



Testimony

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LITTORAL COMBAT SHIP AND FRIGATE

Slowing Planned Frigate Acquisition Would Enable Better-Informed Decisions

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Accessible Version

GAO Highlights

Highlights of [GAO-17-279T](#), a testimony before the Subcommittee on Oversight and Investigations, Committee on Armed Services, House of Representatives

Why GAO Did This Study

The Navy envisioned a revolutionary approach for the LCS program: dual ship designs with interchangeable mission packages intended to provide mission flexibility at a lower cost. This approach has fallen short, with significant cost increases and reduced expectations about mission flexibility and performance. The Navy has changed acquisition approaches several times. The latest change involves minor upgrades to an LCS design—referred to now as a frigate. Yet, questions persist about both the LCS and the frigate.

GAO has reported on the acquisition struggles facing LCS and now the frigate. This statement discusses: (1) the evolution of the LCS acquisition strategy and where it stands today; (2) key risks in the Navy's plans for the frigate based on the LCS program; and (3) remaining oversight opportunities for the LCS and frigate programs. This statement is largely based on GAO's prior reports and larger work on shipbuilding and acquisition best practices. It incorporates limited updated audit work where appropriate.

What GAO Recommends

GAO is not making any new recommendations in this statement but has made numerous recommendations to DOD in the past on LCS and frigate acquisition, including strengthening the program's business case before proceeding with acquisition decisions. While DOD has, at times, agreed with GAO's recommendations, it has taken limited action to implement them. GAO has also suggested that Congress take certain actions to support better LCS and frigate outcomes.

View [GAO-17-279T](#). For more information, contact Michele Mackin at (202) 512-4841 or mackinm@gao.gov.

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What GAO Found

The Navy's vision for the Littoral Combat Ship (LCS) program has evolved significantly over the last 15 years, reflecting degradations of the underlying business case. Initial plans to experiment with two different prototype ships adapted from commercial designs were abandoned early in favor of an acquisition approach that committed to numerous ships before proving their capabilities. Cost, schedule, and capability expectations have eroded over time, as shown in the table below. More recently, the Navy attributed a series of engineering casualties on delivered LCS to shortfalls in crew training, seaframe design, and construction quality.

Evolution of Expectations for the Littoral Combat Ship (LCS) Program

	Early program	Updated program
Quantity and cost	55 seaframes @ \$220 million each	40 seaframes @ \$478 million each
Schedule	Ship Initial operational capability (IOC) in 2007	Ship IOC with partial capability in 2013
Design	Leverage existing designs for reduced cost, rapid fielding	Considerable design changes, under revision throughout early construction
Seaframe	Sprint speed: 40-50 knots; range: 1,000 nautical miles @ 40 knots	Neither seaframe meets combined original speed and range expectations
Mission Packages	IOC for three mission packages by 2010	Revised IOC – one package in 2015; two more planned by 2020
Crewing	LCS would be minimally manned (55-60 crew)	Crew size has increased over time to 70

Source: GAO analysis of Navy documentation. | GAO-17-279T

Concerned about the LCS's survivability and lethality, in 2014 the Secretary of Defense directed the Navy to evaluate alternatives. After rejecting more capable ships based partly on cost, schedule, and industrial base considerations, the Navy chose the existing LCS designs with minor modifications and re-designated the ship as a frigate. Many of the LCS's capabilities are yet to be demonstrated and the frigate's design, cost, and capabilities are not well-defined. The Navy proposes to commit quickly to the frigate in what it calls a block buy of 12 ships.

Soon, Congress will be asked to make key decisions that have significant funding and oversight implications, but without having important information. The Navy plans to request fiscal year 2018 authorization for its frigate block buy approach. Of note, the pricing the Navy intends to seek from the shipyards will be for 12 basic LCS. Only later will the shipyards submit their proposals for adding frigate capabilities to the LCS hulls. Congress will be asked to authorize this approach many months before the Department of Defense (DOD) prepares an independent cost estimate. Further, there is no industrial base imperative to continue with the Navy's planned pace for the frigate acquisition. LCS workload backlogs, when combined with 2 LCS awarded earlier in 2016 and 2 more planned for award in fiscal year 2017, will take construction at both shipyards into 2021.

Chairwoman Hartzler, Ranking Member Speier, and Members of the Subcommittee:

I am pleased to be here today to discuss the Department of the Navy's Littoral Combat Ship (LCS) and frigate programs. The Navy envisioned a revolutionary approach to the LCS program. Unlike other surface combatant programs, LCS consists of two different ship design variants (called seaframes) with interchangeable mission packages carrying equipment for three mission areas—surface warfare, anti-submarine warfare, and mine countermeasures—intended to give the Navy flexibility to rapidly deploy equipment and incorporate new systems. Coupled with this approach, the LCS would have a smaller crew that would rely on shore-based support for its maintenance needs in an effort to reduce life-cycle costs.

