and as a part of an aggregated force. This decision allows the Navy to add organic multi-mission capabilities to the small surface combatant force while leveraging the benefits and affordability of the LCS program. The modified LCS ships will complement the planned 32 LCS ships, resulting in a 52 ship Small Surface Combatant Fleet in keeping with the Navy's Force Structure Analysis. The 32 LCS ships, with their full modular capability, will allow the Navy to deploy assets to meet the Navy's mine warfare, SUW, and ASW demands.²³

December 11, 2014, Navy Fact Sheet

A December 11 Navy fact sheet on "The Modified Littoral Combat Ship (LCS)" stated:

The modified LCS will be multi-missioned, with increased lethality and enhanced survivability at the most affordable cost.

- The modified LCS is multi-mission focused and expands Surface Warfare (SUW) and Anti-Submarine Warfare (ASW) capabilities.
- The ships will be based upon on existing LCS designs with modifications that will include additional capabilities.

²³ "Navy Moving Forward With LCS," *Navy News*, December 11, 2014, accessed December 24, 2014, at http://www.navy.mil/submit/display.asp?story_id=84849.

- Over-the-horizon surface to surface missile and additional weapon systems and combat system upgrades improves lethality.
- Increased survivability will be achieved by incorporating additional self-defense capabilities and increased hardening vital systems and vital spaces.
- The ship will retain certain aspects of modularity but will maintain a baseline of surface and subsurface warfare capabilities.
- Provides lethality, survivability and multi-mission capabilities in accordance with fleet priorities.
- Requirements are based on estimated theater threat environment for the 2025 timeframe.
- Fulfills the remaining 20 ships of our 52 small surface combatant requirement.
- Both LCS variants remain a valuable addition to the fleet.
 - Our procurement strategy of 32 LCS continues, and we intend to provide incremental upgrades to these ships beginning in FY17.
 - The 32 LCS, with their full modular capability, will allow the Navy to deploy assets to meet the Navy's Mine Warfare, Surface Warfare, and Anti-Submarine Warfare demands.
- Small surface combatants enable the Navy to execute Defense Strategic Guidance (DSG).
 - The Navy has a validated requirement for 52 small surface combatants
 - Innovative, low-cost, and small footprint approach to achieve security objectives
 - Offers flexibility to Combatant Commanders for Theater Security Cooperation
 - Frees large surface combatants to conduct their primary missions
 - Builds and strengthens maritime partnerships by being able to train and operate with smaller, regional navies and to enter previously inaccessible, shallow-water foreign ports.
- Procurement of this multi-mission ship supports industrial base schedule and is fiscally responsible.
 - The modified LCS helps maintain industrial infrastructure with no breaks in production.
 - The Navy balanced design alternatives with consideration for cost, risk, and other capabilities currently in the fleet.
 - Ship and combat systems design funding is included in our FY16 President's Budget Request to support procurement starting in FY19.
 - By leveraging the current LCS design, total ownership cost is optimized.
 - This increased capability is achieved at less than 20% more cost than the current LCS.²⁴

²⁴ Navy fact sheet entitled "The Modified Littoral Combat Ship," December 11, 2014, posted at InsideDefense.com (subscription required) December 11, 2014.

The fact sheet goes on to say that specific modifications to the existing LCS design include the following:

- an improved three-dimensional air surveillance radar;
- an upgrade of the ship's air defense capability to include a system called SeaRAM;
- an over-the-horizon (OTH) surface warfare (SUW) missile;
- an improved electronic warfare (EW) capability;
- improved decoy systems;
- improved signature management;
- a multifunction towed-array sonar system;
- torpedo defense and countermeasures equipment;
- increased armor;
- 25mm guns; and
- actions elsewhere to reduce the weight of the ship, so as to help accommodate the above additions.

April 22, 2015, Navy Information Paper

An April 22, 2015, Navy information paper states:

The Small Surface Combatant Task Force (SSCTF) [cost] estimates were based on surrogate systems which are not always representative of the production Frigate systems. SSCTF estimated that the modified LCS/Frigate (FF) will result in no more than a 20% increase to LCS Flight 0+, equating to approximately \$75-100M [million] more for the average follow on ship of a block buy. The Frigate will remain below the LCS congressional cost cap.

Navy is currently working through the process to develop a service cost position in support of the Frigate. The Frigate program office will utilize the surrogate systems from the Small Surface Combatant Task Force until final decisions are made regarding new, different and/or upgraded systems. This work is scheduled to conclude in October 2015 in order to support Program Objective Memorandum (POM) Fiscal Year 17 submission.²⁵

Additional Information in Press Reports

Regarding the acquisition strategy for the 20 ships, a December 15, 2014, trade press article stated:

The Navy will continue to build both Lockheed's Freedom and Austal's Independence-class LCS surface variants, Sean Stackley, the service's top acquisition official, stressed during a Dec. 11 roundtable at the Pentagon. The service's plan is to continue to dual-source the new SSC program in order to increase competition and drive down costs, he said. However, as to how the last 20 out of a planned 52 LCS-type ships would be split between those two shipbuilders, Stackley said it is too soon to tell.²⁶

²⁵ Navy information paper dated April 22, 2015, provided by Navy Office of Legislative Affairs to CRS on April 22, 2015.

²⁶ Lara Seligman, "Stackley: Navy Will Continue Dual-Source Approach For Modified LCS Hull," *Inside the Navy*, December 15, 2014.

Another December 15, 2014, trade press article stated:

Throughout the LCS program, the Navy has asked both firms to compete for the ship contracts, a formula [Navy acquisition chief Sean] Stackley said the Navy plans on keeping for the final 20 ships.

“Absolutely there will be competition. This program has been based on the benefits of competition. That’s how we have been able to bring the price down,” Stackley said, adding the Navy will continue to employ the “duel source” approach.

Stackley said the Navy is still looking at how it will structure a competition, and would not say whether the remaining 20 ships will be evenly split between Lockheed Martin and Austal USA. So far that’s been the case with the LCS program, with each company producing 12 of the 24 ships under contract or already delivered.

“The details in terms of ‘are you going to split it 50/50 etcetera?’—[it’s] too early to make those calls,” he said.

Stackley said the Navy does not plan to compete on a “ship to ship” basis, and wants the savings associated with the multi-year block buy awards currently used on LCS....

Going forward, Stackley said, the Navy will sort through which new capabilities should be competed among industry, which can be leveraged from other programs and transferred to the new small surface combatants, or in other cases will work with the prime contractors to determine solutions.

“It’s going to be a case by case basis,” Stackley said. “So the answer might be for a particular system that we know what capability we want. Rather than go out with a fresh competition we are going to use a system that is already common to other Navy ships. In that case what we are going to do is leverage those other contracts and not go out with a fresh contract.”

“In other cases we might determine ... there are some other alternatives out there that are very attractive, and for other right reasons, we are going to run a competition for this program, for those systems, and that would be a separate, standalone competition,” Stackley added.

In additional instances, Stackley said, the Navy will look to the prime contractors to come up with solutions, such as for an improved degaussing system designed to minimize the hull’s magnetic field and thereby reduce radar detectability.²⁷

A January 21, 2015, press report stated:

Navy Secretary Ray Mabus thinks one of the reasons the ship is misunderstood is the nontraditional LCS designator. He directed an effort to find a more traditional and appropriate designation for the LCS and several other recent ship types, such as the Joint High Speed Vessel (JHSV), the Mobile Landing Platform (MLP) and the Afloat Forward Staging Base (AFSB).

The first of the types to be redesignated is the LCS.

“If it’s like a frigate, why don’t we call it a frigate?” he said Jan. 14 to a roomful of surface warfare sailors at the Surface Navy Association’s annual symposium just outside Washington.

²⁷ Mike McCarthy, “Navy Weighs Acquisition, Competition Strategies For New, Upgraded LCS,” *Defense Daily*, December 15, 2014: 3-5. See also Mike McCarthy, “Calling Them Frigates, Navy Aims For Upgraded Version Of LCSs Sooner,” *Defense Daily*, January 16, 2015: 1-2; Sydney J. Freedberg Jr., “What’s In A Name? Making The LCS ‘Frigate’ Reality,” *Breaking Defense*, January 16, 2015.

“We are going to change the hull designation of the LCS class ships to FF,” Mabus said, citing the traditional hull designation for frigates. “It will still be the same ship, the same program of record, just with an appropriate and traditional name.”...

Redesignating the ships as FF puts the ship squarely back in the surface combatant category, and is appropriate, since the Pentagon direction in developing the modified LCS was to make it more “frigate-like.”

Navy sources said it was intended to designate only the modified LCS as frigates, but many of the upgrades intended for those ships are to be backfitted into earlier LCS hulls, blending the types. Mabus said the designation definitely will apply to the modified ships, and will likely be extended to all LCSs.²⁸

A January 23, 2015, press report stated:

The Navy is working to iron out the details of a plan to backfit upgrades planned for its future fleet of small surface combatants onto earlier Littoral Combat Ships, according to information from top service officials.

The Navy’s overarching plan is to buy 32 LCSs of the current design, and then 20 modified LCSs starting in fiscal year 2019. But the Navy wants to incorporate some, if not all, of the planned improvements onto LCSs built before FY-19.²⁹

FY2016 Funding Request

The Navy’s proposed FY2016 budget requests the procurement of three LCSs. The Navy estimates the combined procurement cost of these three ships at \$1,437.0 million, or an average of \$479.0 million each. The three ships have received a total of \$80 million in prior-year advance procurement (AP) funding, and the Navy’s FY2016 budget requests the remaining \$1,357.0 million that is needed to complete their combined procurement cost.

The Navy’s proposed FY2016 budget also requests \$231.5 million for LCS common mission modules equipment, LCS MCM and SUW mission modules, and the Remote Minehunting System (RMS) used in the LCS MCM module (lines 33, 34, 35, and 36 in the Navy’s Other Procurement, Navy, or OPN, appropriation account).

Issues for Congress

Potential Impact of Continuing Resolution (CR) for FY2016

Overview

One issue for Congress concerns the potential impact on the LCS/Frigate program of an extended continuing resolution (CR) or a full-year CR for FY2016. Extended or full-year CRs can lead to challenges in program execution because they typically prohibit the following:

²⁸ Christopher P. Cavas, “LCS Now Officially Called A Frigate,” *Defense News*, January 21, 2015. See also Sam LaGrone, “SNA: Modified Littoral Combat Ships to be Designated Frigates,” *USNI News*, January 15, 2015; Mike McCarthy, “Calling Them Frigates, Navy Aims For Upgraded Version Of LCSs Sooner,” *Defense Daily*, January 16, 2015: 1-2; Sydney J. Freedberg Jr., “What’s In A Name? Making The LCS ‘Frigate’ Reality,” *Breaking Defense*, January 16, 2015.

²⁹ Lara Seligman, “Navy Working To Iron Out Details Of Plan For Backfitting LCS Upgrades,” *Inside the Navy*, January 23, 2015. See also Sydney J. Freedberg Jr., “What’s In A Name? Making The LCS ‘Frigate’ Reality,” *Breaking Defense*, January 16, 2015.

- new program starts (“new starts”), meaning the initiation of new program efforts that did not exist in the prior year;
- an increase in procurement quantity for a program compared to that program’s procurement quantity in the prior year; and
- the signing of new multiyear procurement (MYP) contracts.³⁰

In addition, the Navy’s shipbuilding account, known formally as the Shipbuilding and Conversion, Navy (SCN) appropriation account, is written in the annual Department of Defense (DOD) appropriation act not just with a total appropriated amount for the entire account (like other DOD acquisition accounts), but also with specific appropriated amounts at the line-item level. As a consequence, under a CR (which is typically based on the prior year’s appropriations act), SCN funding is managed not at the account level (like it is under a CR for other DOD acquisition accounts), but at the line-item level. For the SCN account—uniquely among DOD acquisition accounts—this can lead to line-by-line misalignments (excesses and shortfalls) in funding for SCN-funded programs, compared to the amounts those programs received in the prior year. The shortfalls in particular can lead to program-execution challenges under an extended or full-year CR.

In addition to the above impacts, a CR might also require the agency (in this case, the Navy) to divide a contract action into multiple actions, which can increase the total cost of the effort by reducing economies of scale and increasing administrative costs.

The potential impacts described above can be avoided or mitigated if the CR includes special provisions (called anomalies) for protecting individual programs or groups of programs from adverse effects, or if the CR includes expanded authorities for DOD for reprogramming and transferring funds.

