



June 2016

LITTORAL COMBAT SHIP

Need to Address Fundamental Weaknesses in LCS and Frigate Acquisition Strategies

GAO Highlights

Highlights of [GAO-16-356](#), a report to congressional committees

Why GAO Did This Study

In February 2014, the Secretary of Defense cited concerns with the combat capabilities of the LCS—a small surface combatant (SSC) consisting of a ship and reconfigurable mission packages built by two shipyards as different variants, with 26 LCS delivered or under contract. The Secretary directed an assessment of alternatives for a SSC. A Navy task force analyzed new and existing designs, including modified LCS concepts.

The House report for the National Defense Authorization Act for Fiscal Year 2015 included a provision for GAO to analyze the Navy's study and the implications for future procurement. This report examines: (1) how the Navy arrived at its preferred solution, and (2) the potential risks associated with the Navy's approach to acquiring the SSC and continued procurement of LCS, among other objectives. To conduct this work, GAO analyzed the task force study and other documentation, and interviewed task force, Navy, and Office of the Secretary of Defense officials.

What GAO Recommends

Congress should consider not funding any requested LCS in fiscal year 2017 and should consider requiring the Navy to revise its acquisition strategy for the frigate. GAO also recommends that the Department of Defense (DOD) align reviews to precede key acquisition decisions and enhance oversight by requiring the frigate program to develop key program documents and to report on the frigate separately in the SAR. The department concurred with the first recommendation and partially concurred with the second.

View [GAO-16-356](#). For more information, contact Michele Mackin, 202-512-4841 or mackinm@gao.gov.

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What GAO Found

The Navy's task force studied a number of options to improve upon known shortfalls in Littoral Combat Ship (LCS) lethality and survivability. It found that neither LCS variant with minor modifications met the Navy's desired capabilities without further tradeoffs. After briefing senior Navy leadership, the task force was directed to further examine the LCS options, which required it to alter or in some cases reduce some capabilities. In late 2014, the Navy recommended (and the Secretary of Defense approved) procuring both variants of a minor modified LCS, designating it a "frigate." The Navy prioritized this option because of its relatively lower cost and quicker ability to field, as well as the ability to upgrade remaining LCS, over making more significant capability improvements. GAO's analysis found the planned frigate will not provide much greater capability in some areas than LCS and that some cost assumptions may have overstated this option's affordability.

As the Navy pivots from LCS to the frigate program, which is estimated to cost more than \$8 billion for ship construction alone, its approach would require Congress to appropriate funding with key unknowns. The table outlines GAO's observations on the Navy's acquisition strategy.

Key Upcoming Actions for Littoral Combat Ship (LCS) and Frigate

Fiscal year	Navy planned actions	GAO observations
2016	Request proposals from both shipyards for two LCS with a block buy option for 12 additional LCS.	Including 12 LCS with the current capabilities as a block buy option does not form a sound basis for a future frigate procurement; a robust frigate competition once designs are firm would be a more informed approach.
2017	Procure two LCS, with one ship awarded to each shipyard.	Congress would fund more LCS even though these ships have not demonstrated lethality and survivability capabilities.
2018	Obtain contract change proposals for frigate capabilities for the 12 LCS under the block buy option. Exercise option on one of the shipyard's contracts for detail design and construction.	Navy would exercise the contract option frigate procurement before the start of detail design or completion of weight reduction initiatives needed to determine whether seaframes can accommodate frigate upgrades.
2019	LCS lethality and survivability testing is completed.	Testing will show how LCS can function as basis for frigate.
2021	Both shipyards complete construction of LCS already under contract.	Both shipyards have experienced schedule delays of up to a year or more.

Source: GAO analysis of Navy LCS and frigate information. | GAO-16-356

Of note, the industrial base considerations that have factored into prior LCS decisions are less compelling, as both yards will be building LCS currently under contract through fiscal year 2021. Finally, there are no current plans for official DOD milestone reviews of the frigate program, which is a major acquisition program based on its anticipated costs. In addition, the Navy does not plan to develop key frigate program documents or to reflect frigate cost, schedule, and performance information in the annual Selected Acquisition Reports (SAR) submitted to Congress. Without adequate oversight, federal funds may not be effectively spent.

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Abbreviations

ACAT	Acquisition Category
AOA	Analysis of Alternatives
ASW	Anti-Submarine Warfare
DOD	Department of Defense
DOT&E	Director, Operational Test and Evaluation
CAPE	Director, Cost Assessment and Program Evaluation
CC	Capability Concept
CDD	Capability Development Document
CNO	Chief of Naval Operations
CONOPS	Concept of Operations
JROC	Joint Requirements Oversight Council
KPP	Key Performance Parameter
LCS	Littoral Combat Ship
MCM	Mine Countermeasures
OPNAV	Office of the Chief of Naval Operations
OSD	Office of the Secretary of Defense
PEO	Program Executive Officer
RFP	Request for Proposal
SAR	Selected Acquisition Report
SEWIP	Surface Electronic Warfare Improvement Program
SSC	Small Surface Combatant
SUW	Surface Warfare
USD(AT&L)	Office of the Under Secretary for Acquisition, Technology, and Logistics

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June 9, 2016

Congressional Committees

The Navy’s vision for the Littoral Combat Ship (LCS) has evolved since its inception. As we have previously reported, LCS was initially envisioned as a self-sufficient combatant designed to fight and win in shallow water and near-land environments, but this concept has weakened over time based on the realization that the ship would be less capable of operating independently in higher threat environments than expected and would play a more limited role in major combat operations.¹ Recently, several Department of Defense (DOD) directions have further changed plans for the ship.

In February 2014, approximately 9 years after the first LCS started in production and with 9 ships under construction at each of two shipyards, then-Secretary of Defense Chuck Hagel announced that he had considerable reservations about the level of capability and lethality of LCS and directed the Navy to contract for no more than 32 ships instead of 52 ships as originally planned.² The Secretary directed the Navy to study alternatives to the LCS that would provide capabilities “consistent with a frigate.”³ In response, the Navy established the Small Surface Combatant Task Force, which we refer to in this report as the task force, to evaluate different design solutions including completely new and existing ship designs and LCS options with both major and minor modifications.

¹GAO, *Defense Acquisitions: Plans Need to Allow Enough Time to Demonstrate Capability of First Littoral Combat Ships*, [GAO-05-255](#) (Washington, D.C.: Mar. 1, 2005); *Littoral Combat Ship: Knowledge of Survivability and Lethality Capabilities Needed Prior to Making Major Funding Decisions*; [GAO-16-201](#) (Washington, D.C.: Dec. 18, 2015); and *Navy Shipbuilding: Significant Investments in Littoral Combat Ship Continue Amid Substantial Unknowns about Capabilities, Use, and Cost*; [GAO-13-530](#) (Washington, D.C.: July 22, 2013).

²Lethality refers to the ability of the ship to destroy enemy targets.

³The term “frigate” can be applied to ships of different sizes and capability. The now-retired Oliver Hazzard Perry class frigate (FFG 7) was the last U.S. Navy frigate. The task force identified frigates—including the FFG 7—as typically being an open-ocean, multi-role ships capable of performing surface, anti-submarine, and anti-air warfare.

In November 2014, the Navy recommended buying a small surface combatant (SSC) based on an LCS design with minor modifications. The Navy refers to this ship as a frigate. Secretary Hagel approved the Navy's plan and, in December 2014, authorized the Navy to buy a mix of 52 LCS and frigates with the mix determined by the Navy. Combined, LCS and the frigate will represent approximately one-sixth of the Navy's entire 300-ship fleet. The Navy moved forward with plans to acquire 20 frigates and intended to begin frigate production in 2019 after the first 32 LCS were completed. However, in December 2015, Secretary of Defense Ashton Carter provided new direction to the Navy. Citing concerns with the Navy's balance between capability and quantity of platforms, he directed a number of actions, including that the Navy would buy only 40 LCS and frigates—a reduction of 12 ships.

Since 2005, we have raised many concerns about the Navy's acquisition of LCS, including its combat effectiveness and decreased expectations of its capability. In July 2013, we highlighted the program's risk of cost growth, schedule delays, and technical problems related to delivering intended capabilities. Most recently, in December 2015, we concluded that the lethality and survivability of LCS is still largely unproven, and that important questions remain about how LCS will operate and what capabilities it will provide the Navy. The House Armed Services committee report for the National Defense Authorization Act for Fiscal Year 2015 included a provision that we examine a number of elements related to the task force's work—including whether the study equated to a formal analysis of alternatives—and the Navy's future SSC plans. This report examines: (1) the task force's process for doing its study and the findings presented to Navy leadership; (2) how the Navy arrived at its preferred solution of a modified LCS for its future SSC and the extent to which this solution will address survivability and lethality concerns, and (3) the potential risks associated with the Navy's approach to acquiring the SSC and continued procurement of LCS.

To conduct our work, we analyzed the task force's February 2015 final report and associated classified and unclassified appendices and working papers. We conducted interviews with task force members, including several interviews with the study director. We also consulted with Navy and Office of the Secretary of Defense (OSD) subject matter experts on the study's inputs and conclusions, as well as Office of Cost Analysis and Program Evaluation (CAPE) and Office of the Director, Operational Test and Evaluation (DOT&E) officials who had been asked to assess the task force study and the Navy's decision. To assess any potential risks associated with continued procurement of LCS, we analyzed LCS

contracts and contract modifications, as well as production data related to cost and schedule performance for LCS currently in production. We also interviewed officials from the LCS program office and shipyard representatives from Lockheed Martin and Austal USA, where the LCS variants are being constructed. To assess any potential risks associated with the procurement of the future frigate, we analyzed frigate requirements documentation and available design-related documentation, as well as the preliminary acquisition documentation, and we interviewed officials from the frigate program office. For more information on our scope and methodology, see appendix I.

We conducted this performance audit from April 2015 through June 2016 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives, and that the data we obtained and analyzed are sufficiently reliable for the purposes of our assessment.

Background

LCS is intended to be a reconfigurable ship that can perform one of three different primary missions at one time: mine countermeasures (MCM), surface warfare (SUW), and anti-submarine warfare (ASW). This ability to conduct only one primary mission at a given time is called a single-mission capability. The LCS consists of two distinct parts—the ship itself (called a seaframe) and the interchangeable package of sensors, weapons, and aircraft that it carries and deploys (called a mission package), which enables one of the three primary missions. The mission packages provide the majority of the ship's combat capability. The Navy envisioned LCS as a “truck” that could swap payloads to reconfigure its capabilities based on mission needs. LCS also has a minimal crew size compared to other ships, with much of its maintenance and support performed on shore instead of onboard by the crew.

Two shipyards are currently building an equal number of two different versions of the LCS seaframe: Lockheed Martin—which builds its ships at Fincantieri Marinette Marine in Marinette, Wisconsin—and Austal USA,

which builds its ships in Mobile, Alabama.⁴ This report refers to the Lockheed Martin ships as the Freedom variant and the Austal USA ships as the Independence variant. The two designs reflect different contractor solutions to meeting the same set of performance requirements. The most notable difference is that the Freedom variant (LCS 1 and other odd-numbered seaframes) is a monohull design with a steel hull and aluminum superstructure, while the Independence variant (LCS 2 and other even-numbered seaframes) is an aluminum trimaran.⁵ The Navy had planned to award contracts for 6 additional LCS seaframes in 2017 and 2018 and transition to the frigate on the 33rd seaframe; however, recent direction from the Secretary of Defense to reduce the total number of seaframes from 52 to 40 has changed this plan. Table 1 shows the status of LCS seaframe acquisition as of February 2016.

Table 1: Status of Littoral Combat Ship and Frigate Production as of February 2016

Hull	Status
LCS 1-6	Delivered
LCS 7-24	Under contract; 7-24 funded in fiscal years 2011 through 2015. ^a
LCS 25-26	Under contract; funded in fiscal year 2016.
LCS 27-28	Funding requested in fiscal year 2017.
LCS 29	Navy intends to request funding for one ship in fiscal year 2018.
LCS/frigate beyond LCS 29	Navy currently intends to request one ship in fiscal years 2019 and 2020, and two ships in fiscal year 2021.

Source: GAO analysis of Navy programmatic and budgetary data. | GAO-16-356

^aLCS 23 was partially funded with advanced procurement money in fiscal year 2015; the majority of the balance was funded in fiscal year 2016.

⁴For LCS 2 and LCS 4, General Dynamics/Bath Iron Works was the prime contractor for the Austal USA-built ships. General Dynamics and Austal USA ended their teaming arrangement in 2010. Austal USA is the prime contractor for the 10 other even-numbered seaframes currently under contract.

⁵A trimaran is a ship that has three separate hulls.

Our Prior Work

Since 2005, we have reported on a number of issues with the LCS program.⁶ In addition to highlighting concerns about the ship's combat capabilities, we have also reported on significant changes to the Navy's acquisition strategy for buying LCS. For example, as we reported in 2010, the Navy announced that, following unsuccessful contract negotiations for fiscal year 2010 funded seaframes, it would switch from its plan to continue buying both ship designs and move to a downselect approach, where one shipyard would be awarded contracts for future LCS. Following approval of this strategy in January 2010, the Navy issued a new solicitation—intended to lead to a downselect—for fiscal year 2010 seaframes. However, in November 2010, following receipt of new industry proposals, the Navy proposed changing its acquisition strategy back to awarding new construction contracts to both industry teams. Congress approved this approach in December 2010.