To execute the program, the Navy deviated from traditional shipbuilding acquisition in hopes of rapidly delivering ships to the fleet. The consequences of this approach are well known today—costs to construct the ships have more than doubled from initial expectations, with promised levels of capability unfulfilled and deliveries significantly delayed. Acknowledging capability and affordability concerns, the Navy—with the Secretary of Defense's approval—changed course in late 2014 to pursue a more capable frigate based on the LCS concept.¹ The current Secretary of Defense also directed that the total seaframe buy be reduced from 52 to 40.

Today, with 26 ships delivered or under contract, the LCS program again stands at a crossroads. The Navy's fiscal year 2017 budget request asked Congress to fund the last two planned LCS. Further, early next year Congress will need to decide whether to authorize the Navy's plans to procure the remaining 12 ships, including funding the lead frigate. With that context in mind, I will discuss today: (1) how the LCS program has evolved over time to where it stands today; (2) LCS program cost, schedule, and performance, including several recent engineering casualties on delivered ships; (3) key risks in the Navy's plans for the frigate based on the LCS program; and (4) remaining oversight opportunities for the LCS and frigate programs.

¹The term "frigate" can be applied to ships of different sizes and capability. The now-retired Oliver Hazard Perry-class frigate (FFG 7) was the last U.S. Navy frigate. Frigates—including the FFG 7—have been identified as typically being open-ocean, multi-role ships capable of performing surface, anti-submarine, and anti-air warfare.

This testimony largely leverages our past reports on the LCS program from 2005 to 2016.² We also draw on some conclusions from our broader work on Navy shipbuilding and acquisition reform initiatives. More detailed information on our objectives, scope, and methodology for that work can be found in the issued reports. We conducted the work on which this statement is based 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. This statement also includes updates to information, as appropriate, based on program documentation and discussion with Department of Defense (DOD) officials, work that also was conducted in accordance with generally accepted government auditing standards.

The LCS Program Has Changed Significantly over Time

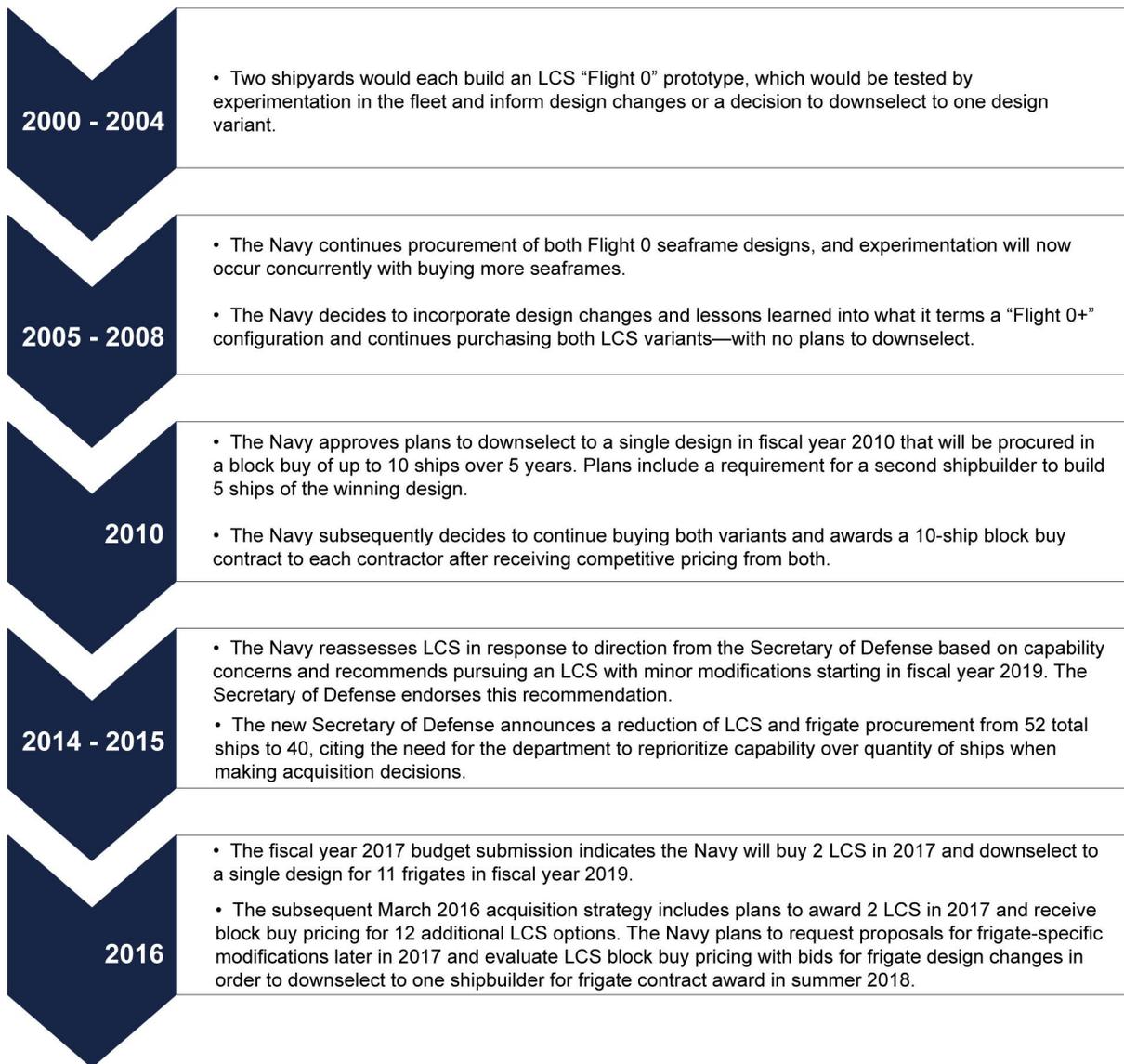
When the Navy first conceived the LCS in the early 2000s, the concept was that two shipbuilders would build prototypes based on commercial designs—Lockheed Martin’s Freedom variant and Austal USA’s Independence variant.³ The Navy planned to experiment with these ships to determine its preferred design variant. However, in relatively short order, this experimentation strategy was abandoned in favor of a more traditional acquisition of over 50 ships. More recently, the Secretary of Defense questioned the appropriate capability and quantity of the LCS and directed a re-evaluation of the small surface combatant needs consistent with frigate-like capabilities. Thus, the program has evolved from concept experimentation, to LCS, and more recently, to an LCS that will be upgraded to a frigate. The strategy for contracting and competing