Impact on LCS/Frigate Program

The Navy states that an extended or full-year CR for FY2016 would impact the LCS/Frigate program because of its effect on a line item in the SCN account, called the completion of prior-year programs line item, that provides funding to cover cost growth on ships that were procured and fully funded in prior years, thereby permitting the construction of the ships in question to be completed. The impact of an extended or full-year CR for FY2016 on this line item, the Navy states, will affect several ongoing Navy shipbuilding programs, including the LCS/Frigate program.³¹

Analytical Foundation for Revised Design for Ships 33-52

Overview

One oversight issue for Congress concerns the analytical foundation for the Navy’s proposed design for the final 20 ships in the program (ships 33-52). Programs with weak analytical foundations can, other things held equal, be at increased risk for experiencing program-execution

³⁰ For more on MYP contracts, see CRS Report R41909, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, by Ronald O'Rourke and Moshe Schwartz.

³¹ Source: Navy point paper, entitled “FY 2016 DON Continuing Resolution (CR) Impact,” undated, provided by Navy Office of Legislative Affairs to CRS on September 14, 2015. See also Christopher P. Cavas, “US Navy Considers Impact of a Yearling CR,” *Defense News*, September 5, 2015.

challenges in later years. The original LCS program arguably had a weakness in its analytical foundation due to a formal, rigorous analysis that was not conducted prior to the announcement of the program's establishment on November 1, 2001. This weakness may have led to some of the controversy that the program experienced in subsequent years, which in turn formed the backdrop for Secretary of Defense Hagel's February 24, 2014, announcement of the program's restructuring. The Navy's restructured plan for the final 20 ships in the program may similarly have a weakness in its analytical foundation due to two formal, rigorous analyses that do not appear to have been conducted prior to the announcement of the program's restructuring.

Three Analyses That Can Strengthen an Analytical Foundation

The analytical foundation for an acquisition program can be strengthened by performing three formal, rigorous analyses prior to the start of the program:

- an analysis to identify capability gaps and mission needs;³²
- an analysis to compare potential general approaches for filling those capability gaps or mission needs, so as to identify the best or most promising approach;³³ and
- an analysis to refine the approach selected as the best or most promising.³⁴

Original LCS Program Lacked One of These Analyses Prior to Announcement of Program

As discussed in CRS reports covering the LCS program going back a decade, the Navy, prior to announcing the establishment of the LCS program on November 2001, performed the first and third studies listed above, but it did not perform the second. In other words, the Navy, prior to announcing the establishment of the LCS program on November 1, 2001, did not perform a formal, rigorous analysis to show that a small, fast modular ship was not simply one way, but rather the best or most promising way, to fill the three littoral warfare capability gaps (for countering mines, small boats, and diesel-electric submarines) that the Navy had identified. Instead of performing such an analysis, which at the time might have been called an analysis of multiple concepts, the Navy selected the concept of a small, fast, modular ship based on the judgment of senior Navy leaders.³⁵ In testimony to the House Armed Services Committee in April

³² Such a study might be referred to under the defense acquisition system as a Capabilities-Based Assessment (CBA), as referenced, for example, on page A-1 of Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3170.01H of January 10, 2012, entitled "Joint Capabilities Integration and Development System." Such analysis might lead to a "validated capability requirements document" or "equivalent requirements document" as referenced on page 5 of DOD Instruction (DODI) 5000.02 of January 7, 2015, entitled "Operation of the Defense Acquisition System." An example of such a requirements document is an Initial Capabilities Document (ICD), which is also mentioned on page 5, although that might not be the correct term to use in this instance, which concerns an effort to acquire ships 33-52 of a planned total of 52 ships. For additional background discussion on the defense acquisition system, see CRS Report RL34026, *Defense Acquisitions: How DOD Acquires Weapon Systems and Recent Efforts to Reform the Process*, by Moshe Schwartz.

³³ Such a study, like the third study listed above, might be referred to under the defense acquisition system as an Analysis of Alternatives (AoA). (In earlier years, a study like the second of the three studies listed above might have been referred to as an Analysis of Multiple Concepts, or AMC.) In discussing the AOA for a new acquisition program, it can be helpful to understand whether the AoA was more like the second or third of the studies listed here.

³⁴ Such a study, like the second study listed above, might be referred to under the defense acquisition system as an Analysis of Alternatives (AoA). In discussing the AOA for a new acquisition program, it can be helpful to understand whether the AoA was more like the second or third of the studies listed here.

³⁵ For example, the October 28, 2004, version of a CRS report covering the DD(X) (aka, DDG-100) and LCS programs (continued...)

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."³⁶ This issue may have led to some of the controversy that the program experienced in subsequent years,³⁷ which in turn formed the backdrop for Secretary of Defense Chuck Hagel's February 24, 2014, announcement of the program's restructuring.

Navy's Restructured Plan for Final 20 Ships Appears to Have Been Announced Without Two of These Analyses

The Navy's restructured plan for the final 20 ships in the program may have a weakness in its analytical foundation due to two formal, rigorous analyses that do not appear to have been conducted prior to Secretary of Defense Chuck Hagel's announcement on February 24, 2014, of the effort to restructure the program. Specifically, neither the Office of the Secretary of Defense nor the Navy has presented

(...continued)

stated:

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 noncombat 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.

(CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke.

³⁶ 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*, April 14, 2003.

³⁷ A January 2015 journal article on the lessons of the LCS program stated:

As Ronald O'Rourke of the Congressional Research Service described it early on [at a presentation at the Surface Navy Association annual symposium in January 2003], the LCS had come about through an "analytical virgin birth... that is going to be a problem for this program down the road." This can be argued to be the root cause of the subsequent LCS woes. One hopes that the new surface combatant [i.e., the Navy's design for the final 20 ships in the program] won't suffer the same problem.

(Gregory V. Cox, "Lessons Learned from the LCS," *U.S. Naval Institute Proceedings*, January 2015: 37-38 (ellipse as in original), citing (for the quoted remark) Hunter Keeter, "O'Rourke: Lack Of Pedigree May Haunt LCS Program," *Defense Daily*, January 16, 2003.)

- a formal, rigorous analysis to identify capability gaps and/or mission needs that was done prior to the Secretary of Defense Hagel's February 24, 2014, announcement, or
- a formal, rigorous analysis that identified "a capable and lethal small surface combatant, generally consistent with the capabilities of a frigate" as not simply one way, but rather the best or most promising way, to fill those capability gaps or mission needs that was done prior to the February 24, 2014, announcement.

Given a July 31, 2014, deadline for the Navy to complete its work, the Navy's Small Surface Combatant Task Force (SSCTF) charged with analyzing options for "a capable and lethal small surface combatant, generally consistent with the capabilities of a frigate" apparently did not have enough time to conduct either of the two above analyses. Instead, the task force surveyed Navy fleet commanders to collect their judgments on capability gaps and mission needs, and to get their judgments on what capabilities would be the best to have in "a capable and lethal small surface combatant, generally consistent with the capabilities of a frigate."³⁸

In addition to permitting the task force to complete its work by July 31, 2014, surveying fleet commanders offered the advantage of collecting the "wisdom of the crowd" on the issues of capability gaps/mission needs and what features "a capable and lethal small surface combatant, generally consistent with the capabilities of a frigate" should have. One potential disadvantage of this approach is that it deprived the Navy of a chance to uncover the kind of counter-intuitive results that a formal analysis can uncover. (Indeed, this is a key reason why formal, rigorous analyses are done.) Another potential disadvantage is that fleet commanders can be focused on what they see the Navy needing today, based on current Navy operations, which might not be the same in all respects as what the Navy will need in the future, given the evolving international security environment, potential changes in technology, and resulting potential changes in the nature of warfare and operational concepts. The risk, in other words, is of fielding in 2023 (when the 33rd ship in the program is scheduled to enter service) the best possible improved LCS for the world of 2014.

Using the results it had gathered from surveying fleet commanders, the SSCTF then performed the third of the three above-listed studies—a formal, rigorous analysis to refine the concept for "a capable and lethal small surface combatant, generally consistent with the capabilities of a frigate."

³⁸ A January 8, 2014, press report, for example, states that "The task force canvassed fleet commanders for ways to improve" the baseline LCS design. (Tony Capaccio, "Navy Fixes Won't Much Help Littoral Ship, Tester Says," *Bloomberg News*, January 8, 2015. A January 16, 2015, press report similarly states:

Fleet commanders told Navy officials over the past year that they see anti-submarine warfare, surface warfare and ship self-defense as the most important capabilities for a new small surface combatant, Surface Warfare Director Rear Adm. Peter Fanta said Jan. 13 during the Surface Navy Association's annual symposium. This feedback led the Navy to its decision to move to a modified LCS that will have enhanced weapons, sensors and armor—along with increased weight and a slower top speed.

"What we did first was we went and asked all the warfighters ... what do you want most?" [said] Fanta, who served as one of the co-chairs of the small surface combatant task force that was stood up last year to provide the defense secretary with alternatives for a more lethal and survivable LCS. "They said 'well, we'd like a small surface combatant that does a lot of ASW work, covers our mine mission and still does a lot of surface engagements depending on different parts of the world.'"

(Lara Seligman, "Upgunned LCS Will Trade Speed, Weight For Offensive Capabilities," *Inside the Navy*, January 16, 2015 [with additional reporting by Lee Hudson] Ellipse as in original.)

A question for Congress is whether the analytical foundation for the final 20 ships in the program will provide sufficient stability for acquiring those ships in coming years. Navy officials have stated that, having refined the design concept for the final 20 ships in the program, the Navy will now define and seek approval for the operational requirements for the ship.³⁹ Skeptics might argue that definition and approval of operational requirements should come first, and conceptual design should follow, not the other way around. One possible alternative to the Navy's approach would be to put the announced design concept for the final 20 ships on hold, and perform both a formal, rigorous analysis of capability gaps/mission needs and a formal, rigorous analysis of general approaches for meeting those identified capability gaps/mission needs, and be prepared to follow the results of those analyses, whether they lead back to the announced design concept for the final 20 ships, or to some other solution (which might still be a design of some kind for a modified LCS).

At a March 18, 2015, hearing on Navy shipbuilding programs before the Seapower subcommittee of the Senate Armed Services Committee, the following exchange occurred:

SENATOR MAZIE K. HIRONO, RANKING MEMBER (continuing):

For Secretary Stackley, the Navy—responding to direction from former Secretary Hagel analyzed numerous upgrades to the current LCS designs. And I know you mentioned that this program is undergoing a number of—a number of challenges including large cost overruns in the beginning and design changes that led to instability.

So, you know, Secretary Hagel identified some upgrades to the ship that the Navy hopes to include in the 33rd ship and later. And we need to understand the reasons behind this change.

So either for Secretary Stackley or Admiral Mulloy, perhaps Admiral Mulloy, do you have an approved requirement for the modified LCS vessel, JROC [Joint Requirements Oversight Council] approved?

SEAN J. STACKLEY, ASSISTANT SECRETARY OF THE NAVY FOR RESEARCH, DEVELOPMENT, AND ACQUISITION:

Let me start. JROC approved for the modified vessel, no, ma'am. What we are doing right now is we're going through what's referred to, inside of the service, our equivalent of the JROC inside of the service, our requirements definition process.

That's ongoing today. We've got a target to get down to JROC in the June timeframe, recognizing that this is a[n] [FY]2019 ship that we're proposing to modify. What we want to do though is get—moving on the design activities to support that time—that timeline.

The Secretary of Defense, he gave us the tasking in discussions with him. A lot of the tasking was not dealing with a new threat, taking a look at 306 ship Navy, 52 LCSs, about one in six having what's referred to as a focused- mission capability. In other words

³⁹ A January 11, 2014, press report, for example, quotes Sean Stackley, the Assistant Secretary of the Navy for Research, Development, and Acquisition (i.e., the Navy's acquisition executive) as stating "We've gone from 'here's the concept,' now we have to go through the formal requirements review board... to define requirements in terms of updating the capabilities document." (As quoted in Christopher Cavas, "Small Combatant Effort Cranks Up," *Defense News*, January 11, 2015. [Ellipse as in original.]) A January 16, 2015, press report similarly states: "The Navy needs to take all the task force's concepts for capabilities and translate them into specific, formal requirements, Stackley explained. Those requirements then need approval by a Resources and Requirements Review Board (R3B)." (Sydney J. Freedberg Jr., "What's In A name? Making The LCS 'Frigate' Reality," *Breaking Defense*, January 16, 2015.) A January 26, 2015, press report similarly states that "the Navy needs to firm up the concept for the new ship's capabilities and translate them into formal requirements, Stackley explained. Those requirements then need to each be approved by a Resources and Requirements Review Board, which is set to occur in the spring." (Lara Seligman, "Navy Working To Iron Out Details Of Plan For Backfitting LCS Upgrade," *Inside the Navy*, January 26, 2015.)

it could be doing ASW or it could be doing anti-surface [warfare], or it could be doing mine countermeasures. But it's not doing all of them at one time and his concern that the concept of employment of operations for the LCS either involve Phase zero [i.e., pre-conflict] or early phase [in a conflict] activities or were in the context of a battle group providing a degree of protection for the LCS.