In July 2013, we highlighted a number of risks related to the LCS program, including cost growth, schedule delays, and technical problems related to delivering intended capabilities.⁷ We found that the LCS concept has changed significantly over time due, in large part, to problems associated with technology development and integration, and we questioned the soundness of the Navy's business case for continuing to buy LCS seaframes and mission packages given the unknowns related to its ability to address key warfighting and support concepts. Due to these unknowns, we asked Congress to consider restricting future funding for construction of LCS seaframes until the Navy conducted certain technical studies and reported on the relative strengths and weaknesses of both seaframe variants. We also recommended that the Navy only buy the minimum quantity and rate of LCS required to maintain the production base and mission modules to support operational testing. DOD did not agree with our recommendation to slow the procurement of either LCS seaframes or mission packages, citing in part industrial base considerations. Congress did not restrict funding, but directed the seaframe variant assessment. As we reported in December 2015, however, the resulting report was not adequately detailed.⁸ The Navy

⁶[GAO-05-255](#).

⁷[GAO-13-530](#).

⁸[GAO-16-201](#).

essentially suggested that since the two variants are built to the same requirements they perform the same way. The Navy did not present a more detailed comparison that would address our recommendation.

Elements of Ship Survivability

Susceptibility is the degree to which a ship can be targeted and engaged by threat weapons. Some ways of improving a ship's susceptibility include avoiding or defeating a threat by using a combination of tactics, countermeasures, and self-defense systems.

Vulnerability is a measure of a ship's ability to withstand initial damage effects from threat weapons and to continue to perform its primary warfare mission areas.

Recoverability is a measure of a ship's ability to take emergency action to contain and control damage, prevent loss of a damaged ship, minimize personnel casualties, and restore and sustain primary mission capabilities.

Source: Navy documentation. | GAO-16-356

In July 2014, we found that key LCS concepts remained untested and concurrency risks—continuing to buy ships while key concepts and performance are still being tested—remained.⁹ We also found that the Navy and its shipyards were having difficulty managing the weight of the seaframes, which can create potential complications for making additional changes to each seaframe design, and that weight growth during construction had negatively affected performance of the initial LCS seaframes. We have also reported that the Independence variant was behind the Freedom variant in terms of overseas deployment experience, with an Independence variant yet to deploy.¹⁰ In that report, we recommended that before approving the release of the request for proposals (RFP) for future contracts for either seaframe variant, the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)) require that both variants have deployed overseas and completed certain testing, including testing of the ships' lethality and survivability. We also recommended the Navy take steps to improve its ability to effectively oversee weight management of the LCS seaframes. DOD partially agreed with our recommendations to complete deployment activities and testing before approving the release of the request for proposals for future seaframes and agreed with our recommendations related to seaframe weight management. To date, certain LCS test events remain incomplete or the Navy has not yet provided test results to Congress and GAO.

⁹GAO, *Littoral Combat Ship: Additional Testing and Improved Weight Management Needed Prior to Further Investments*, [GAO-14-749](#) (Washington, D.C.: July 30, 2014).

¹⁰GAO, *Littoral Combat Ship: Deployment of USS Freedom Revealed Risks in Implementing Operational Concepts and Uncertain Costs*, [GAO-14-447](#) (Washington, D.C.: July 8, 2014).

In December 2015, we issued an unclassified version of a classified July 2015 report that identified concerns with elements of LCS lethality and survivability.¹¹ Survivability is the ability of a ship to avoid, withstand, or recover from damage. It consists of three elements: susceptibility, vulnerability, and recoverability. We found that the lethality and survivability of both LCS variants is still largely unproven. We also found that the Navy lacks a full understanding of LCS vulnerability, particularly with respect to the Independence variant's aluminum hull.¹² In this report, we asked Congress to consider restricting funding for LCS construction in 2016 and beyond until the Navy submitted an acquisition strategy for the frigate that was approved by the Secretary of Defense; a plan to upgrade the existing LCS and an analysis of the cost and engineering feasibility and risks of doing so; and report on the results of a rough water trial report for both variants.¹³ We also recommended that the Secretary of Defense direct the Navy to investigate more operationally stressing mission package testing and solicit an independent technical assessment on Independence variant survivability. DOD largely agreed with our recommendations. Congress funded three LCS in fiscal year 2016 as requested by the Navy but limited obligation of the funds until the Navy submitted an acquisition strategy, a plan to upgrade LCS, and a current LCS test and evaluation master plan. The Navy provided this documentation.

Navy Small Surface Combatant Study

In March 2014, following the then-Secretary of Defense's February announcement requiring the Navy to conduct a study of its SSC needs, the Chief of Naval Operations (CNO) and Assistant Secretary of the Navy for Research, Development, and Acquisitions created the task force to lead the study. This task force was organized under a study leader, and the CNO initially assigned seven Navy officers and one Navy civilian also set up a flag officer/senior executive service advisory group that provided

¹¹[GAO-16-201](#).

¹²[GAO-16-201](#).

¹³This testing is done to characterize the performance of ships in rough water.

input and advice, as required.¹⁴ The study leader subsequently broadened the task force membership, drawing on a number of Navy experts that were assigned to sub-groups that focused on issues like ship designs, combat systems, cost estimation, and other related areas to identify feasible design approaches. The task force final report, issued in February 2015, stated that the team included over 40 engineers and scientists, requirements analysts, and cost analysts from across naval systems commands and warfare center communities.

The task force was directed to consider new and existing ship design options, to include modified LCS design options. The task force created two categories of LCS modifications: one, labeled “minor modified LCS,” that kept the same basic hull, mechanical, and electrical characteristics as the two LCS variants, and another labeled “major modified LCS” that lengthened the hulls to provide for adding new capabilities. New designs reflected designs of ships conceived of and configured by the task force, while existing designs included various non-LCS options offered by both U.S. and international shipbuilders. Senior Navy leadership also directed the task force to conduct a comparison of the capabilities of the most recent U.S. Navy frigate—the now-retired Oliver Hazzard Perry class (FFG 7)—with those of LCS. The task force also developed what it called “capability concepts,” which reflected a range of potential capability options for an SSC and on which it modeled various designs. The Secretary of Defense announced in December 2014 that the department would pursue a minor modified LCS as the SSC (termed a frigate), and the task force produced its written report in February 2015.

Secretary of Defense Directed Program Truncation

In December 2015, the Secretary of Defense issued a memorandum to the Secretary of the Navy in which he stated that the Navy would build no more than 40 LCS and frigates, down from the prior planned 52, and directed the Navy to buy 8 fewer of these ships over the next 5 years than planned. Specifically, the Secretary of Defense directed the Navy to buy a

¹⁴According to the CNO’s tasking memo, this executive board included the Program Executive Officer (PEO) for LCS, a senior executive service official from Fleet Forces Command, the Naval Sea Systems Command Executive Director, the Deputy Assistant Secretary of the Navy for Ships, the head of the Surface Warfare directorate (N96) at the Office of the Chief of Naval Operations (OPNAV), the PEO for Integrated Warfare Systems, and a representative from OPNAV N8 (Integration of Capabilities and Resources).

single LCS or frigate in fiscal years 2017 through fiscal year 2020 and two ships in fiscal year 2021. According to the Secretary of Defense's memorandum, this new direction was in part a response to his concern that the Navy was prioritizing ship numbers over lethality. Further, the Secretary stated that the Navy would be required to downselect to one variant of LCS and frigate by fiscal year 2019, rather than continuing to buy two different variants.¹⁵ Although the procurement profile outlined in the Secretary of Defense's direction called for one ship in fiscal year 2017, the President's fiscal year 2017 budget requested two LCS.

After Extensive Analyses, Task Force Found Minor Modified LCS Was Least Capable Option for Meeting Desired Small Surface Combatant Capabilities

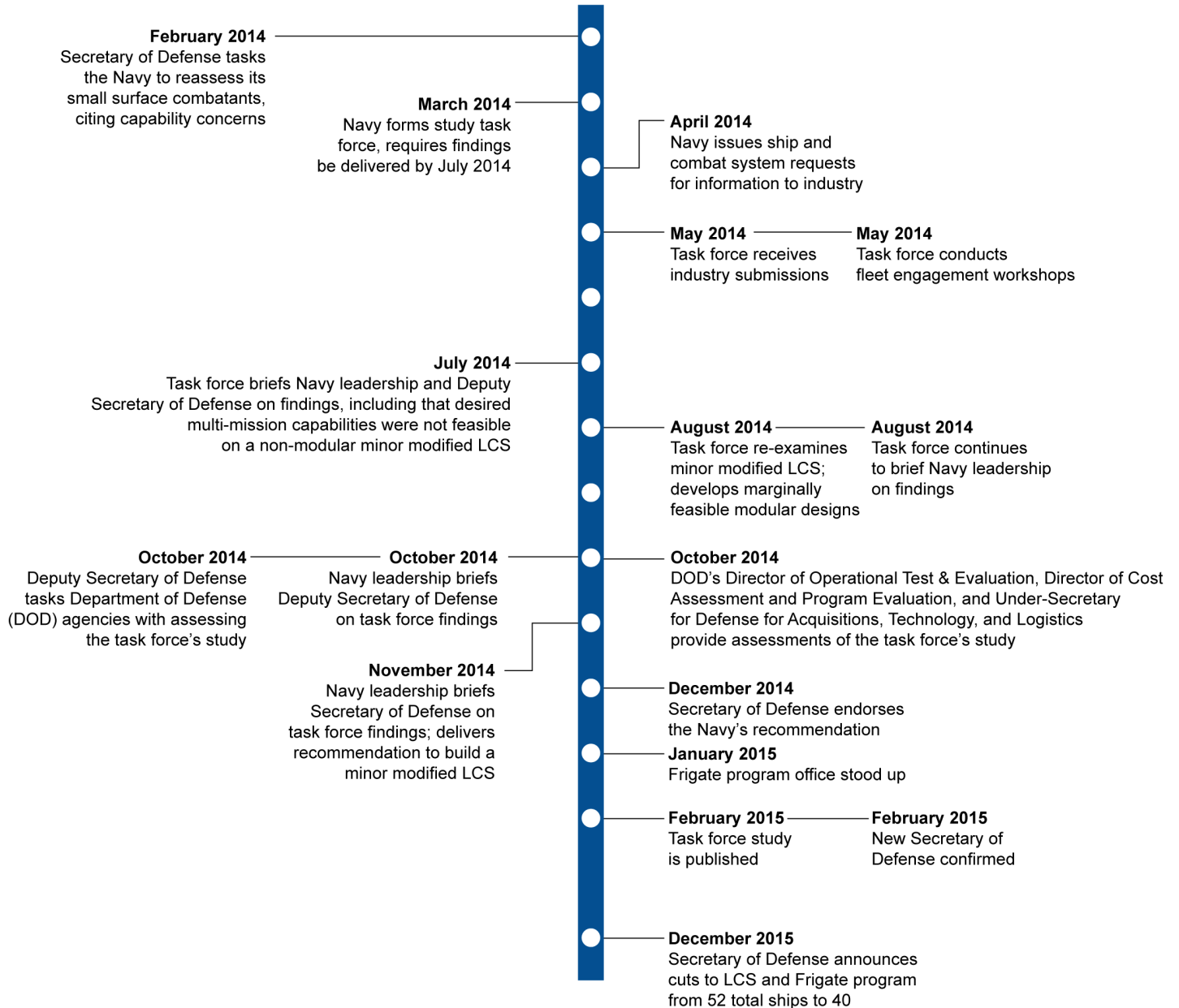
We found that the task force conducted an extensive analysis of existing, modified, and new design options for the Navy's new planned SSC, especially given its limited timeframe. The task force was not directed to conduct an analysis of alternatives (AOA) that is typically used to determine a materiel solution to a capability gap. Senior Navy leadership told us that they believe the process the task force used was more in-depth than an AOA; for example, one component of the task force process was to gather input directly from fleet operators. The task force initially found that a minor modified LCS was the least technically feasible and capable option for meeting the Navy's desired SSC capabilities. After the task force briefed senior Navy leadership in July 2014, the task force was asked to examine what capabilities a minor modified LCS could fulfill. With consideration for the range of desired enhanced performance and capabilities for the SSC as identified by the fleet representatives, the task force subsequently identified additional minor modified LCS options, though these options would also require accepting reduced weight and other design margins to accommodate the changes. These alternate LCS options offered reduced capabilities as compared to some capability concepts the task force had initially identified, as capabilities had to be downgraded to accommodate the design constraints of the minor modified LCS.

¹⁵We and others have noted the challenges posed by maintaining two different seaframes as well as the costs associated with developing and executing two separate training pipelines for LCS crews.

Task Force Conducted an Extensive Analysis Given Time Constraints

The task force conducted an extensive analysis of design and capability alternatives and analyses of total life-cycle costs for potential SSC options, especially given the compressed time frame given by Navy leadership. In his February 2014 tasking memo, Secretary Hagel directed the Navy to report back to him in approximately one year so that the results could inform the fiscal year 2016 budget process. The CNO subsequently told the task force to deliver its findings to his office in July 2014, approximately 4 months after the task force was formed. The final task force report was published in February 2015, after a series of senior level briefings and the Secretary of Defense's December 2014 decision to pursue a minor modified LCS as the SSC, which the Navy has termed a frigate. The Navy established a frigate program office in January 2015, under the current LCS Program Executive Office. Figure 1 illustrates the compressed time frames of these events.

Figure 1: Timeline of Task Force Process



Source: GAO analysis of Navy data. | GAO-16-356

Study Was Not an Analysis of Alternatives Though Purpose Was Similar

While the task force did not conduct an AOA, it was directed to investigate potential materiel solutions to satisfy a capability gap. According to the DOD's Defense Acquisition Guide, an AOA is an analytical comparison of the operational effectiveness, suitability, and life-cycle cost (or total ownership cost, if applicable) of alternatives that satisfy established capability needs. Secretary Hagel did not specify the type of analysis he expected, and the time allotted to complete the study was significantly shorter than typical AOA time frames, which we have previously reported typically require an average of 18 months to complete.¹⁶ Task force and senior Navy officials told us that the study was intended to serve a similar purpose as an AOA, and that they believed their process was more robust than other AOAs with which they had been involved. They cited the direct engagement with the fleet representatives, discussed further below, as a key innovation.