²GAO, *Littoral Combat Ship: Need to Address Fundamental Weaknesses in LCS and Frigate Acquisition Strategies*, [GAO-16-356](#), (Washington, D.C.: June 9, 2016); *Navy Shipbuilding: Significant Investments in the Littoral Combat Ship Continue Amid Substantial Unknowns about Capabilities, Use, and Cost*, [GAO-13-530](#), (Washington, D.C.: July 22, 2013); and *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). A list of additional related GAO products can be found at the end of this statement.

³Lockheed Martin is the prime contractor for LCS 1 and the odd-numbered seaframes. For LCS 2 and LCS 4, General Dynamics 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 remaining even-numbered seaframes.

for ship construction has also changed. This evolution is captured in figure 1.

Figure 1: A Persistent Pattern of Change to the Littoral Combat Ship (LCS) Acquisition Strategy



Source: GAO analysis of Department of Defense data. | GAO-17-279T

While one could argue that a new concept could be expected to evolve over time, the LCS evolution has been complicated by the fact that major commitments have been made to build large numbers of ships before proving their capabilities. Whereas acquisition best practices embrace a “fly before you buy” approach, the Navy has subscribed to a buy before you fly approach for LCS. Consequently, budgets were requested and approved, contracts were awarded, and ship construction was undertaken at two shipyards. This all happened without adherence to the principles that lead to sound shipbuilding outcomes—namely, ensuring the maturity of technologies, requirements, and design before construction begins, and delaying commitments until testing can prove that needed capabilities will be delivered.

As a result, taxpayers have paid for 8 delivered LCS, with 14 more in some stage of the construction process (including LCS 21, with a planned December 2016 construction start) without an understanding of the capability that the ships will ultimately provide and with notable performance issues discovered among the few ships that have already been delivered. I will outline these issues in more detail below.

LCS Cost, Schedule, and Performance Expectations Have Eroded

In addition to significant changes to the acquisition strategy for LCS, the program has also deviated substantially from expectations about its cost, schedule, and the capabilities the ship would provide with the seaframes as well as with the modular mission packages. All the while, the Navy has continued to request funding to buy more ships and mission packages, and Congress has appropriated funds. Table 1 compares the Navy’s initial expectations of the LCS cost, schedule, capabilities, and crewing concepts with the present version of the program.