He believed that one in six of our fleet was too large of a number with that concept of employment. And so, that's how he arrived at—capped that [i.e., procurement of baseline LCSs] at 32 [ships]. He wants to see something that had what he referred to as greater lethality and survivability to enable more independent operations, more operations in support of battle groups and support of—defending the high value units and give it the ability to provide presence without—outside of the balance of—

HIRONO:

So, Mr. Secretary, I am running out of time, so, just to get a better understanding of what's going on with that LCS program though.

I realize that Secretary Hagel wanted to focus on survivability. And is this survivability requirements for the 33rd ship forward basically very much different from that, that was in the basic LCS.

STACKLEY:

We did not change the requirements associated with the survivability for the modified LCS.

HIRONO:

So, Mr. Chairman, where did he [i.e., the Chairman] go? I guess I can carry on then.

My understanding is that before you really get into the specifics of the design of the ship that you should get the approved requirements. That when you don't have the JROC approval or certification or whatever the technical term is, that, you know, you should put the—you shouldn't put the cart before the horse.

So that is why I asked the question as to whether or not there is an approved requirement for the modified LCS vessel before going forward with any further design aspects.

STACKLEY:

We do not have a—as I described we do not have a JROC requirements documents in advance of today, however, we will have that in advance of doing the design for the modification of the LCS.

HIRONO:

So, when would that timeframe be?

STACKLEY:

We're targeting?

HIRONO:

With getting the JROC?

STACKLEY:

We're targeting the June timeframe for the JROC. And eventually today inside of the Department of the Navy we'll work in the requirements document to support that timeframe.⁴⁰

An April 13, 2015, press report states:

The Program Executive Office for Littoral Combat Ships (PEO LCS) is working with both its shipbuilders to determine how to bring the current LCS designs into a more lethal and survivable frigate design, while it works with other Navy offices to finalize the frigate requirements....

The program office is also working with the Navy's Surface Warfare Directorate, Naval Surface Warfare Center Dahlgren, Program Executive Office for Integrated Warfare Systems and more to refine the frigate requirements and clearly document them....

[PEO LCS Rear Admiral Brian] Antonio said the requirements will be finalized "this year, as soon as we can."

Surface warfare director Rear Adm. Peter Fanta will lead a series of requirements resource review boards for the frigate, the first of which will look at the combat management system and upgraded over-the-horizon radar, Antonio said.

"We'll get into what the requirements are for those, and then that will sort of free us up [for] getting into the design work," he said, adding that would happen "in a matter of weeks as opposed to months."⁴¹

An April 15, 2015, press report states:

The Navy's new frigate will go through the requirements-generation and testing processes as a flight upgrade rather than a new-start program, helping save time and money and allowing the program office to focus on what will be different from the Littoral Combat Ship (LCS) to the frigate upgrade, frigate program manager Capt. Dan Brintzinghoffer said on Wednesday [April 15].

The frigate is working its way through the Joint Requirements Oversight Council (JROC) process now to support the first two ships being bought in Fiscal Year 2019, Brintzinghoffer said at the Navy League's Sea-Air-Space 2015 Exposition. A request for proposals with a detailed technical package would go out in FY 2017 to allow tie for industry to ask questions and prepare their bids, which means the Navy has about 18 months to finalize its designs—which will include common combat systems, over-the-horizon radars and over-the-horizon missiles.

Brintzinghoffer noted that he didn't need to decide now which of each system he would use, but rather develop a roadmap for how to ensure a common system could be chosen and engineered into the ship designs. Currently, the Lockheed Martin Freedom variant and the Austal USA Independence variant have different combat systems. Brintzinghoffer said that for the sake of lifecycle costs and fleet flexibility, the frigates would have at the very least common combat system software, if not common consoles.⁴²

⁴⁰ Transcript of hearing.

⁴¹ Megan Eckstein, "Navy Frigate Requirements Will Be Finalized Soon, Will Inform Decision on Hull Downselect," *USNI News*, April 13, 2015.

⁴² Megan Eckstein, "Frigate Will Leverage Littoral Combat Ship Testing, Focus on New Combat Systems," *USNI News*, April 15, 2015.

Survivability of Revised Design for Ships 33-52

Another oversight issue for Congress concerns the survivability of the Navy's proposed design for the final 20 ships in the program (ships 33-52). A January 2015 report from DOD's Director, Operational Test and Evaluation (DOT&E)—DOT&E's annual report for FY2014—states:

SSC Study

- In February 2014, the Secretary of Defense directed the Secretary of the Navy and the Chief of Naval Operations to “Submit to me, in time to inform the PB 2016 budget deliberations, alternative proposals to procure a capable and lethal small surface combatant, generally consistent with the capabilities of a frigate.” In October 2014, the Secretary of Defense requested DOT&E provide an independent assessment of the work done by the SSC Task Force established by the Navy pursuant to the Secretary's direction. In response, DOT&E provided a written classified assessment report to the Secretary.

- In its report, DOT&E concluded that the Navy's SSC Task Force's results indicate, of the alternatives it considered, the multi-mission combat capabilities and survivability design features of a modern frigate could be provided only by a new ship design or a major modification to the LCS design—the so-called large plug insertion developed by the Task Force. While offering some improvements in combat capability and survivability (primarily via reduced susceptibility) relative to LCS, the minor modifications to LCS considered by the Task Force and recommended by the Navy Leadership do not satisfy significant elements of a capability concept developed by the Task Force for a modern frigate. (The Task Force developed a number of capability concepts incorporating various mixes of capabilities consistent with a frigate. After consulting with the Task Force's lead, DOT&E's assessment used one particular concept as representative of a modern frigate's capabilities. Also, “major modification to LCS” and “minor modification to LCS” are the characterizations used by the Task Force of its alternatives.) Notwithstanding potential reductions to its susceptibility relative to LCS, DOT&E's assessment is that minor modifications to LCS will not yield a ship that is significantly more survivable than LCS.

- DOT&E also noted in its report provided to the Secretary that DOT&E's assessment was based on results that might subsequently change, because the Task Force's report remained unfinished at the time of DOT&E's report.⁴³

A July 6, 2015, press report states that

... the Pentagon's top weapons tester is warning lawmakers the Navy's new and improved Littoral Combat Ship does not meet the standards of a modern, multimission frigate.

Director of Operational Test and Evaluation J. Michael Gilmore laid out his criticisms of the Navy's plans for an enhanced LCS, recently re-designated a frigate, in a detailed report to Congress received May 15. The upgrades will not significantly improve the new ship's overall survivability relative to LCS, Gilmore concludes, further noting limitations in the vessel's planned air warfare, surface warfare and anti-submarine warfare capabilities compared to the [Navy's] legacy [frigates].⁴⁴

⁴³ Department of Defense, Director, Operational Test & Evaluation, *FY 2014 Annual Report*, January 2015, p. 203.

⁴⁴ Lara Seligman, “DOT&E Tells Hill Upgraded LCS Won't Meet Standards For Modern Frigate,” *Inside the Navy*, July 6, 2015.

Acquisition Strategy for Ships 25-32

Another oversight issue for Congress concerns the acquisition strategy for ships 25-32 in the program, which are to be procured in FY2016-FY2018. At a February 25, 2015, hearing on Department of the Navy acquisition programs before the Seapower and Projection Forces subcommittee of the House Armed Services Committee, Department of the Navy officials testified that the Navy plans to extend the current block buy contracts to include the 25th and 26th ships in the program (i.e., the second and third of the three ships requested for procurement in FY2016), and “use the competitive pricing from the block buy [contracts] to obtain option prices” for those two ships.⁴⁵ The Navy has not yet announced an acquisition strategy for ships 27-32 (i.e., the six ships scheduled for procurement in FY2017 and FY2018).

At a March 4, 2015, hearing before the Defense subcommittee of the Senate Appropriations Committee on the Department of the Navy’s proposed FY2016 budget, the following exchange occurred:

SENATOR RICHARD SHELBY:

Secretary Mabus, it's my hope that the Navy will continue to equitably—whatever that means—for sometimes distribute work between the two LCS shipyards. Could you describe to the Committee the Navy's acquisition strategies through 2019 for the remaining LCS ships number 25 and 32?

SECRETARY OF THE NAVY RAY MABUS:

Yes, Senator. We have found that having two shipyards and having two variants of the littoral combat ship has been very helpful in a number of ways. One, it keeps competition in the program and it has driven cost down considerably.

Two is it gives us different capabilities. Each ship brings some unique capabilities and capacities that the one doesn't.

And third, we are able to train our Sailors pretty much on common systems for these two ships without duplicating effort. So, for the ships through 2019, we plan to continue the 50/50 split between the two yards.

And the Small Surface Combatant Task Force, which we chartered and which came through, and which recommended some upgrades in lethality and survivability for ships past 2019 for ships through [number] '52, we are hopeful that we can move that up some that we won't wait until 2019 because it's a modification, not a new built. And it is our plan to keep procuring both variants again competitively, but variants through the entire '52 bus (ph).

SHELBY:

This is a top priority for the Navy, is it not?

MABUS:

It's a very high priority.⁴⁶

⁴⁵ Statement of the Honorable Sean J. Stackley, Assistant Secretary of the Navy (Research, Development and Acquisition) and Vice Admiral Joseph P. Mulloy, Deputy Chief of Naval Operations for Integration of Capabilities and Resources and Lieutenant General Kenneth J. Glueck, Jr., Deputy Commandant, Combat Development and Integration & Commanding General, Marine Corps Combat Development Command, Before the Subcommittee on Seapower and Projection Forces of the House Armed Services Committee on Department of the Navy Seapower and Projection Forces Capabilities, February 25, 2015, p. 11.

⁴⁶ Transcript of hearing.

An April 20, 2015, press report states:

In December, then-Defense Secretary Chuck Hagel directed the Navy to provide by May an acquisition strategy to support design and procurement of the modified LCS, since re-designated a frigate....

However, the “framework” service officials previewed last week appears to lack many of the details of a full-up acquisition roadmap, instead laying out a skeleton path ahead for the program. The document will not include a decision on multiyear or block buys, a potential downselect, or a plan to backfit the planned upgrades to existing ships, service officials told *Inside the Navy*.⁴⁷

An August 31, 2015, press report states:

The Navy will award Lockheed Martin a deal to be the sole provider of the future frigate's common combat system, the service announced in early August.

The planned contract will cover fiscal year 2016 through FY-21 requirements for what the Navy terms a “Common Combat Management System Component Based Total Ship System-21st Century” for the frigate, according to an Aug. 7 notice posted to the Federal Business Opportunities website.⁴⁸

Technical Risk and Issues Relating to Program Execution

Another oversight issue for Congress concerns the amount of technical risk in the LCS program and issues relating to program execution. The discussion below addresses this issue first with respect to the LCS sea frame, and then with respect to LCS mission packages.

Sea Frame

March 2015 GAO Report

A March 2015 GAO report assessing DOD weapon acquisition programs stated:

Technology Maturity

Sixteen of the 18 critical technologies for both LCS designs are mature and have been demonstrated in a realistic environment. However, the Navy indicated that the remaining two are also mature because the overhead launch and retrieval system was demonstrated through last year's deployment of LCS 1, and LCS 2's aluminum structure was demonstrated based on its performance in trials and maritime exercises. Yet the Navy stated that the maturity of these technologies has not been formally validated—and no date has been set to do so. Unknowns also remain regarding LCS 2's hull structure, and test events are scheduled through 2016.

Design and Production Maturity

To date, the Navy has accepted delivery of four seaframes; LCS 5 through LCS 16 are in various stages of construction and LCS 17 through 24 are under contract. The next contract award is planned for 2016. The Navy continues to incorporate changes into follow-on ship designs, including an updated radar starting on LCS 17, and Freedom class gunfire control system improvements. LCS 1 and 2 do not meet certain performance

⁴⁷ Lara Seligman, “Frigate Acquisition ‘Framework’ Will Fall Short Of Mandate From OSD,” *Inside the Navy*, April 20, 2015.

⁴⁸ Justin Doubleday, “Navy Plans To Award Lockheed Contract For Future Frigate’s Combat System,” *Inside the Navy*, August 31, 2015.

requirements and face capability limitations due to weight growth during construction. As a result, these ships lack the required amount of service life allowance—the margin to accommodate future changes—without removing weight over the ship's lifetime.

The Navy declared initial operational capability for the Freedom variant when LCS 1 deployed to Singapore in March 2013. DOD's test authority reported in December 2013 on the results of this early fielding with the surface warfare mission package. It noted a number of issues with the seaframe and its planned capabilities, including survivability. The Freedom variant began formal operational testing in fiscal year 2014 and completed total ship survivability trials in October 2014, but the results are not yet available.