Nevertheless, the task force study differed from an AOA in two ways:

- Major defense acquisition programs are required by statute to certify that they have had an AOA performed consistent with study guidance developed by CAPE before requesting approval to enter the technology maturity and risk reduction phase (which begins after successful completion of a milestone A review) or engineering and manufacturing development phase (which follows successful completion of a milestone B review).¹⁷ The task force did not solicit CAPE study guidance, which is used to prepare an AOA study plan describing the intended methodology for the management and execution of the AOA. This guidance is also used to evaluate the final study to determine whether it met defined evaluation criteria, including if the methodology was sound and whether the recommendations of the AOA are supported by the analysis. Senior Navy officials told us that an executive leadership board helped oversee the task force and that having a CAPE member on this board equated to similar

¹⁶GAO, Defense Acquisitions: *Many Analyses of Alternatives Have Not Provided a Robust Assessment of Weapon System Options*, [GAO-09-665](#) (Washington, D.C., Sept. 24, 2009). The task force was initially given four months to perform its analysis. Ultimately eight months elapsed between the start of the task force, and the Navy's recommendation to the Secretary of Defense.

¹⁷10 U.S.C. § 2366a and 10 U.S.C. § 2366b. CAPE's mission is to provide DOD with reliable and independent analysis of programs to assist decision makers.

involvement. However, CAPE officials involved in the task force study told us that they were given only limited and brief access to some of the task force documentation, and only near the end of the process.

- Traditional AOAs also require a Joint Staff assessment of proposed requirements to ensure that the analysis includes only approved requirements that are valid and unmet by other materiel solutions. While the task force had the involvement of a senior Joint Staff official on its executive board, there was no formal Joint Staff assessment of the requirements.

Task Force Identified Small Surface Combatant Capabilities and Requirements

Working within its limited timeframe, the task force developed extensive analyses related to identifying and developing the potential capabilities of an SSC and subsequent performance requirements. The task force identified potential missions for an SSC by reviewing existing domestic and foreign “frigate-like” ships,¹⁸ Navy force structure analysis, the theater threat environment described by Navy campaign analysis for the 2025 timeframe, and by soliciting fleet feedback.

Defining Capability Concepts

The task force initially produced 192 “capability concepts” for an SSC. These capability concepts consisted of four components:

- primary mission areas (like SUW, ASW, and anti-air warfare, or AAW),
- enabling capabilities (like range and speed),
- a concept of operations (describing the roles and tasks an SSC would be asked to fulfill, such as providing high value unit escort, and participating in carrier strike group operations), and
- concept requirements (specific requirements for an SSC to fulfill the given capability concept).

¹⁸The task force considered an array of different frigate-like ships that ranged in both size and capability. It eliminated options that were not capable enough and those that had capability more in line with a large surface combatant. For example, the task force did not consider ships that were unable to deploy outside of the continental United States due to fuel and range restrictions. Similarly, the task force did not consider adding a ballistic missile defense capability since this is a capability associated with large surface combatants.

In determining capability concepts, the task force also analyzed the capabilities of the now-retired FFG 7 class of frigates, which were the most recent U.S. Navy frigate design. In his memo establishing the task force, the CNO specifically asked the task force to create a baseline of the capabilities of this ship class.

The task force refined these concepts by considering a broad range of solutions and then systematically eliminating those solutions determined to be unsuitable, not feasible, or involving unacceptable risks.

Fleet Operators Asked to Prioritize Capabilities

Capability within mission areas is divided into three levels

- Self-defense capability: ship can defend itself against close-in threats.
- Local capability: ship can defend other ships against threats and attack targets within a medium range
- Area capability: ship can defend other ships and attack targets within a larger range. For SUW systems, area capability is defined as over-the-horizon.

Source: GAO analysis of Navy documentation. | GAO-16-356

The task force consulted with Navy leadership and experts, as well as with fleet operators, to help narrow down the capability concepts. In the fleet engagement sessions, approximately 60 experienced operators from both the Atlantic and Pacific Fleets were given a set of performance capabilities—like speed, range, over-the-horizon SUW capability—and told to prioritize them. In order to represent resource constraints and drive prioritization decisions, the task force gave the fleet participants an ever-diminishing budget represented by poker chips that they could spend to acquire capabilities. The capabilities were weighted; for example, ASW, local AAW, and vulnerability improvements were among the most costly. This weighting process meant that the operators would have to pass over some capabilities for those they valued more. For example, the Atlantic and Pacific fleet representatives opted to keep local AAW capability, even when it meant sacrificing ASW capability. The operators were then told to do this same exercise several more times, but they were provided fewer poker chips to represent further resource constraints. By the third reduction, operators no longer had enough chips to opt for local AAW or ASW.¹⁹

Capability Concepts Narrowed to Eight

Ultimately, this fleet engagement process, coupled with consultation with Navy leadership, including Commanders of U.S. Fleet Forces Command, U.S. Pacific Fleet, 3rd, 4th, 5th, 6th, and 7th Fleets and Naval Surface

¹⁹Local AAW was featured in five of the eight capability concepts, and almost all of the 23 existing designs the task force assessed could provide local AAW, although some of these ships would be considerably larger than LCS—upwards of 6,000 metric tons displacement (small destroyer sized) compared to the approximately 3,400 metric tons displacement of LCS.

Forces, helped the task force narrow the 192 capability concepts down to 8. These 8 concepts, depicted in Figure 2, represented a range of acceptable small surface combatant capabilities, with capability concept 8 being the most capable.

Figure 2: Eight Ultimate Capability Concepts (CC) in Small Surface Combatant Study

Mission area capabilities	CC 1	CC 2	CC 3	CC 4	CC 5	CC 6	CC 7	CC 8
Self-defense against air, surface, undersea threats	●	●	●	●	●	●	●	●
Local surface warfare		●	●	●	●	●	●	●
Over-the-horizon surface warfare					●	●	●	●
Anti-submarine warfare	●		●	●			●	●
Local anti-air warfare	●	●		●		●		●

CC = Capability concept

Source: GAO analysis of Navy data. | GAO-16-356

The task force then created top-level requirements documents for each of the eight capability concepts. These requirements captured the preliminary SSC requirements for a given capability concept, and according to the task force could provide the basis for more detailed requirements development for the selected SSC solution.

Assessment of Designs and Combat Systems to Meet Capability Options

Secretary Hagel’s February 2014 tasking directed the task force to investigate potential SSC options based on three categories: (1) new ship designs, (2) modifications to existing ship designs, and (3) modified LCS designs. The task force took two approaches to the modified LCS concepts:

- minor modifications to each LCS variant, where the dimensions of the ship were unchanged, and
- major modifications, where the hulls were lengthened and other physical dimensions changed.

The task force developed and assessed the technical details of over 600 modified LCS designs.

The task force also conducted a market research survey and issued two requests for information to industry to solicit inputs on potential modifications to existing ship designs and combat systems. According to the task force report, these requests generated responses from 48 companies on 161 systems (including 24 full ship designs), though the information varied in level of detail and some was too high-level to be useful without more extensive follow-up. Using this information, combined with open source research of frigates in service with foreign navies, the task force identified 23 existing frigate-type ship designs.

For new designs—which provide the most flexibility—the task force used statistical analysis software to assess the most likely cost and characteristics of over 19 million potential ship designs. The task force also produced over 90 cost estimates across the different design variations.

All designs from each category were assessed on their ability to fulfill one of the eight capability concepts. According to the task force documentation, a design was considered technically “feasible” if it could physically accommodate the systems and equipment on the ship and retain pre-determined service life allowances for space, weight, power, cooling, and stability.²⁰ The task force considered a design “marginally feasible” if it allowed for adequate space and was able to retain estimated service life allowances that were less than the design goal but greater than zero. If there was not adequate space or service life allowances were zero or worse, the design was deemed “infeasible.”

The task force also conducted an analysis of combat system capabilities, using in part the information it gathered from the industry request for information and also information from current Navy systems. In all, the task force assessed over 50 currently available combat system elements. These elements included areas such as sensors (e.g., radars and sonars), command and control systems (e.g., combat management

²⁰The Navy retains weight and center of gravity allowances to enable future changes to the ships, such as adding equipment and reasonable growth during the ship’s service life without unacceptable impacts on the ship. Center of gravity is defined as the height of the ship’s vertical center of gravity as measured from the bottom of the keel, including keel thickness. Weight and center of gravity are closely monitored in ship design due to the impact they can have on ship safety and performance.

systems), and weapons (e.g., guns and missiles). The task force then defined and assessed over 2,300 possible combinations of these combat system elements to identify technically feasible means of fulfilling the 8 capability concepts. As part of this analysis, the task force identified the likely weight and power demands of each combination.

Task Force Identified Minor Modified LCS as the Least Technically Feasible and Capable Option

As it conducted its analysis, the task force found that a minor modified LCS (of either variant) was the least technically feasible of meeting any of the 8 capability concepts among all of design categories that it considered, as shown in figure 3 below.

Figure 3: Initial Small Surface Combatant Task Force Assessment of Design Categories, by Capability Concept (CC)

Ship design	CC 1	CC 2	CC 3	CC 4	CC 5	CC 6	CC 7	CC 8
Minor modified LCS	○	●	●	○	○	●	○	○
Major modified LCS	●	●	●	●	●	●	●	●
Modified existing design	●	●	●	●	●	●	●	●
New design	●	●	●	●	●	●	●	●

- Task force found the design was not feasible to meet capability requirements
- Task force found the design was marginally feasible to meet capability requirements
- Task force found a design was finally feasible to meet capability requirements

CC = Capability concept
 LCS = Littoral Combat Ship

Source: GAO analysis of Navy data. | GAO-16-356

An example of an existing design was a modified U.S. Coast Guard National Security Cutter. The task force found that this option—in addition to the major modified LCS—could provide a full multi-mission capability, would provide greater weight and other margins which would allow for future upgrades, and have greater range and underway days. The National Security Cutter option could also provide local anti-air warfare capability.

According to task force documentation, inherent space, weight, power, and cooling constraints of the minor modified LCS designs prevented this

option from providing the full multi-mission ASW and SUW capabilities that the task force identified as most valued by the fleet for an SSC. Even after considering multiple design iterations for each LCS variant (13 for the Freedom variant and 8 for the Independence variant), the task force found that it was impossible to fit ASW and local AAW combat systems on a minor modified LCS hull while retaining necessary weight and center of gravity margins, which are necessary to ensure that the ship has the needed stability characteristics.

The task force also determined that a minor modified LCS could not be modified to the level of vulnerability resistance of the FFG 7 due to LCS weight and design constraints that would prevent adding more physical structure. For example, Navy task force officials told us that approximately 200 tons of additional weight in steel would need to be accommodated in the LCS seaframe designs if the Navy wanted to upgrade it from commercial build standards to more robust, Navy-like specifications like those used for FFG 7. Task force officials told us that this weight increase would have required a major modification to the LCS design or a new ship design.

The task force found that the major modified LCS and existing designs would also need significant modifications to improve their vulnerability qualities, but unlike the minor modified LCS, these changes were considered technically feasible. Additionally, the task force found that none of the existing designs could meet the survivability requirements for vulnerability and recoverability without extensive redesign, though the study report does not state if these changes are technically feasible for each design considered.

Navy Leadership Directed Task Force to Identify More Feasible Minor Modified LCS Options

In July 2014, near the end of its analysis, the task force briefed senior Navy leadership that the task force concluded that a minor modified LCS would be incapable of delivering some of the eight capability concepts. Task force officials told us that senior Navy leadership directed them to explore what capabilities might be more feasible on a minor modified LCS. According to task force officials, Navy leadership told them to only focus at this point on capability concept 7. As shown in figure 2 above, this concept did not include a local AAW capability.

Because the minor modified LCS was judged not feasible for capability concept 7, the task force then had to consider what trade-offs could be made to create the needed space and weight to develop marginally feasible options. The task force created two additional minor modified

LCS options for which it would be marginally feasible to meet a revised version of capability concept 7 that was less capable than the original concept. These options would retain the modular mission packages characteristic of the LCS program, but add some systems to provide a limited multi-mission capability instead of the single-mission capability of LCS. For example, the task force found that it was feasible to permanently install an over-the-horizon missile on both LCS variants to offer over-the-horizon SUW capability, plus a lightweight towed torpedo countermeasure and multi-function towed array sonar to offer some ASW capability.²¹ But this option would still need to be augmented by an LCS SUW or ASW mission package to provide the full suite of capability (adding 30mm guns and Hellfire missiles for SUW, or the variable depth sonar and torpedoes for ASW). The task force found that it was not technically feasible to include additional vulnerability capabilities beyond adding armor protection to some vital spaces.

The task force documentation stated that in developing these alternate minor modified LCS options, it had to trade some capabilities like speed, range, and the number of rigid hull inflatable boats the ships could carry. In some instances, these trade-offs resulted in capabilities equal to or below the capabilities expected with the current LCS. However, according to the task force, these trades were thoroughly assessed and deemed acceptable to the warfighter by the fleet, though the report is not specific as to how this determination was reached. Table 2 shows several examples of these trade-offs and how they compare to current LCS requirements.

²¹The lightweight towed torpedo countermeasure is a towed decoy that emits signals to draw a torpedo away from its intended target. The multi-function towed array sonar is a towed receive array sonar with a deployment and retrieval cable that is used to detect acoustic energy from ships and submarines. Both these systems are planned for the LCS ASW mission package.

Table 2: Capability Trade-Offs for Minor Modified Littoral Combat Ship (LCS) Alternatives

Capability area	Initial Capability Concept 7	Revised capability concept for minor modified LCS		Current LCS requirements	
		SUW package installed	ASW package installed	SUW package installed	ASW package installed
Anti-Air Warfare	Self-defense	Self-defense	Self-defense	Self-defense	Self-defense
Surface Warfare (SUW)	Self-defense, local, and over-the-horizon	Self-defense, local, and over-the-horizon	Self-defense and over-the-horizon ^a	Self-defense and local	Self-defense a
Anti-Submarine Warfare (ASW)	Local/Area	Limited local/area ^b	Local/Area	None	Local/Area
Rigid hull inflatable boats used for tasks including boarding other vessels	2		1	3	1
Multi-mission capability	●		◐		○
Underway days	30		14		14
Endurance speed (knots)	16		14		14
Range (nautical miles)	4000		2860–3360		3500
Aviation support	2 helicopters or 1 helicopter and Unmanned Aerial Vehicles		1 helicopter		1 helicopter

Legend

- Full: Meets full requirement for both surface warfare and anti-submarine warfare missions with no additional mission packages.
- ◐ Partial: Meets one of the two mission areas, depending on the mission package installed. The other mission area would be partially met.
- None: Provides capability in one mission area at a time, depending on the mission package installed.

Source: Navy documentation. | GAO-16-356

^aThe permanently installed 57mm gun provides some local SUW capability, but cannot meet the full requirement without adding the SUW mission package.

^bThe task force found it could add a lightweight towed torpedo countermeasure and multi-function towed array sonar as permanent seaframe equipment, which would provide some local and area ASW capability. However, the full ASW capability would come with the ASW mission package, which adds the variable depth sonar and torpedoes.

In some cases, the trade-offs made to accommodate the minor modified LCS were significant. For example, during the fleet engagement process, the operators consistently prioritized a range of 4,000 nautical miles and 30 underway days, and the task force analysis also found that a range of 4,000 nautical miles was needed for an SSC. Accommodating a minor modified LCS would result in as much as a 30 percent reduction in range, but the task force did not provide analysis of the operational impact of reducing the speed and range requirements. It is not clear, for example,

what impact, if any, there would be on maintaining a forward presence after a reduction in the range and speed. We previously reported that fleet users in the Western Pacific identified concerns with the current LCS's limited range and the demands this might place on the limited number of refueling platforms.²²

By Selecting a Minor Modified LCS, the Navy Prioritized Affordability and Schedule over Higher Levels of Combat Capability Compared to Current LCS

Based on analysis provided by the task force, the Navy recommended—and Secretary Hagel approved—procuring an SSC (termed a frigate) based on a minor modified LCS. In making its recommendation, the Navy prioritized cost and schedule considerations over the fact that a minor modified LCS was the least capable option considered. However, certain cost assumptions made by the task force may have overstated the minor modified LCS' relative affordability as compared to other options. The Navy's decision was also based on a desire to start production of the first frigate in 2019, and without a break in production at the LCS shipyards. The Navy noted in its recommendation that the minor modified LCS will provide improvements in combat capability over the current LCS fleet—specifically due to its multi-mission capability. However, the frigate will have similar capability in most areas as the current LCS; many of the performance requirements for the frigate are the same as LCS requirements. As noted, some of the improvements led to lowering some capabilities for the frigate, such as range. Moreover, a minor modified LCS will not fully address all lethality and survivability concerns raised by the former Secretary of Defense. DOT&E identified some of these concerns in its reporting on the planned frigate program. Namely, the planned frigate will not have significant improvements to AAW capability or to reducing the vulnerability of the ship to sustaining damage as compared to the current LCS.

²²[GAO-14-749](#).

Navy Estimates a Minor Modified LCS Will Cost Less, but Cost Estimate May Overstate Its Affordability Compared to Other Ship Options

In making the decision to choose the minor modified LCS as the new SSC, senior Navy officials told us that they weighed capability, cost, and schedule considerations with affordability considerations as a key factor. In an assessment of the Navy’s decision, USD(AT&L) concluded that while more capable solutions exist, the Navy could likely not afford a solution much more costly than what the Navy ultimately recommended.

The task force found that a minor modified LCS has the lowest lifecycle costs of all the design alternatives it considered.²³ Table 3 depicts the comparative costs identified in the task force report for the design options equipped with the mix of combat capabilities ultimately selected by Navy leadership (referred to as capability concept 7).

Table 3: Comparison of Costs for Small Surface Combatant Options (in 2014 dollars)

Small surface combatant design option – Capability Concept 7	Total life-cycle cost estimate (dollars in billions)	Lead ship procurement cost estimate (dollars in millions)	Average follow ship procurement cost estimate (dollars in millions)	Annual operations and sustainment costs estimate (dollars in millions)
Minor modified LCS	42-44	732-754	613-631	59-62
Major modified LCS	54-57	914-945	754-754	77-84
Existing design	57	1,100	840	80
New design	57	1,813	843	74

Source: Navy documentation. | GAO-16-356

The Navy also noted that the minor modified LCS solution would not negatively impact LCS training and support infrastructure; in its memo recommending a minor modified LCS option, the Navy wrote that a minor modified LCS would maximize the operations and support investments made to date, including shore-based trainers and maintenance facilities, which would also avoid some potential costs that might be required for other options.

²³Lifecycle costs include research, development, test and evaluation, procurement, operations and support, and disposal costs.

While large ships and new designs tend to be more expensive than smaller ships and repeat designs, we found that the task force study's cost estimating methodology and assumptions used to create these estimates may have overstated the affordability of LCS compared to the costs of other options. This is due to the assumptions the task force made about: (1) the contracting strategy of maintaining two shipyards instead of down-selecting to one, and (2) crew size and manning profiles.

First, we found inconsistencies in the task force's assumptions about whether the frigate would represent a single, down-selected LCS variant or whether both LCS variants would be modified. Specifically, the task force cost analysis assumed that the Navy would select a single variant of an LCS-based frigate. However, the task force's separate analysis examining programmatic plans and considerations for each ship design concept assumed that the Navy would build both variants of the minor modified LCS, consistent with the LCS program to date. A lead task force cost analyst told us that if there were no downselect to a single SSC variant, costs for a minor modified LCS would be higher for several reasons: the construction costs for building two—rather than one—lead ships; reduced quantities of follow on ships for each yard; and the cost of testing two different hulls. This analyst explained that the task force used the assumption of a downselect because it provided a simpler cost comparison. While the task force's overall conclusion that a minor modified LCS would be less expensive than the other options is likely accurate based on the data provided in the workpapers, the magnitude of cost differential for procurement costs between minor modified LCS and the other options is overstated in the event that the Navy continues with two variants. The task force did not document difference because task force officials told us that it was not a part of their original tasking to estimate the costs of a non-downselect option, and therefore such analysis was not conducted or included as a part of the final report.

Second, we found that when estimating the cost of new and existing designs, the task force made assumptions related to crew size that resulted in the non-LCS options appearing more costly by comparison. Specifically, we found that the task force produced a manning estimate for each design concept, but when it then estimated costs it assigned crew sizes to the non-LCS options that were considerably higher than even the upper range identified in the manning estimates. Conversely, the cost estimators assigned a notional crew size that was within the manning estimate range for the major and minor modified LCS options. This approach made the non-LCS design options appear more costly. Task force officials told us that they chose more conservative manning

estimates for the non-LCS designs than what it initially identified based on a detailed, bottom-up analysis but did not provide any additional information on this analysis.

We also found that while the task force created estimates of potential crew sizes—including a reduced manning profile—a concept currently used on LCS as a cost reduction measure—for the ship options, it used the reduced manning profile to estimate costs for the minor modified LCS but not for the other options.²⁴ As a result, the costs of a minor modified LCS are comparatively less expensive than the other options. The task force cost analyst told us that they did not estimate these costs for the other ship options because they did not have enough time.

Manning assumptions have significant implication on costs: crew size is a significant driver of operation and support costs (which typically make up around 70 percent of a ship's life-cycle cost). The task force estimated that over the entire life cycle of the ship class (assuming 20 ships, with a 25-year service life), a minor modified LCS option would cost approximately \$10 billion less in crew-related expenses than the other ship design options. This accounts for almost half the difference in operations and support costs reflected in table 4 (in fiscal year 2014 dollars).

Table 4 shows the comparison in direct and indirect manning costs for each of the options considered; major modified LCS, and new and existing designs have the same cost estimates due to the task force choosing the same manning levels for each of these three options.

²⁴The Navy is still evaluating the adequacy of manning on LCS.

According to the task force, these comparisons do not include all maintenance costs for the minor modified LCS.²⁵

Table 4: Life-Cycle Crew Cost Estimates for Navy’s Preferred Capability Concept (20 ships with a 25 year service life, fiscal year 2014 dollars)

Ship	Total Manning Costs (dollars in millions)
Minor Modified LCS	12,200
Major Modified LCS	22,300
Modified Existing Design	22,300
New Design	22,300

Source: Navy documentation. | GAO-16-356

The magnitude of differences in these operation and support cost estimates would likely be reduced if the task force had estimated the minimal manning concept options on the other design options, though the Navy did not have the data to quantify this difference.

Navy Prioritized Speed with Which Minor Modified LCS Could Start Production

In a November 2014 memo in which it recommends selecting a minor modified LCS, senior Navy leadership also highlighted the speed with which they believe a minor modified LCS based frigate could be fielded as a deciding factor in its deliberations, as well as a desire to maintain stability in the LCS industrial base and vendor supply chain. The task force report stated that this option could achieve full capability faster than the others, and with a neutral impact to the industrial base. In particular, the task force wrote that a minor modified LCS design would provide the shortest timeline to first ship delivery and that a major modified LCS and new and existing designs would result in production gaps of 1 to 5 years.

²⁵The task force told us that these costs do not include costs related to shifts in organization-level to depot-level maintenance or fly away maintenance team cost increases for the minor modified LCS with the reduced crew. Organization-level maintenance is the day-to-day work that an operating unit performs in support of its own operations. Depot-level maintenance is performed on materiel requiring major overhaul or a complete rebuild of items including parts, assemblies, and subassemblies, and requires more extensive shop facilities and technical skill than lower levels of maintenance. Fly away maintenance teams are deployed support teams needed to complete ship maintenance at forward operating locations outside of the United States. On LCS, fly away teams conduct organizational-level maintenance.

The task force estimated that a frigate based on a minor modified LCS would be ready to start production in fiscal year 2020. The task force wrote that other options would not be able to start production until later, as shown in the table below.

Table 5: Navy Task Force Identified Potential Production Start Dates for Small Surface Combatant Options

Ship	Start of production date (fiscal year)
Minor Modified LCS	2020
Major Modified LCS	2021
Modified Existing Design	2021
New Design	2023

Source: GAO analysis of Navy's Small Surface Combatant task force documentation. | GAO-16-356

The task force also noted that a minor modified LCS could allow for incremental upgrades to LCS prior to fiscal year 2019, which offers capability in the near term that might not be possible on other ships. The Navy's November 2014 recommendation memo states that some of these incremental upgrades may be possible as early as fiscal year 2017.

Frigate Will Have Survivability Improvements Focussed on Improving Susceptibility, but Will Provide Minimal Vulnerability or Recoverability Improvements

In its November 2014 recommendation memo to the Secretary of Defense, Navy leadership wrote that a frigate based on a minor modified LCS will meet the objective of providing a "capable and lethal small surface combatant with capabilities consistent with a frigate." This memo stated that the proposed frigate will have improvements in both survivability and lethality as compared to LCS. Table 6 depicts some of the most significant proposed changes.

Table 6: Proposed Frigate Lethality and Survivability Improvements

Proposed improvement	Type of improvement
Improved missile decoy system	Reduces susceptibility against incoming missiles. Will replace Littoral Combat Ship (LCS) decoy systems with a fleet standard system.
Degaussing system to control ship magnetic signatures	Reduces susceptibility by controlling ship susceptibility to mines. The Navy may cancel this improvement because the frigate will not perform mine countermeasures, which necessitates such protections.
Add Multi-Function Towed Array anti-submarine warfare (ASW) sonar array	Reduces susceptibility by giving frigate ability to detect torpedoes and submarines; increases lethality in ASW. On LCS, this array will be carried only as part of the ASW mission package, whereas all frigates would carry this array.
Improved electronic warfare	Reduces susceptibility by improving defensive alert capabilities.
Improved air-search radar	Reduces susceptibility, could increase lethality by giving ship better capability to identify and target hostile air and surface threats. The Navy has already approved changing to an improved air search radar for the LCS starting with LCS 17.
Add Lightweight Tow torpedo countermeasure system	Reduces susceptibility; provides a self-defense ability to neutralize incoming torpedoes. The Navy had planned to add Lightweight Tow to all LCS regardless of mission package.
Add over-the-horizon missile system	Reduces susceptibility/increases lethality. Intended to give frigate the ability to strike surface targets further from the ship than is possible on LCS.
Add armor to LCS vital spaces and magazines	Reduces vulnerability; intended to lessen risk of magazine detonation. LCS already has some armor in these areas.
Improve shock hardening of anti-air warfare missile system	Reduces vulnerability; intended to enable system to function after sustaining a shock.

Source: Navy documentation. | GAO-16-356

We found that, while the Navy’s proposed frigate will offer some improvements over LCS, it will not result in significant improvements in survivability areas related to vulnerability or recoverability.