DOD and Navy test officials have not yet assessed the survivability or cyber defense capabilities of the Independence variant. The Navy continues to develop and test the LCS 2 combat system, and the software and system integration necessary to achieve baseline capabilities will not be complete until September 2015. LCS 2 completed rough water trials in January 2014, the results of which are pending completion of a final test report. The Navy discovered cracks in the mission bay following this testing and imposed a weight limit on the LCS 2 and LCS 4 launch and recovery systems. In lieu of completing final contract trials on the Independence variant, the Navy's Board of Inspection and Survey conducted a one-day special trial in August 2014, and the Navy does not plan to complete the acceptance trial for LCS 2. According to the Navy, the initial operational capability of LCS 2 has been delayed until September 2015 as a result of funding restrictions for one type of mission package.

Other Program Issues

In February 2014, the Secretary of Defense directed the Navy to contract for no more than 32 ships, citing concerns about the ships' survivability and lethality. The Secretary also directed the Navy to create a task force to evaluate a range of cost and capability options for a future small surface combatant, including an improved LCS. The Navy recommended a modified LCS to satisfy DOD's small surface combatant requirement and plans to buy 20 additional LCS hulls, which will be reclassified as frigates, starting in fiscal year 2019.

Program Office Comments

In commenting on a draft of this assessment, the program office noted that it continues to test the long-term behavior of the LCS 2's aluminum hull. The program office is modifying LCS 1 and 2 designs to ensure they meet service life allowance requirements. The LCS 2 Combat System is functional and is supporting developmental testing onboard LCS 2. Both variants of LCS achieved operational and developmental testing milestones. In 2015, LCS will achieve Initial Operational Capability for the LCS 2 variant. The intent of the LCS 2 Special Trial was to identify deficiencies, test the ship, and deliver a report card to US Fleet Forces Command. The scope included standard underway demonstrations. The program office indicated that, with over four years of robust developmental testing the performance of the ship, and its systems are well understood. The program office also provided technical comments, which were incorporated where deemed appropriate.⁴⁹

January 2015 DOT&E Report

Regarding technical risk in the LCS sea frame, a January 2015 report from DOD's Director, Operational Test and Evaluation (DOT&E)—DOT&E's annual report for FY2014—states:

⁴⁹ Government Accountability Office, *Defense Acquisitions[:] Assessments of Selected Weapon Programs*, GAO-15-342SP, March 2015, p. 108.

Seaframes

- While both seaframe variants are fast and highly maneuverable, they are lightly armed and possess no significant offensive capability without the planned Increment 4 SUW Mission Package or the Increment 2 ASW Mission Package.

—In comparison to other Navy ships, the LCS seaframes have relatively modest air defense capabilities; however, their air defense capabilities cannot be characterized fully until tests on LCS 5 and LCS 6 (the production-representative seaframes) and the Navy's unmanned Self-Defense Test Ship provide data for the Navy Probability of Raid Annihilation high-fidelity modeling and simulation analyses in FY18. The Navy plans to test the Independence class variant's capability to defeat unmanned aerial vehicles and slow-flying aircraft in FY15.

—The Freedom class seaframe's surface self-defense capability was operationally tested in FY14 (see below) and the Independence class seaframe's capability is scheduled to be tested in FY15 aboard USS Coronado (LCS 4).

—The seaframes include no systems designed to detect torpedo attacks or mines without the appropriately configured mission packages installed.

- Crew size can limit the mission capabilities, combat endurance, and recoverability of the ships. The Navy continues to review manning to determine appropriate levels, and is adding 20 berths to all seaframes. The increased berthing supports small increases in the size of the core crew, mission package detachments, and the aviation detachment.

- *Freedom Class Variant (LCS 1 and 3):*

—Although not all aspects of operational effectiveness and operational suitability could be examined during the 2014 operational testing, that testing identified shortcomings in air defense, reliability, and endurance, and significant vulnerabilities in cybersecurity.

—Cybersecurity testing conducted during operational testing aboard LCS 3 uncovered significant vulnerabilities in the ship's capability to protect the security of information and prevent malicious intrusion. Limited cybersecurity testing conducted during a 2012 Quick Reaction Assessment aboard LCS 1 also found vulnerabilities.

—Tracking events conducted during operational testing aboard LCS 3 demonstrated that in some scenarios the SPS-75 (TRS-3D) air search radar is unable to detect and track some types of air threats in operationally realistic environments. Tracking performance improved significantly when the LCS received tracking information via datalink from a nearby Aegis destroyer. The lack of an integrated electronic support measures system limits the ship's capability to make best use of its inventory of RAM surface-to-air missiles.

—Critical equipment required to support ship operations, core mission functions, and mission package operations is unreliable. The ship's crew does not have adequate training and technical documentation to troubleshoot equipment failures; the Navy lacks repair parts for some critical systems; and the Navy's plan for distribution of the maintenance workload among the ship's crew, shore-based Navy support organizations, and technical experts from other organizations is immature. The operational availability of shipboard systems in 10 of 12 categories examined met or exceeded Navy requirements, however, failures of critical propulsion and maneuvering and Total Ship Computing Environment systems forced the ship to return to port for repairs that, respectively, caused 42 and 36 days of downtime during the period of data collection during operational testing. Excluding scheduled maintenance periods, LCS 3 was fully mission capable less than 25 percent of the time during that period.

—During operational testing, LCS 3 did not demonstrate that it could achieve the Navy requirement for fuel endurance (operating range) at the prescribed transit speed or at

sprint speed. Information provided by the Navy indicated that between 91 and 92 percent of the ship's total diesel fuel (F-76) tank capacity would actually be available for use since some room must be left for expansion when the tanks are filled, a portion of the tanks' volume is filled with piping and structural members, and a small amount of fuel remains inaccessible when the tanks are emptied. Based on fuel consumption data collected during the test, the ship's operating range at 14.4 knots is estimated to be approximately 1,961 nautical miles (Navy requirement: 3,500 nautical miles at 14 knots) and the operating range at 43.6 knots is approximately 855 nautical miles (Navy requirement: 1,000 nautical miles at 40 knots). In an emergency, the ship could use its aviation fuel (F-44) to extend the transit and sprint ranges by 360 and 157 nautical miles, respectively. The shortfall in endurance may limit the flexibility of the ship's operations in the Pacific and place a heavier than anticipated demand on fleet logistics.

—Operational testing confirmed earlier observations that, except for the ships' lack of endurance, the Freedom class variant is well-suited for Maritime Security Operations. LCS 3 readily demonstrated the capability to position, launch, and recover the 11-meter boats included in the SUW Mission Package when the launch, recovery, and handling system is operational.

—The ship's Mk 110 57 mm gun system performed reliably during operational testing, and the ship was able to demonstrate the core capability for self-defense against a small boat in two valid trials. The Navy attempted to collect additional data from swarm presentations, but the data were invalid. The 57 mm gun failed to achieve a mission kill during one swarm presentation, and the target killed by the 57 mm gun during a second swarm presentation had previously been engaged by 30 mm guns.

—The Freedom class LCS has sufficient aviation facilities and meets Navy requirements to safely launch, recover, and handle all appropriate aircraft while operating in Sea State 4 conditions. However, the ship frequently experienced difficulty with establishing and maintaining a Tactical Common Data Link with the aircraft during the FY14 operational test. The crew's efforts were hampered by an antenna failure and the total lack of technical documentation on the operation and maintenance of the datalink.

—The LCS 3 anchoring system could not securely anchor the ship in an area with a bottom composed of sand and shells. Despite repeated efforts, the ship was unable to set the anchor. It appears that the anchor and chain are too light and there are too many friction points along the anchor chain's internal path from the chain locker to the hawse pipe to allow the anchor and chain to pay out smoothly.

—The fenders designed to guide the 11-meter Rigid Hull Inflatable Boats included in the SUW Mission Package during launch and recovery are fragile and occasionally sheared off when impacted by the boats during operational testing. Although the fenders have undergone several redesigns, they are not yet strong enough to sustain such impacts.

• *Independence Class Variant (LCS 2):*

—DOT&E still has no data to assess the core mission capabilities of the Independence class variant seaframe.

—The USS Independence (LCS 2) crew encountered multiple problems with the twin-boom extensible crane (TBEC) and other mission package support systems during initial developmental testing of the MCM Mission Package. Since then, the vendor has improved the TBEC, and the Navy has made changes to the RMMV launch and recovery hardware. Developmental testing in August 2013, May 2014, and October 2014 demonstrated that the ship's capability to launch and recover the RMMV has improved because of crew training, but it is not yet clear that launch and recovery can be completed routinely without problems.

—In the past, availability of the USS Independence (LCS 2) to support testing has been degraded by equipment failures, including problems with operator consoles, power generation equipment, components of the ship's computing and networking equipment, propulsion drive train components, and communications systems. DOT&E is unable to evaluate the success of Navy efforts to improve the reliability of these systems. In September and October 2014, the start of developmental testing of the MCM Mission Package was delayed by LCS air conditioning and propulsion system failures. During at-sea testing, observers noted that LCS sometimes experienced difficulties when communicating with a simulated Mine Warfare Commander operating from a shore-based command center....

LFT&E [Live Fire Test & Evaluation]

- LCS is not expected to be survivable in high-intensity combat because the design requirements accept the risk the ship must be abandoned under circumstances that would not require such an action on other surface combatants. Although the ship incorporates capabilities to reduce susceptibility to attack, previous testing of analogous capabilities demonstrates it cannot be assumed LCS will not be hit in high-intensity combat.
- During the TSST on LCS 3, the Machinery Plant Control and Monitoring System (MPCMS) appeared to be improperly controlling the ventilation system for the highest of three material conditions of damage control readiness known as "Condition ZEBRA." This could allow smoke to spread through fire boundaries. Pressure differentials were observed in several spaces that made hatches and doors difficult to operate.
- There is a problem with the MPCMS that caused every fire alarm on the ship to activate during shot 1 of the TSST on LCS 3, even though the fire was limited to the 01 Level. Based on discussions with system experts, this is a known problem with the MPCMS.⁵⁰

A July 6, 2015, press report states that

Recent tests on Lockheed Martin's [baseline-design] Freedom-class Littoral Combat Ship showed significant vulnerabilities in the ship's design....

An at-sea test of the Fort Worth's (LCS-3) survivability... "highlighted the existence of significant vulnerabilities in the Freedom-class design," Director of Operational Test and Evaluation J. Michael Gilmore wrote in a report to Congress received May 15....

During the October 2014 test, much of the ship's mission capability was lost after the hit.... The initial impact and ensuing fire damaged the ship before the crew could respond, and the vessel's inherent design does not have sufficient redundancy to recover the lost capability, the document states.⁵¹

Mission Packages

July and August 2015 Press Reports About Mine Countermeasures (MCM) Module

A July 30, 2015, press report states:

⁵⁰ Department of Defense, Director, Operational Test & Evaluation, *FY 2014 Annual Report*, January 2015, pp. 199-200, 203.

⁵¹ Lara Seligman, "Gilmore: Survivability Test Showed Vulnerabilities Of LCS Freedom Variant," *Inside the Navy*, July 6, 2015. See also Anthony Capaccio, "U.S. Navy Littoral Ship Found Vulnerable to Attack," *Bloomberg News*, June 24, 2015.

The Littoral Combat Ship's mine countermeasures (MCM) mission package will not reach initial operating capability (IOC) by the end of September as planned, after reliability issues forced the program to stretch out the test period and delay Pentagon-level initial operational test and evaluation (IOT&E).

USS Independence (LCS-2) has been off the coast of Florida conducting a technical evaluation since April, and that test event was supposed to have wrapped up by early June to allow for IOT&E this month and a final IOC declaration by the end of the fiscal year, Sept. 30.

But LCS Mission Modules Program Manager Capt. Casey Moton said Thursday [July 30] at a Mine Warfare Association lunch that across-the-board reliability problems in the two start-to-finish mine clearance runs in the technical evaluation led the program to extend the evaluation for several months rather than move prematurely to IOT&E.

An August 2, 2015, press report states:

The complicated job of testing and evaluating the major warfare modules for the Littoral Combat Ship (LCS) program is making strides, said a key US Navy officer, but reliability and weight issues still need to be solved, particularly with the anti-submarine warfare (ASW) and mine countermeasures (MCM) warfare packages.

Key problems with the MCM module revolve around reliability issues, while the ASW package is overweight, Capt. Casey Moton, program executive officer for LCS mission modules, said July 30 at a Mine Warfare Association luncheon near the Pentagon.

The MCM module began tests in April aboard the LCS Independence in the Gulf of Mexico, Moton said, and was scheduled to wrap up in September. But more time is needed to work out the bugs.

"We've been pleased with the performance of individual systems—they are finding mines," Moton told the audience. "We're happy with the crews' performance, and the shore support structure is going well."

Yet, he noted, "we've experienced ship and mission system failure that has hurt reliability."

Among the issues, Moton said, were problems with various ship systems, the Remote Minehunting Vehicle, launch and recovery of the RMV, and integration systems.

Some of the problems, he added, were "wear and tear." Some of the RMVs being used for the tests, he noted, have been in service for up to a decade.

Other issues are in getting procedures right. "The crews can make mistakes, and we need some refinement," he observed....

As a result, he said, tech[nical] eval[uation] will need to continue at "least a couple months. I'm still confident we'll get there. We just need to do more."

Moton couldn't yet say how much more testing will be needed.

"Frankly, we need to go talk with Congress some more about things we've seen. I don't mean money," Moton said to reporters after the luncheon address. "The schedule is being looked at in the Pentagon right now. It's not going to be another year of testing, but it's not going to be another two or three weeks. It's going to be X number of months."

An August 30, 2015, press report on the Remote Minehunting System (RMS) that forms part of the LCS's MCM module states:

Despite years of development, constant effort and numerous official pronouncements of progress, the minehunting system at the heart of a new family of US Navy mine countermeasures gear shows no signs of improvement and poses a significant risk to the

planned deployment of the system aboard littoral combat ships (LCS), according to the Pentagon's top test and evaluation officer.

"Recent developmental testing provides no statistical evidence that the system is demonstrating improved reliability, and instead indicates that reliability plateaued nearly a decade ago," Michael Gilmore, director of the Office of Test and Evaluation (DOT&E), wrote in an Aug. 3 memo to Pentagon acquisition chief Frank Kendall....

"The reliability of existing systems is so poor that it poses a significant risk to both the upcoming operational test of the LCS Independence-variant equipped with the first increment of the Mine Countermeasures (MCM) mission package, and to the Navy's plan to field and sustain a viable LCS-based minehunting and mine clearance capability prior to fiscal year 2020," Gilmore wrote....

The problem-plagued program has routinely failed or delayed test and evaluation programs and encountered a Nunn-McCurdy breach in 2010. Gilmore noted that reliability has improved since then, but continues to fall far short of the threshold of 75 hours' mean time between operational mission failure (MTBOMF).

But despite all the efforts to improve reliability, Gilmore assessed the RMS system's current overall reliability at 18.8 hours between failure, and the RMMV vehicle at 25.0 hours. He took consistent issue with Navy reliability data, pointing out that in some instances, "the Navy inflated operating time estimates for the MTBOMF calculations by assuming that post-mission analysis time (when the vehicle is not in the water and not operating) could be counted."

Gilmore detailed 41 RMS and RMMV failures from technical evaluation tests that began in September aboard the LCS Independence, mostly while operating in the Gulf of Mexico....

A sampling of failures from the 2015 tests includes faulty depth sensors; throttle failures; alignment issues; inertial navigation unit failures; problems with recovery equipment; bad operator consoles; numerous computer and software connectivity problems; variable depth sonar failures; power failures; offboard communications failures; problems with maintaining line-of-sight communications between the ship and the vehicle; and repeated problems with the vehicle's emergency recovery system, designed to float the craft to the surface should it begin to sink.

In many cases and for a variety of reasons, the LCS was unable to recover the RMMV and it was towed back to base by support craft—an option, Gilmore pointed out, unlikely to be available to an operational LCS using the system in a real minefield. On several occasions, the ship requested support personnel to come aboard to fix an RMS problem....

"I continue to recommend strongly that the Navy's estimates of RMMV/RMS reliability not be reported to the Congress or used for any other purpose," Gilmore wrote. "To do otherwise could lead many observers to incorrectly conclude that all significant RMS development and fielding challenges have been conquered."...

"In order to ensure better results for upcoming test runs, the Navy is implementing a more robust ready-for-use inspection, procuring additional spares, and providing additional training, additional technicians, better tools, and updated procedures," Chris Johnson, a spokesman for the Naval Sea Systems Command, said Aug. 28.

"While all four RMMVs being utilized in the ongoing TECHEVAL have received a number of upgrades approved through rigorous Reliability Growth Program analysis, there are a number of further upgrades we have identified that could not be installed, such as improved hydraulic actuators, fuel systems, and sensors," the Navy added.

"These upgrades will be incorporated as part of a more thorough design update that will accompany vehicles in the next low-rate initial production procurement. We will also

continually look for the means of inserting these and any other reliability upgrades into the existing systems.”

Because of ongoing reliability issues, the LCS mission module office recently requested permission from Congress to continue tests into the next fiscal year, which begins Oct. 1. Over the next few weeks, the Navy will evaluate the system and, in October or November, is to decide whether or not to proceed to the initial operational test and evaluation phase.⁵²

March 2015 GAO Report

The March 2015 GAO report assessing DOD weapon acquisition programs stated:

Mine Countermeasures (MCM)

The Navy has accepted five MCM packages without demonstrating that they meet interim—or threshold—requirements and plans to accept one more in fiscal 2015. The package will field in four increments: the first is designed to remove sailors from the minefield and improve mine detection, classification, and neutralization over legacy vessels. Operational testing for the first increment is scheduled to begin in fiscal 2015 on both variants. Future increments, needed to meet threshold requirements, are intended to provide additional capability to detect mines as well as different means of neutralizing them.

Surface Warfare (SUW)

The Navy has accepted five SUW packages and plans to accept two more in fiscal year 2015. Each package currently consists of two 30 millimeter guns, an armed helicopter, and two rigid hull inflatable boats. In August 2014, the Navy found that the current package met its interim performance requirements on the Freedom variant (LCS 1) and declared initial operational capability in November 2014. Operational testing of the current package with the Independence variant (LCS 2) is planned for 2015. To meet threshold requirements for SUW the Navy needs a surface-to-surface missile and plans to use the Army's Longbow Hellfire missile for this capability, as it canceled previous efforts with the Griffin missile. According to program officials, initial demonstrations with Longbow Hellfire have been successful, and the Navy is currently integrating this missile with both variants of the LCS. Operational testing is planned for fiscal 2016, with initial capability planned for fiscal 2017.

Antisubmarine Warfare (ASW)

According to the Navy, the systems that comprise the ASW mission package are mature as they have been fielded by United States and foreign navies. In September 2014, the

⁵² Christopher P. Cavas, “Official: Minehunting System Shows No Improvement,” *Defense News*, August 30, 2015. See also “Indefensible: \$706 Million And 16 Years Developing A Navy Minehunting System That Doesn’t Really Work,” undated but released September 3, 2015; accessed September 22, 2015, at http://www.mccain.senate.gov/public/_cache/files/1807ea90-50bf-4816-91fe-67b3b74701cb/americas-most-wasted-presents-indefensible—remote-minehunting-system-9-3-15.pdf.) For an alternative URL that shows the release date of September 3, 2015, see <http://www.defense-aerospace.com/cgi-bin/client/modele.pl?shop=dae&modele=release&prod=166690&cat=3>.) For additional press reports, see Tony Capaccio, “Navy Littoral Ship Minehunting Gear Flawed, McCain, Reed Say,” *Bloomberg Government (bgov.com)*, September 1, 2015; Sam LaGrone, “McCain, Reed Chide Navy Over Problems with LCS Mine Countermeasure Package, Recommend Review of Other Technologies,” *USNI News*, September 2, 2015; Christopher P. Cavas, “Lawmakers Offer A Way Out of US Navy Minehunting Mess,” *Defense News*, September 2, 2015; Thomas Gibbons-Neff, “Pentagon’s Mine Hunting System That’s 16 Years in The Making Still Doesn’t Work,” *Washington Post*, September 4, 2015; Philip Ewing, “Navy Defends Minehunting System Amid Criticism,” *Politico*, September 4, 2015; Lance M. Bacon, “McCain Slams Remote Minehunting System As A Failure,” *Navy Times*, September 14, 2015.

Navy completed development testing aboard the Freedom variant. Program officials report that currently the mission package is 5 tons too heavy to fit within the parameters reserved for the packages. According to program officials, the Navy is soliciting industry for suggestions to reduce the package's weight by at least 15 percent. The Navy is planning to meet the threshold requirement for ASW in 2016.

Other Program Issues

The Navy continues to procure LCS seaframes, even though the sub-systems necessary to meet full mission package requirements have not yet been fully developed, demonstrated, and integrated with either seaframe class. Integrating these systems on the LCS seaframe is challenging because of limitations on space and weight inherent in the seaframe designs. The Navy will not achieve the capability to meet full requirements for all three of the mission packages until 2020, by which time it plans to take delivery of 24 ships.

Program Office Comments

The Navy states that it is purchasing the quantity of mission systems and packages needed for system integration, crew training, developmental testing, operational testing, and LCS operational deployments. The mission packages have all been demonstrated in a relevant environment prior to mission package integration, and therefore, the LCS program is purchasing the mission systems in accordance with DOD guidance and regulations. Further, the Navy is following its plan to incrementally deliver operationally effective mission package capability to the fleet rather than waiting years to acquire all mission systems needed to meet the threshold requirements. For example, initial SUW capability has been fielded and initial MCM capability will be fielded in fiscal 2015.

GAO Response

The systems that comprise the Navy's mission packages have yet to work successfully together to achieve results. For example, none of the mission packages for any increment have achieved interim requirements on the Independence variant, or meet its threshold requirements for either seaframe. In the absence of a defined increment-based approach to sequentially gain knowledge and meet requirements, the Navy's acquisition approach is not in accordance with best practices.⁵³

January 2015 DOT&E Report

Regarding technical risk in LCS mission packages, the January 2015 DOT&E report states:

SUW Mission Package

- LCS 3 equipped with the Increment 2 SUW Mission Package demonstrated the capability to defeat a small swarm of Fast Inshore Attack Craft under the conditions specified in the Navy requirement; however, the crew received extensive hands-on training that might not be available to crews on other ships. Testing conducted to date has not been sufficient to demonstrate LCS capabilities in more stressing scenarios consistent with existing threats.
- The SUW Mission Package has not yet been tested aboard an Independence class LCS.
- The 30 mm Gun Mission Modules (GMM) remain prone to jams caused by separation of ammunition links and accumulation of spent cartridges in the ejection path; however, LCS 3 experienced fewer jams during operational testing than had been observed in past developmental testing. While the Navy has made a concerted effort to improve

⁵³ Government Accountability Office, *Defense Acquisitions[:] Assessments of Selected Weapon Programs*, GAO-15-342SP, March 2013, p. 110.

ammunition belts, the problem was not entirely eliminated. Ammunition jams interrupt firing but can typically be cleared in a few minutes; however, they are still sufficiently disruptive to cause the ship to maneuver to bring the other 30 mm GMM to bear on the target.

MCM Mission Package

- During developmental testing, attempts to demonstrate the sequence of events necessary for an LCS to complete end-to-end mine clearance operations have been limited by low operator proficiency, software immaturity, system integration problems, and poor reliability of MCM components including RMS/RMMV. In the most recent period of developmental testing in 1QFY15, fleet operators using mission package tools such as the Organic Post Mission Analysis (OPMA) and the new Contact Management Tool (CMT) failed to convey some mine targets, correctly detected by the RMS in an initial search pass, to the AMNS for neutralization. As a result, fleet operators were unable to execute operationally-realistic, end-to-end mine reconnaissance and clearance without intervention by testers with knowledge of ground truth target positions. The Navy continues to investigate the root cause of target position errors and incorrectly dropped contacts; unless corrected, these problems will limit LCS MCM mission effectiveness.
- During developmental testing, the operational availability of MCM Mission Package systems has been degraded by low reliability, the LCS crew's limited capacity for corrective maintenance, and the ship's constrained inventory of repair parts. Testing has often been delayed to obtain the assistance of shore-based technicians and repair parts not available onboard LCS. Left uncorrected, these problems will severely limit LCS's operational capability for mine reconnaissance and clearance.
- Mission package minehunting systems (AN/AQS-20A and ALMDS) have not demonstrated the detection and localization capabilities needed for an LCS equipped with an Increment 1 MCM Mission Package to meet its required sustained area coverage rate. During developmental testing and a shore-based operational assessment, AN/ AQS-20A contact depth (vertical localization) errors have exceeded Navy limits in all operating modes. A shore-based operational assessment of ALMDS showed that the system does not meet Navy detection requirements. Both systems generate a large number of false classifications (objects erroneously classified as mine-like). Unless eliminated from the contact list, these false classifications require identification and neutralization effort, result in the expenditure of limited neutralizer assets, and substantially reduce the LCS sustained area coverage rate. As an alternative, the Navy has implemented tactics that require multiple search passes over the same area to minimize the number of false classifications conveyed for identification / neutralization. Although multiple search passes also reduce the LCS sustained area coverage rate relative to single pass systems, Navy modeling suggests this approach is less detrimental to MCM timelines. Whether LCS can meet the already-reduced low area clearance requirement for the Increment 1 Mission Package remains in question. Furthermore, testing has not yet shown whether the goal of minimizing AN/AQS-20A false classifications can be accomplished without also eliminating correct classifications from the contact list and degrading minehunting performance.