Multi-mission Capability an Improvement over LCS If Frigate Fully Equipped

The Navy expects to eliminate LCS’s modular mission package concept for the frigate, and instead equip it with the mission systems from both SUW and ASW mission packages simultaneously. This would provide a multi-mission capability that was identified by the task force as a key characteristic of a frigate and would also provide a capability improvement over LCS because it will be able to have both SUW and ASW capabilities embarked at one time. This will improve lethality in that the ship will be capable of engaging different types of threats at all times, whereas with the current LCS, the type and degree of lethality depends on the mission package embarked. However, frigate program officials told us that the Navy has not yet determined if all frigates will be equipped with both ASW and SUW mission package equipment at all times, or if the decision about the mission equipment to be carried will depend on specific situations or other criteria. If the frigate is deployed without the

equivalent of both mission packages onboard, its combat capability will be much closer to that of the current LCS.

Frigate Will Not Provide Major AAW Capability Improvements

The Navy did not select an option that will offer major AAW capability improvements, though the task force identified that escorting and protecting high-value units against airborne threats was a typical mission for an SSC. This type of mission would require an AAW capability beyond the self-defense capability found on LCS. However, senior Navy leadership told us that the preferred solution did not need to hinge on a ship's ability to provide local AAW defense because destroyers and cruisers could take care of this mission.²⁶

The minor modified LCS selected by the Navy cannot feasibly carry a local AAW capability with the desired area ASW capability due to physical limits of the ship. As such, the frigate will have similar self-defense AAW capabilities to LCS. In addition to carrying the AAW missile system found on the Independence variant (and already approved for eventual addition to all LCS), the frigate will add an improved air search radar and electronic warfare and decoy capability. These improvements should help reduce the ship's susceptibility, but the ship will still only retain an ability to protect itself (like LCS) and not protect other ships.

Frigate Will Not Provide Major Vulnerability or Recoverability Improvements

The proposed SSC is not planned to have significant improvements to vulnerability, a component of survivability. The ships will still be based on a hybrid of commercial and Navy shipbuilding specifications (as are the LCS), which results in the ship having fewer vulnerability mitigation features than a ship built fully to Navy specifications. The Navy plans to add additional armor to the ship magazines and other critical spaces and to add shock hardening to the AAW missile system. These improvements will not make the new frigate as survivable as an FFG 7 or a larger surface combatant, but it will provide some improvement over current LCS.

²⁶We previously reported on concerns with LCS's self-defense AAW capability in [GAO-16-201](#).

In its recommendation memo, Navy leadership wrote that all ships are vulnerable to damage once hit, and as such they put the first priority on reducing susceptibility of the frigate to getting hit by weapons. Similarly, task force officials told us that the fleet engagement process did not prioritize vulnerability-reducing features to the same extent as primary mission areas like SUW or ASW.

The task force report discussed how the Navy could employ improved self-defense capability to reduce the susceptibility of the ship (essentially destroying or evading threats before they can hit the ship), which could help compensate for the ship's vulnerability. Task force officials told us that this was a cheaper and more feasible means of achieving greater survivability than increasing the armor, shock hardening, or separation and redundancy of critical systems. However, the task force did not provide analysis as to the relative cost of this approach compared to making vulnerability improvements. The task force also identified that the concept of operations for any ship can be modified to minimize its vulnerability (essentially not putting it into situations where it will likely take damage). While this approach is feasible, we have previously found that changes in the LCS concept of operations have resulted in LCS being employable in fewer situations today than it was intended to be at its inception.²⁷

The Navy has not proposed changes to improve the ship's recoverability, which it believes is already adequate on LCS. We have previously found that there are recoverability features on LCS that could be improved, such as adding a casualty power system or improving system redundancy.²⁸ The task force considered other design options that could be less vulnerable to damage, but these options would cost more and take longer to begin production.

Senior Navy leadership told us that the Secretary of Defense also consulted with DOT&E and CAPE officials, as well as the Deputy Secretary of Defense and the Vice Chief of the Joint Chiefs of Staff. As part of this consultation, DOT&E officials told us that they were asked by the Secretary of Defense to independently assess the Navy's

²⁷GAO-13-530.

²⁸GAO-15-361C.

recommendation prior to the Secretary of Defense making a decision. DOT&E wrote a report in which it expressed concerns with the Navy's recommendation. Similarly, in its January 2016 annual report on weapon systems, DOT&E pointed out that the vulnerability reduction features proposed for the frigate provide no significant improvement in the ship's survivability as compared to LCS. This report added that, notwithstanding potential reductions to its susceptibility due to improved electronic warfare system and torpedo defense, minor modifications to LCS (e.g., magazine armoring) would not yield a ship that is significantly more survivable than LCS when engaged with threat missiles, torpedoes, and mines expected in major combat operations.

DOT&E noted that the proposed frigate design is not substantially different from LCS and does not add much more redundancy or greater separation of critical equipment or additional compartmentation, making the frigate likely to be less survivable than the Navy's previous frigate class.

Frigate Performance Requirements Similar to LCS

Beyond the over-the-horizon missile that is also under consideration for addition to LCS, the proposed frigate does not add any new offensive ASW or SUW capabilities that are not already part of one of the LCS mission packages, so while the frigate will be able to carry what equates to two mission packages at once, the capabilities in each mission area will be the same as LCS. The capabilities development document (CDD) for the frigate, which outlines notional requirements, states that all existing LCS seaframe requirements will apply to the frigates unless otherwise specified in the CDD. While specific details are classified, there are only a few areas where there are differences in warfighting capability compared to the LCS CDD; specifically, the CDD states that the primary capabilities that differentiate the frigate from LCS are multi-mission capabilities and the over-the-horizon missile capability. In addition, consistent with the task force approach that traded off speed and range for other capabilities, the Navy is envisioning the frigate to have a slower maximum and sustained speed than LCS, dropping by several knots depending on the ship variant (e.g., a modified Freedom or Independence class). Navy officials have told us that they have determined that the high top speed of LCS is not essential to mission performance. Frigate program officials told us that they expect that the range of the frigate will be improved as compared to LCS because the Navy may be able to add additional fuel as part of design changes.

The Navy has also re-designated certain requirements related to combat capabilities—such as SUW and ASW—from Key Performance

Parameters (KPPs) to Key System Attributes. Significant changes in KPPs must be approved by the JROC; Key System Attributes do not, so this re-designation allows the Navy to alter the requirements for combat capabilities as needed to remain within the planned frigate budget and without seeking approval from the JROC. While specifics are classified, the Navy's approach in the frigate CDD is a change in practice from the LCS CDD. DOT&E, in its January 2016 assessment of the frigate, pointed out that this change means since some combat capability is not assigned KPP status the frigate could meet all its KPPs but have reduced combat capability in other areas.

Acquisition Strategy Buys More LCS with Unresolved Capability Concerns and Commits to Frigates without Requisite Knowledge

The Navy plans to buy additional LCS in fiscal year 2017, even though key test events have not yet taken place that would demonstrate whether the ships will meet needs. In addition, the Navy plans to contract for the frigate before establishing a sound business case that sets forth realistic technical, cost, and schedule parameters. The specifics of the current acquisition strategy, which USD(AT&L) approved in late March 2016, differ from the plan as set forth in the fiscal year 2017 budget submission. In the budget, the Navy had planned to release an RFP for the frigate in fiscal year 2018. The Navy would make a single award for 11 frigates, with award and construction beginning by fiscal year 2019. Now, under the March 2016 acquisition strategy, the Navy will request proposals from the two current LCS contractors for a single LCS in fiscal year 2017 with a block buy option for 12 additional LCS. The Navy intends to make an award to each contractor for one LCS, then later use the contract change process to obtain proposals from each contractor that would upgrade the block buy option of LCS to frigates. The Navy will evaluate the change proposals and then exercise the option—now for frigates—on the contract that provides the best value based on tradeoffs between price and technical factors. This downselect will occur in fiscal years 2018 or 2019.

Navy frigate program officials told us that these changes were made to improve affordability. They explained that if they were to only seek proposals for a single ship from each shipyard in fiscal year 2017, they would likely receive unfavorable pricing. By combining the fiscal year 2017 ships with contract options for 12 additional LCS, the Navy believes it will receive better industry pricing. According to the fiscal year 2017 President's budget, the frigate program will cost over \$8 billion through fiscal years 2019-2025 for ship construction. However, this is based on procuring 11 frigates, while the current plan is for 12, so the actual cost will be higher.

Table 7 describes the March 2016 acquisition strategy compared to the plan in the Navy’s fiscal year 2017 budget request.

Table 7: Changes in Navy Littoral Combat Ship (LCS) and Frigate Acquisition Strategy since Fiscal Year 2017 President’s Budget Request

Navy acquisition strategy plan	Fiscal year			
	2016	2017	2018	2019
Plan reflected in Fiscal Year 2017 President’s Budget	Request funding for two LCS in fiscal year 2017.	Fund construction of two LCS. Request funding for one LCS.	Fund construction of one LCS. Request proposals for frigate construction.	Downselect to single frigate design and fund construction of lead frigate. Program would consist of 11 total frigates.
Approved Navy frigate acquisition strategy	Navy requests proposals from both shipyards for construction of final two LCS as well as options for a block buy of 12 additional LCS. Navy will later request modification proposals to change block buy LCS to frigates.	Award contracts to each shipyard for one LCS with options for a block buy of 12 additional LCS using a profit related to offer competitive strategy, whereby the shipbuilder that offers the lowest price receives a higher target profit percentage. Request proposals from both shipyards for frigate upgrade package.	Fund construction of lead frigate. Review proposals for frigate upgrade package. Downselect to single frigate design by modifying one shipyard’s fiscal year 2017 LCS contract to exercise the option for a block buy of 12 LCS and add the frigate upgrade package, occurring as early as fiscal year 2018 but no later than fiscal year 2019. Program would consist of 12 total frigates.	

Source: GAO analysis of Navy LCS and frigate budget and program documentation. | GAO-16-356

Acquisition Strategy Results in Buying More LCS with Unresolved Capability Concerns under a Compressed Construction Schedule

Extent of LCS Combat Capability Upgrades Uncertain, and Navy Has Not Yet Fully Demonstrated that LCS Meets Survivability Requirements

The Navy plans to make certain upgrades to LCS—similar to those planned for the frigate—to enable needed improvements to be incorporated sooner. For example, the Navy is considering adding the over-the-horizon missile and magazine armor planned for the frigate. Changes are being considered for addition to upcoming LCS during ship

construction (called forward fit) or sometime after delivery (called backfit). In announcing the requirement for the Navy to conduct a study for an alternate small surface combatant, Secretary Hagel stated that DOD needed 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. Subsequently, the Secretary recommended changing course from LCS to buying the more capable frigates. The Navy cited the ability to make these upgrades to LCS and incrementally improve its capability as an advantage to selecting the minor modified LCS option over others studied. In approving the Navy's recommendation, Secretary Hagel directed the Navy to provide an assessment of the cost and feasibility of back-fitting survivability and lethality enhancements on LCS already under contract, as well as those built before production of frigate commences, with an intent to improve the lethality and survivability of LCS as much as practical. Navy officials told us that they requested funds in the fiscal year 2017 President's budget to make these upgrades, but there is no specific identification of these funds or their intended uses in the budget. Program officials told us that the Navy plans to obtain pricing on the costs to implement selected frigate survivability and lethality upgrades on these ships during construction as part of the RFP for the 2017 LCS. According to the LCS program office, the changes that they will ask the shipyards to price are adding the lightweight towed torpedo countermeasure and magazine protection; hardening the water system onboard to better withstand shock; and adding weight and space allowances for an over-the-horizon missile. The shipyards will also propose commensurate weight-reduction efforts needed to incorporate these changes. Implementing these improvements is contingent on both the affordability of the offers submitted by the shipbuilders and the technical feasibility of incorporating additional weight to the ship.

Further, the ability to make these upgrades is dependent on the availability of funds. The Navy told us that a prior request in the fiscal year 2016 President's budget request for funds to forward fit and backfit LCS with selected lethality and survivability features was not funded. Additionally, cost growth in the program will likely limit the availability of funding for forward fit improvements in the near future. The Navy received an additional \$160 million in fiscal years 2015 and 2016 and plans to request another \$239 million through fiscal year 2020 to complete

construction of ships funded in prior years.²⁹ According to Navy budget documentation, this additional funding is needed to cover the government's share of shipbuilding contract overruns and restoration of de-scoped requirements resulting from sequestration reductions.³⁰ For fiscal years 2015-2017, of the funding received or requested by the Navy to address LCS program shortfalls (\$246 million), almost 70 percent (\$169 million) was used or is planned to be used to address shipbuilding contract overruns on 12 LCS seaframes funded in fiscal years 2010-2013. Additionally, the LCS and frigate programs reported that costs of LCS currently under construction would increase further due to rising shipyard labor rate costs following the Secretary of Defense's directed change in the procurement quantities of LCS and the frigate, which would result in fewer ships in the shipyard on which to base overhead costs.

Additionally, in our December 2015 report on LCS survivability and lethality, we noted that the Navy still had unknowns related to the survivability and lethality of LCS. Specifically, we identified a number of events that had not yet been completed, shown in the table below.

²⁹Under the LCS block buy contracts, the Navy's share of any cost underruns or cost overrun is 50 percent and the shipbuilder's share is 50 percent. When the actual contract cost reaches the contract ceiling price, the contractor is responsible for all additional costs.

³⁰Among other things, the Budget Control Act of 2011 (Pub. L. No. 112-25) established the Joint Select Committee on Deficit Reduction, which was tasked with proposing legislation to reduce the deficit by an additional \$1.2 trillion through fiscal year 2021. The Joint Committee failed to report a proposal, and Congress and the President did not enact legislation. This failure triggered the sequestration process in the Balanced Budget and Emergency Control Act of 1985 (Pub. L. No. 99-177), which required the Office of Management and Budget to calculate, and the President to order, a sequestration of discretionary and direct spending on March 1, 2013.