—The Navy expected to correct AN/AQS-20A deficiencies prior to the first phase of operational testing in FY15 by implementing pre-planned product improvements (the AN/AQS-20B version of the sonar) and integrating the improved sensor into the MCM Mission Package. Delays in the delivery of AN/AQS-20B prototypes and problems discovered in early characterization testing in FY14 leave little time to complete necessary developmental and operational testing of the AN/AQS-20B prior to the planned operational test of LCS equipped with the first increment of the MCM Mission Package in FY15.

—The Navy is working on pre-planned product improvements to improve ALMDS detection performance and reduce the frequency of receiver failures, but does not expect to integrate these changes into the first increment of the MCM Mission Package. Frequent receiver failures continued to affect ALMDS performance during an experimental deployment to the Navy's 5th fleet and recent developmental testing aboard LCS 2. During LCS developmental testing, the MH-60S aircrew was also unable to assess ALMDS achieved search/clearance level during post-mission analysis. Observations from 5th fleet operators also indicate mission planning and evaluation tools do not adequately support ALMDS mission planning and post-mission clearance estimates.

- During a shore-based operational assessment of the AMNS in FY14, AMNS was unable to achieve the Navy's requirement for mine neutralization success except under limited conditions not generally expected during combat. Failures of the host MH-60S aircraft's systems and its associated AMCM Mission Kit limited AMNS mission availability. Frequent loss of fiber-optic communications between the aircraft and the neutralizer was the primary cause of unsuccessful attack runs. Although the Navy attributed the failures to the bottom composition (sand and shells), the root cause of these failures has not yet been determined, and the bottom compositions used in testing are representative of realistic operating areas. Both problems negatively affect the timeliness of LCS-based AMNS operations and will likely reduce the ship's sustained area coverage rate.

- As noted earlier, the Independence class LCS has had difficulty launching and recovering the RMMV because of the vehicle's erratic motion in the ship's wake. In past developmental testing, violent RMMV yaw and roll motions have overstressed and damaged the launch and recovery hardware and resulted in damage to the RMMV, causing the Navy to limit handling operations to when sea state is less than 3. Following changes to launch and recovery hardware, procedures, training, and RMMV hardware, the Navy demonstrated 16 RMMV launches and 14 RMMV recoveries during 23 days at sea in developmental testing during favorable sea state conditions in 1QFY15. Nonetheless, the most recent period of developmental testing witnessed several instances of equipment damage that delayed or prevented recovery of an off-board RMMV. Because of the cracks in the welds at the base of support stanchions located in the mission bay, during this phase of testing, launch and recovery operations could be conducted only when wave-induced loading on the recovery system (a function of wave height and period) did not exceed 32,000 pounds-force. For example, a wave height of 2 feet coupled with a wave period of 2 seconds, which could occur in a Sea State 2, would have precluded RMMV recovery until calmer sea conditions developed. The Navy revealed they are making design changes to LCS 6 and later seaframes to correct the problem and remove the weight limit. LCS 2 and LCS 4 will be corrected during the next shipyard availability. This problem must be corrected to ensure safe and sustained RMS operations.

—No RMMV launch and recovery operations have been conducted aboard a Freedom class LCS at sea.

—Although the RMMV can search autonomously while operating over the horizon from the LCS, it can currently only conduct operations to reacquire and identify bottom mines within the range of Ultra High Frequency communications. This limitation will complicate MCM operations in long shipping channels, and may make it necessary to clear a series of LCS operating areas to allow MCM operations to progress along the channel. The cleared operating areas will be needed to keep the LCS and its crew out of mined waters. The additional effort required to clear these LCS operating areas would increase the demand for mine clearance and delay attainment of strategic objectives. This issue is not new to RMS; however, it did not become operationally significant until the Navy decertified the MH-60S helicopter for towing MCM devices, including the AN/AQS-20A/B sensor. The RMS communication range limitation was not an

operational concern when the option existed for the helicopter with towed sensor to conduct identification operations beyond the horizon. The Navy has not yet identified a solution.

—RMS reliability problems persisted in the recent phase of developmental testing (1QFY15) evidenced in part by fewer vehicle recoveries than vehicle launches. Problems observed include the inability to align the system’s inertial navigational unit, intermittent communications, a lube oil pump failure that caused a mission abort, capture latch impairment that precluded shipboard recovery of the RMMV, degraded electro-optic identification resulting in a mission abort to replace the AN/AQS-20A towed body, tow cable damage following an apparent snag that rendered the system inoperable in the assigned mission until a replacement tow cable could be installed with the assistance of shore-based support, and multiple incidents of AN/AQS-20A stuck fins or fin actuation faults. Although the Navy demonstrated more frequent RMMV launches during this period of testing, continued RMS reliability problems limited system minehunting to less than 50 hours during the 3 weeks of most intensive testing (approximately 16 hours per week).

- LCS reliability problems also forced the ship to remain in port for repairs instead of conducting at-sea RMS testing as planned. Including an additional week spent in port for LCS repairs, RMS averaged approximately 12 hours of minehunting per week. This result is consistent with the assessment of RMS capability DOT&E provided to members of the Defense Acquisition Board following RMMV v4.2 and AN/AQS-20A testing to indicate that the Navy had not yet demonstrated that it could sustain operations of more than one 14-hour RMMV sortie per week (i.e., 10 to 12 hours of RMS minehunting per week). Unless greater minehunting operating tempo is achieved, the Navy will not meet its interim area clearance rate requirements.

- The Navy reports that the RMS operated for approximately 140 hours during LCS developmental testing in 1QFY15. DOT&E’s preliminary assessment of test data identified at least seven RMS failures that precluded vehicle recovery, required sensor replacement, or required assistance from shore-based support contractors to restore system availability. In operational testing, these failures would be assessed as operational mission failures. Thus, by operational criteria, RMS demonstrated reliability was no more than 20 hours Mean Time Between Operational Mission Failure during this phase of testing. Because much of the operating time cited by the Navy was not devoted to minehunting activities, this estimate should be considered an upper bound for current RMS operational reliability. Moreover, statistical analysis of all existing data does not yet support the Navy’s assertions of improving RMS reliability.

- Since RMS is critical to achieving the Navy’s sustained area coverage rate requirement, this Annual Report includes a separate article on the RMS that provides additional detail.⁵⁴

Additional Oversight Issues Raised in GAO Reports

Additional oversight issues raised in recent GAO reports include LCS operation and support (O&S) costs,⁵⁵ weight management on the LCS sea frames—an issue that can affect the ability of

⁵⁴ Department of Defense, Director, Operational Test & Evaluation, *FY 2014 Annual Report*, January 2015, pp. 201-203.

⁵⁵ 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.

LCSs to accept new systems and equipment over their expected life cycles⁵⁶—and construction quality on the lead ships in the LCS program.⁵⁷

Legislative Activity for FY2016

FY2016 Funding Request

The Navy's proposed FY2016 budget requests the procurement of three LCSs. The Navy estimates the combined procurement cost of these three ships at \$1,437.0 million, or an average of \$479.0 million each. The three ships have received a total of \$80 million in prior-year advance procurement (AP) funding, and the Navy's FY2016 budget requests the remaining \$1,357.0 million that is needed to complete their combined procurement cost.

The Navy's proposed FY2016 budget also requests \$231.5 million for LCS common mission modules equipment, LCS MCM and SUW mission modules, and the Remote Minehunting System (RMS) used in the LCS MCM module (lines 33, 34, 35, and 36 in the Navy's Other Procurement, Navy, or OPN, appropriation account).

FY2016 National Defense Authorization Act (H.R. 1735/S. 1376)

House

The House Armed Services Committee, in its report (H.Rept. 114-102 of May 5, 2015) on H.R. 1735, recommends approving the Navy's FY2016 request for \$1,357.0 million in procurement funding for three more LCSs (page 422, line 010) and the Navy's FY2016 request for \$231.5 million for LCS common mission modules equipment and LCS MCM and SUW mission modules (page 424, lines 33, 34, 35, and 36).

Section 1073(c) of H.R. 1735 as reported by the committee states:

SEC. 1073. Repeal or revision of reporting requirements related to naval vessels and Merchant Marine....

(c) Reports on mission modules of Littoral Combat Ship.—Section 126 of the National Defense Authorization Act for Fiscal Year 2013 (Public Law 112-239; 126 Stat. 1657) is amended—

(1) by striking “(a) Designation required.—”; and

(2) by striking subsection (b).

Section 126 of P.L. 112-239—the provision that would be amended by the above legislation—currently states:

SEC. 126. DESIGNATION OF MISSION MODULES OF THE LITTORAL COMBAT SHIP AS A MAJOR DEFENSE ACQUISITION PROGRAM.

(a) Designation Required.—The Secretary of Defense shall—

⁵⁶ Government Accountability Office, *Littoral Combat Ship[:] Additional Testing and Improved Weight Management Needed Prior to Further Investments*, GAO-14-749, July 2014, 54 pp.

⁵⁷ 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.

(1) designate the effort to develop and produce all variants of the mission modules in support of the Littoral Combat Ship program as a major defense acquisition program under section 2430 of title 10, United States Code; and

(2) with respect to the development and production of each such variant, submit to the congressional defense committees a report setting forth such cost, schedule, and performance information as would be provided if such effort were a major defense acquisition program, including Selected Acquisition Reports, unit cost reports, and program baselines.

(b) *Additional Quarterly Reports.*—The Secretary shall submit to the congressional defense committees on a quarterly basis a report on the development and production of each variant of the mission modules in support of the Littoral Combat Ship, including cost, schedule, and performance, and identifying actual and potential problems with such development or production and potential mitigation plans to address such problems.

H.Rept. 114-102 states:

Littoral Combat Ship simulation training

The committee notes the significant cost savings, increase in fidelity of training, and improved operational readiness rates that are achievable through the use of game-based immersive virtual ship training environments (IVSE), as is being developed for the Littoral Combat Ship (LCS). The committee also notes that the Navy intends to delay funding for this LCS courseware developments that may provide near-term efficiencies and longer-term operational cost-savings.

The committee believes that IVSE is integral to initial training initiatives and concurrency training in order to ensure mission readiness for the crews of the LCS squadron. The committee also believes IVSE may not only expand the LCS multi-mission training profile, but that it may also provide opportunities for expansion to aircraft maintenance and other vessel training. The committee would support opportunities that expand IVSE mission training to additional platform training programs that may include aviation, surface, and subsurface operation and maintenance virtual training environments. (Page 34)

H.Rept. 114-102 also states:

Advanced Low Cost Munitions Ordnance

The committee notes the Navy's efforts to develop an Advanced Low Cost Munitions Ordnance (ALaMO) for the Littoral Combat Ship (LCS) by Fiscal Year 2020. The committee believes the LCS program should be equipped with the most affordable, lethal, defensive, and offensive capabilities across all mission areas. The committee supports the Navy's efforts to develop ALaMO, specifically a guided 57mm projectile to counter threats against small boat swarms and others. Therefore, the committee directs the Assistant Secretary of the Navy (Research, Development and Acquisition) to brief the House Committee on Armed Services by August 30, 2015 on the current status of the ALaMO program. The briefing should include, but not be limited to, an evaluation of the current funding profile and schedule for this program across the Future Years Defense Program, as well as discuss potential courses of action to accelerate or streamline the current program strategy. (Page 64)

H.Rept. 114-102 also states:

Anti-surface warfare missile capability for Littoral Combat Ship

The committee is aware of the complex close combat environments that Navy surface combatants encounter when operating in the littorals. Characteristic of this environment is the irregular threat posed by clusters of swarming small boats intermingled with non-

combatant vessels. As a result, the anti-surface warfare mission for vessels, such as the Littoral Combat Ship (LCS) and Patrol Coastal (PC) ships, must possess positive-control missile capabilities that enable agile rules of engagement for applying decisive defensive countermeasures while minimizing the risks of collateral damage. Furthermore, it is critical that this balance of capabilities be fielded to the fleet as rapidly as possible.

The committee is also aware of the Navy's efforts to field an antisurface warfare missile capability for the LCS that meets these criteria; however, the committee is concerned that the current development path will require significant engineering/test and integration work that impacts the initial operating capability. Therefore, the committee directs the Secretary of the Navy to provide a briefing to the House Committee on Armed Services not later than March 1, 2016, detailing the cost and schedule of current development efforts on anti-surface warfare missile capability for the LCS and PC ships. The briefing should evaluate comparative systems' speed of integration to the fleet, range, weight, In-Flight Target Update capability, and ability to leverage existing fielded systems. (Pages 64-65)

Senate

The Senate Armed Services Committee, in its report (S.Rept. 114-49 of May 19, 2015) on S. 1376, recommends approving the Navy's FY2016 request for \$1,357.0 million in procurement funding for three more LCSs (page 363, line 10). The report recommends reducing by \$121.4 million the Navy's FY2016 request for \$231.5 million for LCS common mission modules equipment and LCS MCM and SUW mission modules. The recommended reduction consists of a reduction of \$55.8 million in the line for LCS MCM mission modules (for which a total of \$85.2 million had been requested), and a reduction of \$65.6 million for the line for the Remote Minehunting System (for which a total of \$87.6 million had been requested). Both reductions are for "Procurement in excess of need ahead of satisfactory testing." (Page 365, lines 33, 34, 35, and 36.)