Table 8: Remaining Littoral Combat Ship (LCS) Survivability and Lethality Test Events

Test event/activity	Date (calendar year)	Description
Full ship shock trials	2016	The Navy plans to subject both LCS variants to an underwater explosion and then assess them for damage.
Anti-air warfare self-defense testing complete	2018	The Navy has yet to complete live end-to-end testing of anti-air warfare capabilities using both LCS variants and also the unmanned Self Defense Test Ship. The Navy also has not yet completed computer simulations for anti-air warfare engagements that would be costly or difficult to test with live targets.
Final survivability assessments completed	2018	Navy technical experts complete their analysis and issue their final survivability assessment reports. Navy officials stated that until this time, its technical warrant holders cannot certify that the two variants meet their survivability requirements and that no further modifications to the design or operational concept of operations are necessary.
Final surface warfare mission package Initial Operational Test and Evaluation complete	2018	Conclusion of this testing will represent achieving the final level of capability for the surface warfare mission package, and is necessary to demonstrate that the ships can achieve threshold—or minimum—performance requirements.

Source: GAO analysis of Navy documentation. | GAO-16-356

Due to these unknowns, we suggested that Congress consider not fully funding the Navy’s request for future LCS ships beyond fiscal year 2016 given the uncertainties over the long term about the ship’s survivability and lethality and proposed changes to future ships.³¹ These unknowns remain outstanding.

Schedule Slips Result in Increases in Near-Term Workload at Shipyards

LCS cost overruns have been accompanied by significant schedule delays at both shipyards. In 2013, we found that delivery of the two lead ships and LCS 4-8 were delayed by as much as 2 years due to various design and construction issues. At that time, the Navy reported that it had adjusted delivery schedules to account for these delays and did not envision further delays beyond LCS 8.³² However, our analysis of Navy contracting and budget documents identified that actual or planned deliveries of almost all LCS under contract (LCS 5-26) were delayed by several months, and in some cases close to a year or longer.³³ As shown

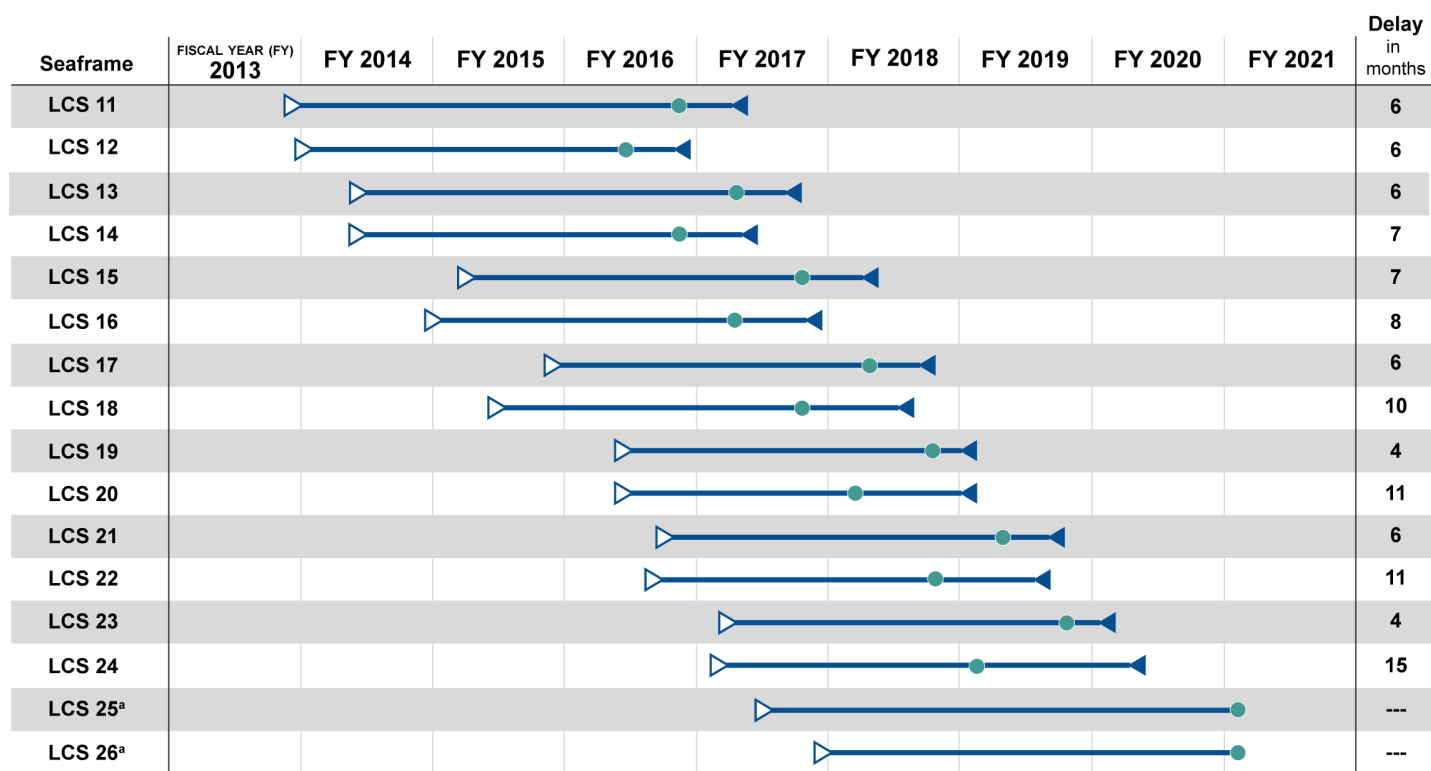
³¹GAO-16-201.

³²GAO-13-530.

³³In addition to providing schedule relief, through these contract modifications the Navy also provided the two shipbuilders with the ability to receive up to \$45 million each in incentive fees for launching and delivering LCS.

in figure 4 below, there are 16 LCS (11-26) that are currently slated to be under construction and delivered from fiscal year 2017 through fiscal year 2021, not including any further ships procured in fiscal year 2017.

Figure 4: Delays in Delivery Dates for Littoral Combat Ship (LCS) Seaframes, Fiscal Year 2019 and Beyond



Current start construction date
 Original delivery date
 Modified delivery date
 LCS = Littoral Combat Ship

Source: GAO analysis of Navy contract data and budget documents. | GAO-16-356

^aThe delivery dates for LCS 25 and 26—awarded in March 2016—have not been modified.

These schedule delays mean that the Navy now plans to start construction of four LCS in fiscal year 2017 (LCS 23-26). Also, during this same period, the shipbuilders will be working to deliver up to 12 additional LCS seaframes funded in prior fiscal years (LCS 11-22). This workload indicates that there is not a schedule imperative to awarding additional LCS in fiscal year 2017 as the shipyards will both have work remaining

from prior LCS contract awards. According to the Navy, in most cases shipyard labor skillsets are not translatable from one stage of construction to another, and loss of production work is felt much earlier than delivery of the last ship. The Navy's viewpoint is that pausing production of LCS would result in start-up delays to the frigate program. However, each shipyard will start production of two LCS in fiscal year 2017 assuming no further delays, and this concern does not account for any other work that the shipyards may have from other Navy or commercial contracts.

Risks with Frigate Business Case Due to Design, Costs, and Oversight Issues

The Navy's business case for the acquisition of the frigate is compromised by unknowns related to the ship's design, cost, and program oversight plans. A business case is part of a knowledge-based approach to acquisition that, in its simplest form, is demonstrated evidence that the warfighter's needs are valid and that they can best be met with the chosen concept, and the chosen concept can be developed and produced within existing resources—that is, proven technologies, design knowledge, adequate funding, and adequate time to deliver the product when it is needed. Our past work on major defense acquisition programs—including shipbuilding programs—has highlighted a number of underlying systemic causes for cost growth and schedule delays and has emphasized the importance of having a sound business case at program start.³⁴

³⁴For examples of GAO work on acquisition best practices and executable business cases, please see: GAO, *Best Practices: Better Matching of Needs and Resources Will Lead to Better Weapon System Outcomes*, [GAO-01-288](#) (Washington, D.C.: Mar. 8, 2001); *Best Practices: Capturing Design and Manufacturing Knowledge Early Improves Acquisition Outcomes*, [GAO-02-701](#) (Washington, D.C.: July 15, 2002); *Best Practices: High Levels of Knowledge at Key Points Differentiate Commercial Shipbuilding from Navy Shipbuilding*, [GAO-09-322](#) (Washington, D.C.: May 13, 2009); *Defense Acquisitions: Strong Leadership Is Key to Planning and Executing Stable Weapon Programs*, [GAO-10-522](#) (Washington, D.C.: May 6, 2010); *DOD Weapon Systems: Missed Trade-off Opportunities During Requirements Reviews*, [GAO-11-502](#) (Washington, D.C.: June 16, 2011); and *Defense Acquisitions: Navy Strategy for Unmanned Carrier-Based Aircraft System Defers Key Oversight Mechanisms*, [GAO-13-833](#) (Washington, D.C.: Sept. 26, 2013).

Frigate Design Still in Preliminary Stages, with the Acquisition Strategy Postponing Significant Design Work until after the Downselect Decision

Frigate program officials told us that they have been working with the shipyards for the past year on preliminary design work to determine how frigate design changes can be accommodated within the space, weight, and power limitations of each LCS design. The Navy has also concluded its efforts to identify and select the systems that will go on the frigate; for example, the Navy selected a new version of Surface Electronic Warfare Improvement Program system as the electronic warfare system.³⁵ However, the Navy faces three challenges to its ongoing efforts to incorporate frigate survivability and lethality improvements: (1) the challenge of implementing weight reductions on both LCS variants to accommodate the frigate changes; (2) incomplete information about the frigate design available to inform the shipyards' proposals under the acquisition strategy; and (3) the Navy's transition to a contractor-driven design, which can limit system commonality compared to a more prescriptive approach where the Navy tells the shipyards what systems and design features to incorporate.

Weight Reduction Challenges

First, the Navy and shipyards' efforts to add additional survivability and lethality capabilities to the frigate are constrained by weight limitations affecting both LCS variants. Weight is a critical aspect of ship design because the total weight of a ship and the locations of weight concentrations dictate the center of gravity and the stability of the vessel. As a result, all ships are designed with service life allowances to account for future weight growth. These allowances provide for the addition of future capability and weight while providing margin before reaching the ship's naval architectural limit, which is the maximum weight a ship can tolerate while still meeting its stability and survivability requirements.

As we found in July 2014, the Navy has faced challenges managing the weight of both variants of LCS, and weight growth during construction has required the Navy to make compromises on LCS 1 and 2 performance.³⁶ We also found that because of the LCS's low service life allowance requirements for weight and center of gravity compared to other ship

³⁵Surface Electronic Warfare Improvement Program (SEWIP) is an electronic warfare system that performs the mission of early detection, signal analysis, threat warning and protection from anti-ship missiles.

³⁶[GAO-14-749](#).

classes, the Navy's ability to accommodate alterations and growth on these ships over their expected 25-year minimum service lives will be significantly more constrained than is typical for other surface ships. The LCS weight margins are also lower than those called for under Navy instruction and industry recommended practices. Specifically, LCS has a requirement to retain a margin of only 50 metric tons of weight, which translates to just over 1 percent of the total weight, while other ship classes typically must reserve between 5-10 percent of their total weight to accommodate future upgrades or equipment changes. In 2012, an Office of the Chief of Naval Operations instruction highlighted the importance of weight management across ship classes, noting that inadequate service life allowances for weight and vertical center of gravity have resulted in expensive corrective ship changes or in the inability to modernize ships through installation of new weapons systems.³⁷

According to preliminary frigate design documentation, the Navy's proposed frigate changes could add significant weight to both variants. According to the Navy, the Frigate program has directed an increase to the naval architectural limits of each frigate variant to accommodate the required frigate capabilities. Additionally, the frigate is not going to have the same type of mission package swap requirement as LCS, and the Navy stated that the removal of these requirements allows the shipyards to change and compartmentalize the large reconfigurable spaces that typically accommodate mission package equipment. This results in a design that carries more stability and weight margins, and allows for the vessels to accommodate added frigate capabilities without a required and costly corresponding weight removal. Some of the weight reduction changes will alter the frigate's performance compared to LCS capabilities. For example, the Navy is planning a reduction in the size of the rigid-hulled inflatable boats that the ship can carry and deploy. An LCS configured with an SUW mission package can carry two 11-meter boats used by boarding teams to interdict other vessels, utilizing specific launch, handling, and recovery systems to facilitate these missions. On LCS, the 11-meter boats are in addition to a 7-meter rescue boat. On the frigate, the Navy is proposing changing the two 11-meter boats to two 7-meter boats, and small boat launching systems to simpler side-launch

³⁷OPNAV Instruction 9096.1A, Weight and Stability Limits for Naval Surface Ships (Sep. 12, 2012).

boat cranes. This plan could provide significant weight savings for the Navy. Further, the Navy has applied a reduced endurance range requirement for the frigate when compared to LCS.

Adding capability to the frigate depends on the success of these and other design initiatives. It is too early to determine how successful these efforts will be. If the planned weight reductions cannot be achieved, the Navy and shipyards will have to identify other weight reduction efforts, or will have to reduce capability of the frigate. The program office has already stated that both variants will have less than the required service life allowance for both power and cooling, but that current power and cooling needs will be met.