S.Rept. 114-49 states:

Littoral Combat Ship Mine Countermeasures Mission Module

The budget request included \$85.1 million in Other Procurement, Navy to procure Littoral Combat Ship (LCS) Mine Countermeasures (MCM) mission modules. The committee notes the Navy has two MCM mission modules delivered and four MCM mission modules procured through fiscal year 2015. The Director of Operational Test and Evaluation (DOT&E) has stated that only one MCM module of each increment is required to complete operational testing. During developmental testing, as noted by DOT&E, "attempts to demonstrate the sequence of events necessary for an LCS to complete end-to-end mine clearance operations have been limited by low operator proficiency, software immaturity, system integration problems, and poor reliability of MCM components including RMS/RMMV." As a result, the committee recommends a decrease of \$55.8 million for this program due to procurement in excess of need ahead of satisfactory operational testing.

This reduction would reduce the hardware components to the manufacturer minimum sustaining rate—a reduction from two to one Airborne Mine Neutralization Systems (AMNS), two to one Airborne Laser Mine Detection Systems (ALMDS), six to one AN/AQS-20A Minehunting Sonars, and two to zero COBRA systems (two other COBRA systems are requested in LI 2624, which satisfies the manufacturer minimum sustaining rate). (Pages 25-26)

S.Rept. 114-49 also states:

Remote Minehunting System

The budget request included \$87.6 million in Other Procurement, Navy for the Remote Minehunting System (RMS). In January 2015, the Director of Operational Test and Evaluation noted in his annual report, “RMS had not demonstrated sufficient performance or successful integration with interfacing LCS systems to demonstrate the Navy’s minimum Increment 1 warfighting capability, and developmental testing completed in the first quarter of fiscal year 2015 demonstrated continued performance issues and RMS mission package integration challenges.” The committee believes that upgrading two previously procured systems may provide further assets for testing to demonstrate whether upgrades improve performance and reliability. As a result, the committee recommends a decrease of \$65.6 million for this program due to procurement in excess of need, ahead of satisfactory developmental and operational testing. (Page 26)

Section 115 of S. 1376 as reported by the committee states:

SEC. 115. Limitation on availability of funds for Littoral Combat Ship.

Of the funds authorized to be appropriated by this Act or otherwise made available for fiscal year 2016 for research and development, design, construction, procurement or advanced procurement of materials for the Littoral Combat Ships designated as LCS 33 or subsequent, not more than 25 percent may be obligated or expended until the Secretary of the Navy submits to the Committees on Armed Services of the Senate and the House of Representatives each of the following:

- (1) A Capabilities Based Assessment to assess capability gaps and associated capability requirements and risks for the upgraded Littoral Combat Ship, which is proposed to commence with LCS 33. This assessment shall conform with the Joint Capabilities Integration and Development System, including Chairman of the Joint Chiefs of Staff Instruction 3170.01H.
- (2) A certification that the Joint Requirements Oversight Council has validated an updated Capabilities Development Document for the upgraded Littoral Combat Ship.
- (3) A report describing the upgraded Littoral Combat Ship modernization, which shall, at a minimum, include the following elements:
 - (A) A description of capabilities that the LCS program delivers, and a description of how these relate to the characteristics of the future joint force identified in the Capstone Concept for Joint Operations, concept of operations, and integrated architecture documents.
 - (B) A summary of analyses and studies conducted on LCS modernization.
 - (C) A concept of operations for LCS modernization ships at the operational level and tactical level describing how they integrate and synchronize with joint and combined forces to achieve the Joint Force Commander’s intent.
 - (D) A description of threat systems of potential adversaries that are projected or assessed to reach initial operational capability within 15 years against which the lethality and survivability of the LCS should be determined.
 - (E) A plan and timeline for LCS modernization program execution.
 - (F) A description of system capabilities required for LCS modernization, including key performance parameters and key system attributes.
 - (G) A plan for family of systems or systems of systems synchronization.
 - (H) A plan for information technology and national security systems supportability.
 - (I) A plan for intelligence supportability.
 - (J) A plan for electromagnetic environmental effects (E3) and spectrum supportability.

(K) A description of assets required to achieve initial operational capability (IOC) of an LCS modernization increment.

(L) A schedule and initial operational capability and full operational capability definitions.

(M) A description of doctrine, organization, training, materiel, leadership, education, personnel, facilities, and policy considerations.

(N) A description of other system attributes.

(4) A plan for future periodic combat systems upgrades, which are necessary to ensure relevant capability throughout the Littoral Combat Ship or Frigate class service lives, using the process described in paragraph (3).

Regarding Section 115, S.Rept. 114-49 states:

Limitation on availability of funds for Littoral Combat Ship (sec. 115)

The committee recommends a provision that would limit 75 percent of fiscal year 2016 funds for research and development, design, construction, procurement or advance procurement of materials for the upgraded Littoral Combat Ships (LCS), designated as LCS-33 and subsequent, until the Secretary of the Navy submits to the Committees on Armed Services of the Senate and of the House of Representatives: a capabilities based assessment to assess capability gaps and associated capability requirements and risks for the upgraded LCS, an updated capabilities development document for the upgraded LCS, and a report describing the upgraded LCS modernization.

The committee understands that the Secretary of Defense directed the Navy to explore “alternative proposals to procure a capable and lethal small surface combatant, generally consistent with the capabilities of a frigate”. The outcome of this analysis, subsequently approved by the Secretary of Defense, was modifications to the two existing variants of the LCS. The committee recognizes the significant analysis the Navy did accomplish, which is similar to an analysis of alternatives in defense acquisition.

However, the committee is concerned by the absence of analysis to identify the specific capability gaps and mission needs that the Navy is seeking to address, which would have been appropriate prior the Secretary of Defense’s initial tasking. Without this analysis, it is unclear why the capabilities of the current LCS are inadequate and if the proposed modifications will be sufficient to address a defined warfighting gap. In addition, given the significant proposed changes to the LCS, the committee believes an updated capabilities development document is warranted and understands the Navy is pursuing this action.

Finally, the committee believes this modernization of the LCS class needs to be pursued in a comprehensive and analytically-derived manner, particularly because these ships are planned to be in service until 2050. Large surface combatants, submarines, and tactical aircraft follow documented, proven modernization processes to outpace the advances of potential adversaries. Most relevant for the LCS is the advanced capability build process for large surface combatants, which is based on a naval capabilities document. The 14 sections of this document are listed in the recommended provision.

Therefore, this provision would direct the Navy to deliver a capabilities based assessment, an updated capabilities development document certified by the Joint Requirements Oversight Council, and a report on LCS modernization. (Page 10)

Section 116 of S. 1376 as reported by the committee states:

SEC. 116. Extension and modification of limitation on availability of funds for Littoral Combat Ship.

Section 124(a) of the National Defense Authorization Act for Fiscal Year 2014 (Public Law 113–66; 127 Stat. 693), as amended by section 123 of the Carl Levin and Howard P. “Buck” McKeon National Defense Authorization Act for Fiscal Year 2015 (Public Law 113–291; 128 Stat. 3314), is further amended—

(1) by striking “this Act, the Carl Levin and Howard P. ‘Buck’ McKeon National Defense Authorization Act for Fiscal Year 2015, or otherwise made available for fiscal years 2014 or 2015” and inserting “this Act, the National Defense Authorization Act for Fiscal Year 2016, or otherwise made available for fiscal years 2014, 2015, or 2016”; and

(2) by adding at the end the following new paragraphs:

“(6) A Littoral Combat Ship seaframe acquisition strategy for the Littoral Combat Ships designated as LCS 25 through LCS 32, including upgrades to be installed on these ships that were identified for the upgraded Littoral Combat Ship, which is proposed to commence with LCS 33.

“(7) A Littoral Combat Ship mission module acquisition strategy to reach the total acquisition quantity of each mission module.

“(8) A cost and schedule plan to outfit Flight 0 and Flight 0+ Littoral Combat Ships with capabilities identified for the upgraded Littoral Combat Ship.

“(9) A current Test and Evaluation Master Plan for the Littoral Combat Ship Mission Modules, approved by the Director of Operational Test and Evaluation, which includes the performance levels expected to be demonstrated during developmental testing for each component and mission module prior to commencing the associated operational test phase.”.

Section 124(a) of P.L. 113-66—the provision that would be further amended by the above legislation—stated:

SEC. 124. LIMITATION ON AVAILABILITY OF FUNDS FOR LITTORAL COMBAT SHIP.

(a) Limitation.—None of the funds authorized to be appropriated by this Act or otherwise made available for fiscal year 2014 for construction or advanced procurement of materials for the Littoral Combat Ships designated as LCS 25 or LCS 26 may be obligated or expended until the Secretary of the Navy submits to the congressional defense committees each of the following:

(1) The report required by subsection (b)(1).

(2) A coordinated determination by the Director of Operational Test and Evaluation and the Under Secretary of Defense for Acquisition, Technology, and Logistics that successful completion of the test evaluation master plan for both seaframes and each mission module will demonstrate operational effectiveness and operational suitability.

(3) A certification that the Joint Requirements Oversight Council—

(A) has reviewed the capabilities of the legacy systems that the Littoral Combat Ship is planned to replace and has compared such capabilities to the capabilities to be provided by the Littoral Combat Ship;

(B) has assessed the adequacy of the current capabilities development document for the Littoral Combat Ship to meet the requirements of the combatant commands and to address future threats as reflected in the latest assessment by the defense intelligence community; and

(C) has either validated the current capabilities development document or directed the Secretary to update the current capabilities development document based on the performance of the Littoral Combat Ship and mission modules to date.

(4) A report on the expected performance of each seaframe variant and mission module against the current or updated capabilities development document.

(5) Certification that a capability production document will be completed for each mission module before operational testing.

Section 123 of P.L. 113-291—the provision that amended Section 124 of P.L. 113-66—stated:

SEC. 123. EXTENSION OF LIMITATION ON AVAILABILITY OF FUNDS FOR LITTORAL COMBAT SHIP.

Section 124(a) of the National Defense Authorization Act for Fiscal Year 2014 (P.L. 113-66; 127 Stat. 693) is amended by striking “this Act or otherwise made available for fiscal year 2014” and inserting “this Act, the Carl Levin and Howard P. ‘Buck’ McKeon National Defense Authorization Act for Fiscal Year 2015, or otherwise made available for fiscal years 2014 or 2015”.

Regarding Section 116, S.Rept. 114-49 states:

Extension and modification of limitation on availability of funds for Littoral Combat Ship (sec. 116)

The committee recommends a provision that would amend section 123 of the Carl Levin and Howard P. “Buck” McKeon National Defense Authorization Act for Fiscal Year 2015 (Public Law 113-291) by extending the limitation on funds for LCS-25 and LCS-26 until pre-existing requirements are met and would additionally require the Navy to provide to the congressional defense committees the following: an acquisition strategy for LCS-25 through LCS-32; a LCS mission module acquisition strategy; a plan to outfit Flight 0 and Flight 0+ Littoral Combat Ships with capabilities identified for the upgraded Littoral Combat Ship; and a current test and evaluation master plan for the Littoral Combat Ship mission modules.

The committee believes the additional requirements are in keeping with defense acquisition policies and best practices. The committee is concerned that the introduction of an upgraded LCS, beginning with LCS-33, will further complicate configuration management of the LCS seaframes and mission modules. Opportunistic modifications or “backfits” of existing LCS with some, but not all, of these upgraded capabilities are another source of concern. The committee needs clarity on the LCS seaframe acquisition strategy, requirement for mission modules in light of the upgraded LCS decision, cost and schedule of the Navy’s plan to modify or “backfit” existing LCS, and how the Navy will achieve developmental and operational testing for each component and mission module. (Page 11)

FY2016 DOD Appropriations Act (H.R. 2685/S. 1558)

House

The House Appropriations Committee, in its report (H.Rept. 114-139 of June 5, 2015) on H.R. 2685, recommends reducing by \$9.58 million the Navy’s FY2016 request for procurement funding for the LCS program, with the reduction being for “Plans growth” (page 161). The report recommends approving the Navy’s FY2016 procurement funding requests for LCS mission modules (page 164, lines 33, 34, 35, and 36).

Senate

The Senate Appropriations Committee, in its report (S.Rept. 114-63 of June 11, 2015) on S. 1558, recommends reducing by \$25.4 million the Navy’s FY2016 request for procurement funding for

the LCS program, with the reduction being for “Restoring acquisition accountability: Defer weight and survivability enhancements until more research and development is completed” (page 100, line 10).

The report recommends reducing by \$86.439 million the Navy’s FY2016 request for procurement funding for LCS mission modules, with the reduction being for LCS common mission modules equipment for “Restoring acquisition accountability: MPCE cost growth” (\$439,000), for LCS MCM mission modules for “Restoring acquisition accountability: COBRA ahead of need” (\$17.7 million), and “Restoring acquisition accountability: MCM mission module ahead of need” (\$33.75 million), and for the Remote Minehunting System (RMS) for “Restoring acquisition accountability: RMMV ahead of need” (\$34.55 million). (Page 110, lines 33, 34, and 36, continuing [for line 36] to page 111.)

S.Rept. 114-63 states:

Littoral Combat Ship [LCS] Mission Modules.—The Committee continues to be concerned with the Navy’s acquisition strategy for LCS mission modules. The Government Accountability Office has repeatedly noted that the Navy’s strategy includes buying significant numbers of LCS mission modules before their performance is demonstrated and that the current inventory of mission packages exceeds the quantities necessary for operational testing. Additionally, the Director of Operational Test and Evaluation [DOT&E] noted in the latest DOT&E annual report that low operator proficiency, software immaturity, system integration issues and poor reliability of mine countermeasure components have continued to plague the program. Given these ongoing testing concerns, the Committee finds it prudent to slow the procurement of LCS mission modules and recommends a total reduction of \$104,516,000 to the fiscal year 2016 budget request for LCS mission modules and related components. (Page 111)

Appendix A. Some Major Program Developments Prior to Program's 2014 Restructuring

Growth in Sea Frame Procurement Costs

The Navy originally spoke of building LCS sea frames for about \$220 million each in constant FY2005 dollars. Unit costs for the first few LCSs subsequently more than doubled. Costs for subsequent LCSs then came down under the current block buy contracts, to roughly \$450 million each in current dollars, which equates to roughly \$380 million in constant FY2005 dollars, using DOD's budget authority deflator for procurement excluding pay, fuel, and medical.⁵⁸

2007 Program Restructuring and Ship Cancellations

The Navy substantially restructured the LCS program in 2007 in response to significant cost growth and delays in constructing the first LCS sea frames. This restructuring led to the cancellation in 2007 of four LCSs that were funded in FY2006 and FY2007. A fifth LCS, funded in FY2008, was cancelled in 2008. The annual procurement quantities shown above in **Table 1** reflect these cancellations (i.e., the five canceled ships no longer are shown in the annual procurement quantities in this table).

2009 Down Select Acquisition Strategy (Not Implemented)

On September 16, 2009, the Navy announced a proposed acquisition strategy under which the Navy would hold a competition to pick a single design to which all LCSs procured in FY2010 and subsequent years would be built (i.e., carry out a design "down select").⁵⁹ Section 121(a) and

⁵⁸ This deflator is shown in *National Defense Budget Estimates for FY 2014*, May 2013, Table 5-7 (pages 71-72). This DOD budget reference document is also known as the "Green Book."

⁵⁹ The winner of the down select would be awarded a contract to build 10 LCSs over the five-year period FY2010-FY2014, at a rate of two ships per year. The Navy would then hold a second competition—open to all bidders other than the shipyard building the 10 LCSs in FY2010-FY2014—to select a second shipyard to build up to five additional LCSs to the same design in FY2012-FY2014 (one ship in FY2012, and two ships per year in FY2013-FY2014). These two shipyards would then compete for contracts to build LCSs procured in FY2015 and subsequent years.

Prior to the Navy's announcement of September 16, 2009, the Navy had announced an acquisition strategy for LCSs to be procured in FY2009 and FY2010. Under this acquisition strategy, the Navy bundled together the two LCSs funded in FY2009 (LCSs 3 and 4) with the three LCSs to be requested for FY2010 into a single, five-ship solicitation. The Navy announced that each LCS industry team would be awarded a contract for one of the FY2009 ships, and that the prices that the two teams bid for both the FY2009 ships and the FY2010 ships would determine the allocation of the three FY2010 ships, with the winning team getting two of the FY2010 ships and the other team getting one FY2010 ship. This strategy was intended to use the carrot of the third FY2010 ship to generate bidding pressure on the two industry teams for both the FY2009 ships and the FY2010 ships.

The Navy stated that the contracts for the two FY2009 ships would be awarded by the end of January 2009. The first contract (for Lockheed Martin, to build LCS-3) was awarded March 23, 2009; the second contract (for General Dynamics, to build LCS-4) was awarded May 1, 2009. The delay in the awarding of the contracts past the end-of-January target date may have been due in part to the challenge the Navy faced in coming to agreement with the industry teams on prices for the two FY2009 ships that would permit the three FY2010 ships to be built within the \$460 million LCS unit procurement cost cap. See also Statement of RADM Victor Guillory, U.S. Navy Director of Surface Warfare, and RADM William E. Landay, III, Program Executive Officer Ships, and Ms. E. Anne Sandel, Program Executive Officer Littoral and Mine Warfare, before the Subcommittee on Seapower and Expeditionary Forces of the House Armed Services Committee [hearing] on the Current Status of the Littoral Combat Ship Program, March 10, 2009, pp. 7-8.

(b) of the FY2010 National Defense Authorization Act (H.R. 2647/P.L. 111-84 of October 28, 2009) provided the Navy authority to implement this down select strategy. The Navy's down select decision was expected to be announced by December 14, 2010, the date when the two LCS bidders' bid prices would expire.⁶⁰ The down select strategy was not implemented; it was superseded in late December 2010 by the current dual-award acquisition strategy (see next section).

2010 Dual-Award Acquisition Strategy (Implemented)

On November 3, 2010, while observers were awaiting the Navy's decision under the down select strategy (see previous section), the Navy notified congressional offices that it was prepared to implement an alternative dual-award acquisition strategy under which the Navy would forego making a down select decision and instead award each LCS bidder a 10-ship block buy contract for the six-year period FY2010-FY2015, in annual quantities of 1-1-2-2-2-2.⁶¹ The Navy stated that, compared to the down select strategy, the dual-award strategy would reduce LCS procurement costs by hundreds of millions of dollars. The Navy needed additional legislative authority from Congress to implement the dual-award strategy. The Navy stated that if the additional authority were not granted by December 14, the Navy would proceed to announce its down select decision under the acquisition strategy announced on September 16, 2009. On December 13, 2010, it was reported that the two LCS bidders, at the Navy's request, had extended the prices in their bids to December 30, 2010, effectively giving Congress until then to decide whether to grant the Navy the authority needed for the dual-award strategy.

The Navy's November 3, 2010, proposal of a dual-award strategy posed an issue for Congress of whether this strategy would be preferable to the down select strategy, and whether Congress should grant the Navy, by December 30, 2010, the additional legislative authority the Navy would need to implement the dual-award strategy. On December 14, 2010, the Senate Armed Services Committee held a hearing to review the proposed dual-award strategy. Congress granted the Navy authority to implement the dual-award strategy 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.

On December 29, 2010, using the authority granted in H.R. 3082/P.L. 111-322, the Navy implemented the dual-award strategy, awarding a 10-ship, fixed-price incentive (FPI) block-buy contract to Lockheed, and another 10-ship, FPI block-buy contract to Austal USA. As mentioned earlier (see "Unit Procurement Cost Cap"), in awarding the contracts, the Navy stated that LCSs to be acquired under the two contracts are to have an average unit cost of about \$440 million, a figure well below the program's adjusted unit procurement cost cap (as of December 2010) of \$538 million. The 20 ships to be acquired under the two contracts have a target cost and a higher ceiling cost. Any cost growth above the target cost and up to the ceiling cost would be shared between the contractor and the Navy according to an agreed apportionment (i.e., a "share line"). Any cost growth above the ceiling cost would be borne entirely by the contractor. The Navy stated that, as a worst case, if the costs of the 20 ships under the two FPI contracts grew to the ceiling figure and all change orders were expended, the average cost of the ships would increase

⁶⁰ The Navy had earlier planned to make the down select decision and award the contract to build the 10 LCSs in the summer of 2010, but the decision was delayed to as late as December 14. (The final bids submitted by the two LCS contractors were submitted on about September 15, and were valid for another 90 days, or until December 14.)

⁶¹ 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 Ronald O'Rourke and Moshe Schwartz.

by about \$20 million, to about \$460 million, a figure still well below the adjusted cost cap figure of \$538 million.⁶²

The Navy on December 29, 2010, technically awarded only two LCSs (one to each contractor). These ships (LCS-5 and LCS-6) are the two LCSs funded in FY2010. Awards of additional ships under the two contracts are subject to congressional authorization and appropriations. The Navy states that if authorization or sufficient funding for any ship covered under the contracts is not provided, or if the Navy is not satisfied with the performance of a contractor, the Navy is not obliged to award additional ships covered under contracts. The Navy states that it can do this without paying a penalty to the contractor, because the two block-buy contracts, unlike a typical multiyear procurement (MYP) contract, do not include a provision requiring the government to pay the contractor a contract cancellation penalty.⁶³

Changes in Mission Package Equipment

The Navy since January 2011 has announced changes to the composition of all three LCS mission packages. The concept for the ASW package, and consequently the equipment making up the package, was changed substantially. The equipment making up the MIW package has changed somewhat, partly as a result of the testing of the MIW systems being developed for the package. An Army-developed missile called Non-Line of Sight Launch System (NLOS-LS) that was to be used in the SUW package was canceled by the Army and has been replaced for the next few years in the LCS SUW module by the shorter-ranged Army Longbow Hellfire missile, pending the eventual acquisition for the LCS SUW module of a follow-on missile with longer range.⁶⁴

2012 Establishment of LCS Council

On August 22, 2012, Admiral Jonathan Greenert, the chief of Naval Operations, established an LCS Council headed by four vice admirals to address challenges faced by the LCS program for supporting the planned deployment of an LCS to Singapore beginning in 2013. The challenges were identified in four internal Navy reviews of the LCS program (two of them based on wargames) that were completed between February and August of 2012. The memorandum from the CNO establishing the council states that the council will be “empowered ... to drive action across the acquisition, requirements and Fleet enterprises of the Navy.” The council was given an immediate focus of developing and implementing an LCS plan of action and milestones by January 31, 2013. The memorandum also required the council to develop a charter for its operations within 14 days.⁶⁵

⁶² Source: Contract-award information provided to CRS by navy office of Legislative Affairs, December 29, 2010.

⁶³ Source: Navy briefing to CRS and the Congressional Budget Office (CBO) on December 15, 2010. For a press article on this issue, see Cid Standifer, “FY-11 LCS Contracts On Hold Because Of Continuing Resolution,” *Inside the Navy*, March 14, 2011.

⁶⁴ The Navy initially chose the Griffin missile as the near-term replacement for NLOS-LS, but in April 2014 announced that the near-term replacement for NLOS-LS would instead be the Longbow Hellfire missile. See Sam LaGrone, “Navy Axes Griffin Missile In Favor of Longbow Hellfire for LCS,” *USNI News* (<http://news.usni.org>), April 9, 2014; Mike McCarthy, “LCS Program Dumping Griffin Missile In Favor Of Army’s Longbow,” *Defense Daily*, April 10, 2014; Michael Fabey, “Hellfire Front-Runner For U.S. Navy Littoral Combat Ship,” *Aerospace Daily & Defense Report*, April 10, 2014: 4.

⁶⁵ Memorandum from Chief of Naval Operations to Director, Navy Staff, dated August 22, 2012, on Littoral Combat Ship (LCS) Council, posted at *InsideDefense.com* (subscription required), August 24, 2012. See also Defense Media Activity—Navy, “CNO Establishes LCS Council,” *Navy News Service*, August 22, 2012; Christopher P. Cavas, “U.S. Navy Creates LCS ‘Council’ To Guide Development,” *DefenseNews.com*, August 22, 2012; Megan Eckstein, “CNO (continued...) ”

Appendix B. Defense-Acquisition Policy Lessons of LCS Program

Another issue for Congress concerns what defense-acquisition policy lessons, if any, the LCS 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),⁶⁶ 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 has reached IOC (initial operational capability) will 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,

(...continued)

Establishes LCS Council To Review Recent Data, Lessons Learned,” *Inside the Navy*, August 27, 2012; Mike McCarthy, “Navy Establishes LCS Council,” *Defense Daily*, August 27, 2012.

⁶⁶ A CONOPS is a detailed understanding of how to use the ship to accomplish various missions.

it will succeed in getting no more than two of these things,⁶⁷ or, more simply, that the LCS program validated the general saying that haste makes waste.

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 gear⁶⁸ from a supplier firm that forced the shipbuilder to build the lead ship in a significantly revised and sub-optimal construction sequence.

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⁶⁷ The guideline is sometimes referred to in the business world as "Fast, cheap, good—pick two."

⁶⁸ 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.