Limited Frigate Design Knowledge Prior to Downselect Decision

Second, under the approved acquisition strategy, the Navy plans to exercise a block buy contract option for frigate construction before the shipyards have initiated detail design.³⁸ Under an earlier draft acquisition strategy, the program office would have awarded a contract to each shipyard in fiscal year 2018 to support detail design of the frigate, which was to occur before the award of the construction contract for frigates in fiscal year 2019. With this approach, the Navy would have had detail design data in hand while considering proposals for ship construction. The Navy's approved acquisition strategy now places detail design after the Navy has contracted for ship construction. This puts the Navy in the position of having to negotiate the contract target prices for construction of the lead and follow-on ships without the benefit of information gained during detail design about the materials and equipment or specific processes that will be used to construct the ship.³⁹

We have previously reported that this type of approach—which is a common Navy practice that has also been used on other Navy ship

³⁸The scope of work in detail design can vary depending on the Navy program, but it can include engineering; integration; related development efforts including drawing and work package development; advanced planning; design weight estimate; lifecycle support products and related logistics data; and production planning efforts.

³⁹With cost-plus-incentive fee and fixed-price-incentive contracts, the parties may negotiate a target cost, target profit, and formula that allows profit to be adjusted by comparing actual costs to the target cost.

acquisitions—has resulted in increased ship target prices.⁴⁰ For example, for the San Antonio (LPD 17) class ships, the Navy negotiated prices for the detail design and construction of the lead ship (LPD 17) and the first two follow-on ships (LPD 18 and LPD 19) at the same time. By negotiating target prices for these ships before detail design even began, target prices for these three ships did not benefit from information gained during detail design. An alternative approach would be the Navy's original plan, which was also used on the Virginia class submarine program where the Navy negotiated detail design separately from construction, thus benefitting from the knowledge gained from detail design in negotiating prices for construction. The Navy also plans to use this approach with the Ohio class replacement submarine program and intends to have a high level of design complete prior to the award of the lead ship construction contract. Assuming it continues to employ a block buy approach for the frigate as it has on the LCS program, the Navy will have to request funding for at least detail design and lead ship construction in its fiscal year 2018 President's budget request. The Navy's request would be based on target prices that it negotiated in the absence of detail design information, which affects the realism of the budget request.

Contractor Driven Frigate Design May Reduce Commonality

Third, the Navy is also transitioning to a less prescriptive design approach under which the shipyards have more latitude in proposing design approaches and equipment than was initially planned. Frigate program officials told us that they had initially planned on giving the shipyards a more prescriptive set of design parameters with specific systems identified that the shipyards would need to incorporate into their designs. Program officials told us that they are adjusting this approach; now it will be similar to the original LCS program, whereby the shipyards were given performance specifications and requirements. The shipyards then selected the design and systems that they felt best met these requirements, but that were also the most affordable and best suited to fitting their design in a producible manner.

⁴⁰GAO, *Defense Acquisitions: Improved Management Practices Could Help Minimize Cost Growth in Navy Shipbuilding Programs*, [GAO-05-183](#) (Washington, D.C.; Feb. 28, 2005).

Program officials told us that this new approach should yield cost efficiencies. They told us that they are transitioning from a plan where the government would furnish some frigate equipment to having the contractors furnish equipment, which they believe allows the shipyards to potentially secure better pricing for systems such as the air search radar. A similar approach was used during initial LCS design; in some instances, this led to the ships having non-standard equipment, making the ships not common with either one another or the rest of the Navy.

Frigate Costs Remain Uncertain

According to the fiscal year 2017 President's budget request, the Navy estimates almost \$10 billion for the remaining LCS and frigate procurements, with the lead frigate expected to cost \$188 million or approximately 30 percent more than the single LCS requested in fiscal year 2018, and follow-on frigates in 2020-2021 closer to an increase of 20 percent more per ship. Program officials said that the acquisition strategy, which would downselect to a frigate as early as fiscal year 2018, but no later than fiscal year 2019, is contingent on securing additional funding a year earlier than planned. The Navy, however, does not yet have a complete estimate of frigate costs. The Navy had planned to approve its frigate service cost position—which is the Navy's cost estimate for the program—in late 2015. However, as of February 2016, the frigate program office told us that it needs to revise its estimate due to the Secretary of Defense's 2015 direction to reduce frigate procurement quantities. As a result, the Navy currently does not have an approved cost estimate for the frigate. Navy officials told us that they expect the frigate to cost no more than 20 percent—approximately \$100 million—more per ship than the average LCS seaframes. However, we were unable to assess this cost as the Navy did not provide us the basis for its estimate and has not yet completed its estimate.

The Navy has also not yet determined the quantity of mission package equipment that will be required for the frigate, which will be another cost element. Unlike LCS, the frigate concept does not entail readily interchangeable mission packages to provide single mission capability; rather, the multi-mission functionality will enable the frigate to carry both SUW and ASW equipment simultaneously. However, as noted above, frigate program officials told us that they have not yet decided if every frigate will be equipped with all mission equipment at all times, or if the Navy will buy a smaller subset of equipment for the frigates to share as they deploy. The Navy had planned to buy 64 LCS mission packages, but a senior Navy official and a mission packages program official told us that this will change based on the Secretary of Defense's 2015 direction. Additionally, frigate program officials told us that four systems—the

variable depth sonar, the 30mm gun modules, the airborne torpedo, and the surface-to-surface missile module—will not be funded with shipbuilding procurement money but that they will instead be funded from other procurement accounts. Therefore, the more than \$8 billion expected for frigates does not include the costs for these three systems for any of the frigates.

Oversight Structure for Frigate Acquisition Remains Undetermined

According to officials from the Navy and OSD, the precise oversight structure for the frigate acquisition has not yet been determined, although the Navy established a frigate program office over a year ago and the office has received congressional appropriations. The frigate program office is under the purview of the LCS Program Executive Office, which oversees the LCS seaframe and mission packages program offices, among other offices. The Navy also assigned a new system designation—FF—specific to the frigate and received procurement and research and development funds within the LCS fiscal year 2016 budget. In the President’s fiscal year 2017 budget request, the Navy created a new budget line item for research and development funds and included frigate procurement cost information within the LCS procurement budget line.

Navy officials, including frigate program office officials, told us that they will develop some key requirements and acquisition documentation, but that they do not envision formal frigate milestone reviews. Frigate program officials told us that a determining factor of whether or not they will be able to procure the lead frigate in fiscal year 2018 instead of 2019 is if the frigate design is matured to a sufficient level to allow the shipbuilders to submit proposals for the frigate upgrade with minimum risk. However, when we asked the program office how it would evaluate the maturity of these designs before down-selecting to the winning shipyard, the program office described an iterative review process but with no formal milestone or event like a preliminary design review to approve readiness to proceed. The Navy’s approved acquisition strategy—which we obtained while DOD was reviewing our draft report—states that OSD will hold reviews called “in process reviews” in fiscal years 2016 through 2025; according to frigate program officials, the Navy plans to combine the frigate and LCS program reviews into this annual

review.⁴¹ The acquisition strategy does not provide details on the nature of these reviews, including requirements and timing. At this time it is unclear if one of these reviews will approve the release of the RFP for the fiscal year 2017 LCS and the request for contract change proposals for the frigate upgrade, and if another will be held to approve modifying the 2017 LCS contract to exercise the option for a block buy of 12 additional LCS with the frigate upgrades.

Frigate program officials also told us that they do not intend on completing all the documentation that would normally be required of major weapon system programs at the system development phase, including developing an independent cost estimate for the frigate program. Major defense acquisition programs, including acquisition category (ACAT) I programs like the Navy's LCS and frigate programs, are defined as such based on anticipated expenditures. Even with the Secretary of Defense's reduction in quantity of ships, the expected dollar value of frigate seaframe procurement alone, which according to the Navy's latest budget submission exceeds \$8 billion in current dollars, makes the frigate acquisition equivalent to a major defense acquisition program with ACAT I status.⁴² ACAT I programs generally go through a series of phases as they progress from the identification of the need for a new capability, through initial planning of a solution, to system development, and finally production and deployment of the fielded system. At Milestone B, which commonly corresponds to the start of detail design for ship programs, major defense acquisition programs are required to have approved requirements, an independent cost estimate, and an acquisition program baseline which includes parameters to describe the cost estimate, schedule, performance, supportability, and other relevant factors.⁴³ Additionally, major defense acquisition programs begin tracking unit cost changes and report unit cost growth against

⁴¹According to DOD acquisition guidance, the purpose of an in-process review is review a project or program at critical points to evaluate the status and make recommendations to the decision authority.

⁴²An ACAT I major defense acquisition program has a dollar value for procurement, including all planned increments, of more than \$2.79 billion (fiscal year 2014 constant dollars). Department of Defense Instruction 5000.02, Operation of the Defense Acquisition System Encl. 1, Table 1 (Jan. 7, 2015).

⁴³Department of Defense Instruction 5000.02, Operation of the Defense Acquisition System (Jan. 7, 2015).

Nunn-McCurdy statutory thresholds and are required to periodically report to Congress in Selected Acquisition Reports (SAR), a key source of program information on cost, schedule, and performance progress.⁴⁴

The Navy's approved acquisition strategy does not describe specific documentation that the Navy will be required to submit for OSD approval. Frigate program officials have stated that they do not intend on soliciting an independent cost estimate from CAPE, and officials were unclear on how or if they would generate a frigate-specific acquisition program baseline or break out the frigate in SAR updates. We have previously reported that milestone requirements form the basic oversight framework to ensure that Congress and DOD decision makers are adequately informed about the program's cost, schedule, and performance progress. While DOD acquisition policy does allow for decision authorities to tailor information requirements and the acquisition process to achieve cost, schedule, and performance goals, the risk of prematurely committing resources to the frigate before certain knowledge is attained will remain until the Navy or OSD establishes a process through which the frigate will be subject to acquisition criteria in the same manner as other major defense programs. Without requiring the new frigate program to have a formal review prior to awarding the frigate contract or to prepare key program documentation such as those cited above, decision makers may lack information on program cost and technical baselines on which to base oversight of the program.

Conclusions

We and others, including the former Secretary of Defense and DOT&E, have raised significant concerns about whether the LCS provides the Navy with needed capabilities. In response to its own concerns about LCS's combat capabilities, the department concluded that improvements are necessary. In the past, we have recommended that LCS procurements be paused while needed testing took place. The Navy has cited reluctance to do so due to concerns about the industrial base; specifically, keeping the two LCS shipyards in business. The continued delays in production of LCS lessens this concern as a factor in the timing of the frigate production start. The LCS delays, coupled with the absence of planned upgrades to the two planned LCS in fiscal year 2017 that

⁴⁴10 U.S.C. §§ 2433, 2432(b).

would help mitigate some of the capability concerns and the persistent unknowns with LCS combat capabilities, suggest that it is reasonable to again consider a pause in production. The delays facing LCS already under contract mean that the shipyards have ongoing LCS work through fiscal year 2021. Not buying the proposed ships in 2017 would provide the Navy and OSD time to buy the ships in an upgraded frigate configuration that is more in line with the capabilities approved by the former Secretary of Defense and complete further LCS testing.

As the Navy pivots from LCS to the frigate—which is expected to provide some enhanced capabilities over the current LCS—there are many unknowns with regards to cost and the design of the frigate, and sufficient oversight structures are not yet defined. The recently approved acquisition strategy for the frigate reflects an accelerated approach. Specifically, the Navy would now award a construction contract for the frigate before having sufficient knowledge of the ship’s detail design. This situation is not consistent with best practices and puts the taxpayer at risk of paying for cost overruns.

Further, the planned oversight of the frigate program could be enhanced by requiring the Navy to develop key oversight documents related to cost, capability, and schedule; at the most basic level, these would include an independent cost estimate, an acquisition program baseline, and a plan to incorporate the frigate into SARs. Without these documents or a milestone review, the program will not be subject to key statutory and regulatory oversight requirements, such as providing Congress with regular, formal reports on program cost and schedule performance that are specific to the frigate program. Such information is needed to hold this multi-billion dollar program accountable for achieving its cost, schedule, and performance requirements, once they are defined. Further, aligning OSD-level reviews of the program with key decision points—including approving the release of the request for contract change proposals for the frigate upgrade and the frigate downselect—would offer an important oversight mechanism.

While we are making new recommendations, we also believe that the prior recommendations we made about LCS in our recent past work would enhance the Navy’s knowledge about LCS capabilities prior to committing additional funds.

Matters for Congressional Consideration

Congress should consider not funding any requested LCS in fiscal year 2017 because of unresolved concerns with lethality and survivability; the Navy's ability to make needed improvements; and the current schedule performance of the shipyards.

Congress should also consider directing the Navy to submit a revised, OSD-approved acquisition strategy under which it completes a significant portion of detail design for the frigates prior to soliciting proposals for the frigate upgrade package.

Recommendations for Executive Action

We recommend that the Secretary of Defense take the following two actions:

1. Ensure that there are OSD-level reviews scheduled to assess the Navy's level of knowledge prior to key events, such as the Navy releasing the request for modification proposals for the frigate upgrade and committing to a frigate downselect decision.
2. Before the downselect decision for the frigates, require the program to submit appropriate milestone documentation as identified by OSD, which could include an Independent Cost Estimate, an Acquisition Program Baseline, and a plan to incorporate the frigate into SAR updates.

Agency Comments and Our Evaluation

We provided a draft of this report to DOD for review and comment. Its written comments are reprinted in appendix II of this report. DOD concurred with one of our recommendations and partially concurred with one.

Originally, our draft report contained three recommendations to DOD; the department concurred with one and partially concurred with two. However, due to events that occurred while our draft report was out for comment, we have deleted one recommendation from this report. Specifically, we had planned to recommend that DOD not approve the Navy's planned acquisition strategy for the remaining LCS and frigates, because it had shortcomings, outlined in this report, which presented risks. However, after we sent the draft report to DOD on April 15, 2016 to review, we were notified that USD(AT&L) had approved the acquisition strategy on March 29, 2016. We requested this document several times, but were told it was pending approval. Despite our pending request and the document being approved in March, we were not provided a copy until May 2016. Since the department has already approved the

acquisition strategy and it does not fully address the concerns we raised in this report, we have converted our recommendation into a Matter for Congressional Consideration.

DOD agreed with our recommendation to ensure that OSD-level reviews are held to assess the Navy's level of knowledge prior to key events. DOD noted that the department already plans to conduct annual OSD-level reviews of the LCS and frigate program, stating that coordinating future program reviews with key acquisition decisions is standard practice. DOD also stated that the Navy would be required to return for an additional review in advance of releasing the fiscal year 2017 request for proposals that will inform the frigate down select, and that OSD will participate in peer-review of the request for proposals for the 2017 procurements and 2018 downselect. While these are positive steps, neither the department's response nor the approved acquisition strategy elaborate on the specific requirements for these reviews or any specific documentation requirements. To make these mechanisms effective, OSD would need to ensure that these reviews occur regularly and in advance of key decision points, including prior to committing to the frigate downselect. Further, we would expect that these reviews would include submissions of updated key documentation such as a Test and Evaluation Master Plan.

Regarding our recommendation on milestone documentation for the frigate, DOD partially concurred, stating that the Navy views the LCS transition to the frigate as an incremental upgrade. DOD stated that the Navy would be required to provide key documentation related to the seaframe, including an independent cost estimate and an updated acquisition program baseline, though DOD did not provide specific timeframes for when these documents would be submitted, nor is this information contained in the approved acquisition strategy. DOD stated that the Navy is also required to provide updated mission package quantities, with an updated mission packages acquisition program baseline, as well as further analytical reports on the capabilities and quantities of the mission packages. We believe these are important steps, but that it is important that this documentation is provided in advance of investment decisions. We also believe that to provide visibility over frigate-specific cost and schedule performance, OSD should require the Navy to report frigate cost and schedule baselines as a separate section of the SAR and acquisition program baseline instead of aggregated into the baseline LCS SAR and acquisition program baseline data, as they are presented now. Such reporting would better facilitate oversight of cost and schedule variances for both efforts. While the Navy sees the frigate

as an incremental upgrade, separate reporting is consistent with DOD provisions that describe increments of capability that are designated as subprograms.

DOD also separately provided over 50 technical comments on our draft report. We incorporated the comments as appropriate, such as to provide additional context in the report. In doing so, we found that the findings and message of our report remained the same. In a few cases, the department's suggestions or deletions were not supported by the preponderance of evidence or were based on a difference of opinion, rather than fact. In those instances, we did not make the suggested changes.

We are sending copies of this report to the appropriate congressional committees, the Secretary of Defense, and the Secretary of the Navy, and other interested parties. In addition, the report is available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at 202-512-4841 or mackinm@gao.gov. GAO staff who made key contributions to this report are listed in appendix III.



Michele Mackin
Director, Acquisition Sourcing Management

List of Committees

The Honorable John McCain
Chairman
The Honorable Jack Reed
Ranking Member
Committee on Armed Services
United States Senate

The Honorable Thad Cochran
Chairman
The Honorable Richard J. Durbin
Ranking Member
Subcommittee on Defense
Committee on Appropriations
United States Senate

The Honorable Mac Thornberry
Chairman
The Honorable Adam Smith
Ranking Member
Committee on Armed Services
House of Representatives

The Honorable Rodney Frelinghuysen
Chairman
The Honorable Pete Visclosky
Ranking Member
Subcommittee on Defense
Committee on Appropriations
House of Representatives

Appendix I: Scope and Methodology

To assess the task force's process and key information, we analyzed Navy and task force documentation, including the final report, classified and unclassified appendices, working papers, and senior leadership briefings. We also met with the task force study director and several study team lead analysts on several occasions, and received briefings on their process. We consulted with Navy and Department of Defense (DOD) subject matter experts on study inputs and conclusions. For example, we met with and obtained written responses from a lead task force cost analyst from Naval Sea Systems Command Costing Engineering and Industrial Analysis Division, and Office of the Secretary of Defense (OSD) officials from the Office of the Under Secretary for Acquisition, Technology & Logistics (USD(AT&L)), Director Cost Assessment and Program Evaluation (CAPE), and Director, Office of Test and Evaluation (DOT&E). To evaluate the extent to which the task force study compares to an analysis of alternatives we compared the task force's study and methodology to relevant DOD acquisition guidance, including the DOD 5000.02 instruction. We also discussed the type of analysis that would be typical of an Analysis of Alternatives (AOA) with CAPE and senior Navy and OSD officials. We also consulted with a GAO methodologist on the study methodology, and a GAO economist on cost issues.

To examine how the Navy arrived at its preferred solution of a modified Littoral Combat Ship (LCS) for its future small surface combatant (SSC) and the extent to which the Navy's solution will address survivability and lethality concerns, we analyzed relevant Navy, DOT&E and CAPE studies and reports and the Navy's draft frigate requirements documentation. We met with Navy and OSD officials, including officials from both the LCS seaframe and frigate program offices, Navy's Surface Warfare directorate (N96) and DOT&E, to discuss the Navy's proposed design and capabilities for the frigate. We also met with the Assistant Secretary of the Navy for Acquisition, Technology, and Logistics and the Deputy Assistant Secretary of the Navy for Ships, as well as the Deputy Assistant Secretary of Defense for Tactical Warfare Systems. We also compared LCS requirements with the Navy's draft proposed capabilities for the new frigate to identify any differences. To understand OSD's intent when directing the Navy to conduct the study and restructure the LCS program in 2014, we met with OSD officials including a former senior OSD official who helped draft the direction to the Navy.

To address any potential risks associated with the Navy's approach to acquiring the frigate, we assessed Navy-provided weight reduction initiatives and descriptions of frigate upgrades. We also met with representatives from Austal USA and received written responses to

questions from Lockheed Martin. We also reviewed the draft frigate acquisition strategy documents and compared with GAO-identified best practice standards for using knowledge to support key program investment decisions.¹ Additionally, we compared the Navy's strategy against relevant DOD policy, including DOD Instruction 5000.02, and met with officials from OSD AT&L to discuss the frigate acquisition strategy. We discussed the proposed acquisition approach to the frigate with the Navy. We met or received written input from task force leadership, the frigate and LCS seaframe program offices and officials from the office of the Navy Acquisition Executive—the Assistant Secretary of the Navy, Research, Development and Acquisition. To identify the extent to which, if any, LCS production trends will impact the Navy's plans for the frigate program, we analyzed LCS contract and contract modifications documents and Navy Supervisor of Shipbuilding cost and schedule performance production data related to for LCS currently in production.

We conducted this performance audit from April 2015 through June 2016 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives, and that the data we obtained and analyzed are sufficiently reliable for the purposes of our assessment.

¹GAO developed these standards for using knowledge to support key program investment decisions, which are discussed in the report. For more information, see GAO, *Defense Acquisitions: Assessments of Selected Weapon Programs*, [GAO-13-294SP](#) (Washington, D.C. Mar. 28, 2013).

Appendix II: Comments from the Department of Defense



ACQUISITION

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
3015 DEFENSE PENTAGON
WASHINGTON, DC 20301-3015

May 23, 2016

Ms. Michele Mackin
Director
Acquisition and Sourcing Management
U.S. Government Accountability Office
441 G Street, N.W.
Washington, DC 20548

Dear Ms. Mackin:

This is the Department of Defense (DoD) response to the Government Accountability Office (GAO) Draft Report, GAO-16-356SU, "LITTORAL COMBAT SHIP: Need to Address Fundamental Weaknesses in Planned LCS and Frigate Acquisition Strategies," dated April 18, 2016 (GAO Code 121237).

The Department acknowledges receipt of the draft report. As more fully explained in the enclosure, the Department partially concurs with recommendations 1 and 3 and concurs with recommendation 2.

The Department appreciates the opportunity to comment on the draft report. For further questions concerning this report, please contact Dr. James Moreland, Deputy Director for Naval Warfare, at james.d.moreland18.civ@mail.mil or 703-614-3170.

Sincerely,

A handwritten signature in black ink that reads "James A. MacStravic".

James A. MacStravic
Acting Principal Deputy Assistant Secretary of
Defense for Acquisition
Performing the Duties of the ASD(A)

Enclosure:
As stated

**GAO DRAFT REPORT DATED APRIL 18, 2016
GAO-16-356SU (GAO CODE 121237)**

**“LITTORAL COMBAT SHIP: NEED TO ADDRESS
FUNDAMENTAL WEAKNESSES IN PLANNED LCS AND
FRIGATE ACQUISITION STRATEGIES”**

**DEPARTMENT OF DEFENSE COMMENTS
TO THE GAO RECOMMENDATIONS**

RECOMMENDATION 1: We recommend that the Secretary of Defense not approve the Navy’s Acquisition Strategy for the remaining LCS or frigates. Instead, require the Navy to submit an Acquisition Strategy under which it completes a significant portion of detail design for the frigates prior to soliciting competitive bids for the frigates, and not to obtain bids for unmodified LCS seaframes.

DoD RESPONSE: Partial Concur. An updated LCS Acquisition Strategy to address the Fiscal Year (FY) 2017 procurement of two LCS Flight 0+ ships and the transition to the Frigate design, as soon as FY 2018, was approved by the Under Secretary of Defense for Acquisition, Technology, and Logistics on March 29, 2016. The approved Acquisition Strategy supports the guidance provided in the Secretary of Defense [Hagel] Memorandum of December 10, 2014, to “procure a small surface combatant based on an upgraded Flight 0+ LCS” and supports the direction in the Secretary of Defense [Carter] Memorandum of December 14, 2015, directing a down-select and transition to the Frigate no later than FY 2019.

This Acquisition Strategy sustains competition for the single ship awards in 2017, prevents a significant production valley that would impact vendor and supplier industrial bases, and delivers the desired Frigate capability ahead of the original schedule. With this strategy, the Navy will also solicit proposals for the forward fit modifications to the LCS Flight 0+ to achieve the survivability and lethality requirements outlined in the Frigate’s Capability Development Document.

The Acquisition Strategy for the LCS and Frigate is based upon transition to Frigate as an incremental upgrade. Design development for the Frigate commenced in FY 2016 and design efforts will continue to mature throughout FY 2017 and FY 2018 in support of each shipbuilder’s submission of an Engineering Change Proposal for the Frigate Design.

RECOMMENDATION 2: We recommend that the Secretary of Defense ensure that there are OSD-level reviews scheduled to assess the Navy’s level of knowledge prior to key events, such as the Navy releasing the requests for proposal for the frigate and prior to approving the Navy to commit to a frigate downselect and contract award decision.

DoD RESPONSE: Concur. With the approval of the LCS/Frigate Acquisition Strategy on March 29, 2016, the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)) has already highlighted the need for future program reviews of key acquisition decisions. The Navy conducted annual LCS Defense Acquisition Board In Process Reviews chaired by USD(AT&L) through April 2016. USD(AT&L) recently

tasked the Navy to return for a review of the program in advance of releasing the FY 2017 Request for Proposals which will address the Frigate down-select. OSD will also participate in peer reviews of the Request for Proposals for the anticipated FY 2017 procurements and the upcoming FY 2018 down-select.

RECOMMENDATION 3: We recommend that the Secretary of Defense, before awarding any frigate procurement contracts, require the program to submit appropriate milestone documentation as identified by OSD, which could include an Independent Cost Estimate, an Acquisition Program Baseline, and a plan to incorporate the frigate into Select Acquisition Reports.

DoD RESPONSE: Partial Concur. The recently approved LCS Acquisition Strategy transition to Frigate is an incremental upgrade. Consistent with other programs that pursue incremental upgrades, the Navy will ensure key documentation is updated and expanded to address the Frigate in future revisions and provided to the Milestone Decision Authority. USD(AT&L) recently tasked the Navy to provide the following items:

- An update to the current LCS seaframe Will Cost/Should Cost estimates once the LCS/Frigate cost estimates are approved to account for changes in profile.
- An update to the LCS seaframe Acquisition Program Baseline (APB) once an Independent Cost Estimate (ICE) for the Frigate configuration completes.
- A white paper focused on the Remote Minehunting System and the lessons learned from the decisions and outcomes of the Nunn-McCurdy Certification in FY 2010 until the program's cancellation in FY 2016.
- A Mine Counter Measures (MCM) Capabilities Roadmap that identifies the Fleet assets, over time, for MCM missions. The roadmap will include all assets, not just those provided by LCS.
- An update to the LCS Mission Modules (MM)/Mission Packages (MP) APB reflecting any quantity changes once the Office of the Chief of Naval Operations completes its on-going 60-day review.
- An updated LCS MM Program Funding and Quantities Chart reflecting any FY 2017 adjustments made to support LCS.
- A summary of MM/MP plans for test, procurement, and progress for FY 2016 and FY 2017 that maintains the plan presented at the April 2016 USD(AT&L) chaired program review.

The LCS Program is already reporting both the LCS and Frigate in its annual Selected Acquisition Report (SAR). An OSD led review of both the APB and SAR reporting approaches will precede any APB updates and the next SAR submission.

Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

Michele Mackin, 202-512-4841 or mackinm@gao.gov

Staff Acknowledgments

In addition to the contact named above, Diana Moldafsky (Assistant Director), Pedro Almoguera, Jacob Leon Beier, Lorraine Ettaro, Laura Greifner, Kurt Gurka, Kristine Hassinger, Kate Lenane, C. James Madar, Roxanna Sun, and Christopher J. Yun made key contributions to this report.

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