Table 1: Evolution of Expectations for the Navy’s Littoral Combat Ship (LCS) Program

Expectation	Early program	Updated program
Quantity and cost	<ul style="list-style-type: none"> 55 seaframes \$220 million per seaframe 64 mission packages, \$2.3 billion total cost 	<ul style="list-style-type: none"> 40 seaframes (includes 12 frigates) \$478 million per seaframe 64 mission packages, \$5.8 billion
Schedule	<ul style="list-style-type: none"> Ships rapidly fielded, with initial operational capability (IOC) in 2007, 3 years after program initiation 	<ul style="list-style-type: none"> IOC achieved with partial capability in 2013, 9 years after program initiation
Design	<ul style="list-style-type: none"> Leverage existing designs to enable a low-cost, rapidly fielded platform 	<ul style="list-style-type: none"> Designs required considerable change and were under revision throughout the first several ships built
Seaframe capability	<ul style="list-style-type: none"> Sprint speed: 40-50 knots Range: 4,300-nautical-mile range when operated at a speed of 16 knots and 1,000-nautical miles at 40 knots 	<ul style="list-style-type: none"> Speed: Freedom variant (odd-numbered ships, e.g., LCS 1) can meet speed requirements, but Independence variant (even-numbered ships, e.g., LCS 2) did not meet speed requirements; frigate will have reduced speed Range: In 2009, endurance requirement reduced to 3,500-nautical-mile range at a speed of 14 knots. Freedom variant cannot meet these reduced requirements—with a 2,138- nautical-mile range at a speed of 14 knots and 855 nautical miles at 43.6 knots; Independence variant can meet range requirements
Mission packages capability	<ul style="list-style-type: none"> New capabilities would be rapidly fielded as the Navy would integrate existing technologies on to the three types of mission packages—mine countermeasures, surface warfare, and anti-submarine warfare 	<ul style="list-style-type: none"> Some technologies were ultimately less mature than envisioned, leading to significant difficulty developing mission capabilities Only one of three packages (surface warfare) has demonstrated required performance. However, initial operational capability was achieved at a temporarily reduced minimum capability requirement
Crewing and logistics constructs	<ul style="list-style-type: none"> LCS would be minimally manned (55-60 crew), with many support functions transferred to shore facilities LCS was initially intended to have a 3-2-1 crewing construct, where 3 crews would support 2 LCS, and 1 LCS would remain forward deployed 	<ul style="list-style-type: none"> Crew size has increased over time to 70 Reliance on shore-based maintenance remains challenging. Despite manning increases, crew has been unable to adequately address maintenance The Navy is transitioning to a blue/gold crew concept for LCS, where two crews will rotate on and off the same hull

Source: GAO analysis of prior GAO reports and Navy documentation. | GAO-17-279T

Note: Costs are in fiscal year 2005 dollars.

We reported in July 2014 on issues with LCS training, manning, and maintenance constructs during the 2013 deployment of USS Freedom. We found that the seaframe crew experienced high workload even though

they were augmented by mission module crew and contractor ship riders, and that gaps remained in fully training LCS sailors prior to deployment.⁴

The Navy has attributed a series of recent engineering casualties on delivered LCS to shortfalls in crew training, seaframe design, and construction quality. According to the Navy, these failures have resulted in substantial downtime and costs for repairs or replacements. Table 2 describes the recent major failures at sea.

Table 2: High Profile LCS Incidents during the Last 12 Months

Ship	Date	Casualty
LCS 5	December 2015	High speed clutch assembly failure and debris in combining gear filter systems
LCS 3	January 2016	Port and starboard combining gear bearings (operated without oil)
LCS 1	July 2016	Main propulsion diesel engine seawater contamination
LCS 4	August 2016	Water jet shaft coupling failure
LCS Fleet	July – August 2016	Fleetwide engineering stand down
LCS 8	September 2016	Water jet hydraulic system seawater contamination
LCS 8	October 2016	Sustained hull crack along weld seam from tugboat
LCS 8	October 2016	Hull damage during Panama Canal transit

Source: GAO analysis of Navy documentation. | GAO-17-279T

However, these types of major incidents are not limited to the past 12 months. For example, LCS 4 also rubbed against the sides of the Panama Canal locks and experienced hull damage in February 2014 when pieces of the lock penetrated the hull.

The question may be asked: who pays for these types of damage and deficiencies? Our past work has found that, by virtue of using guaranty provisions as opposed to warranties (such as the U.S. Coast Guard generally uses), the Navy is responsible for paying for the vast majority of

⁴GAO, *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).

defects.⁵ Specifically regarding LCS, we found that for LCS 4, the Navy's guaranty provisions were structured such that the Navy paid all of the costs to correct all defects. For LCS 3, the shipbuilder was responsible for 30 percent of the cost of the first \$100,000 in defects—a number the Navy surpassed just days after delivery. Thus, the Navy was 100 percent responsible for the costs of all remaining defects. For LCS 5-8, the shipbuilder is responsible for some portion of the first \$1 million in defects for each ship. Time will tell whether this amount is sufficient to account for discovered defects.⁶

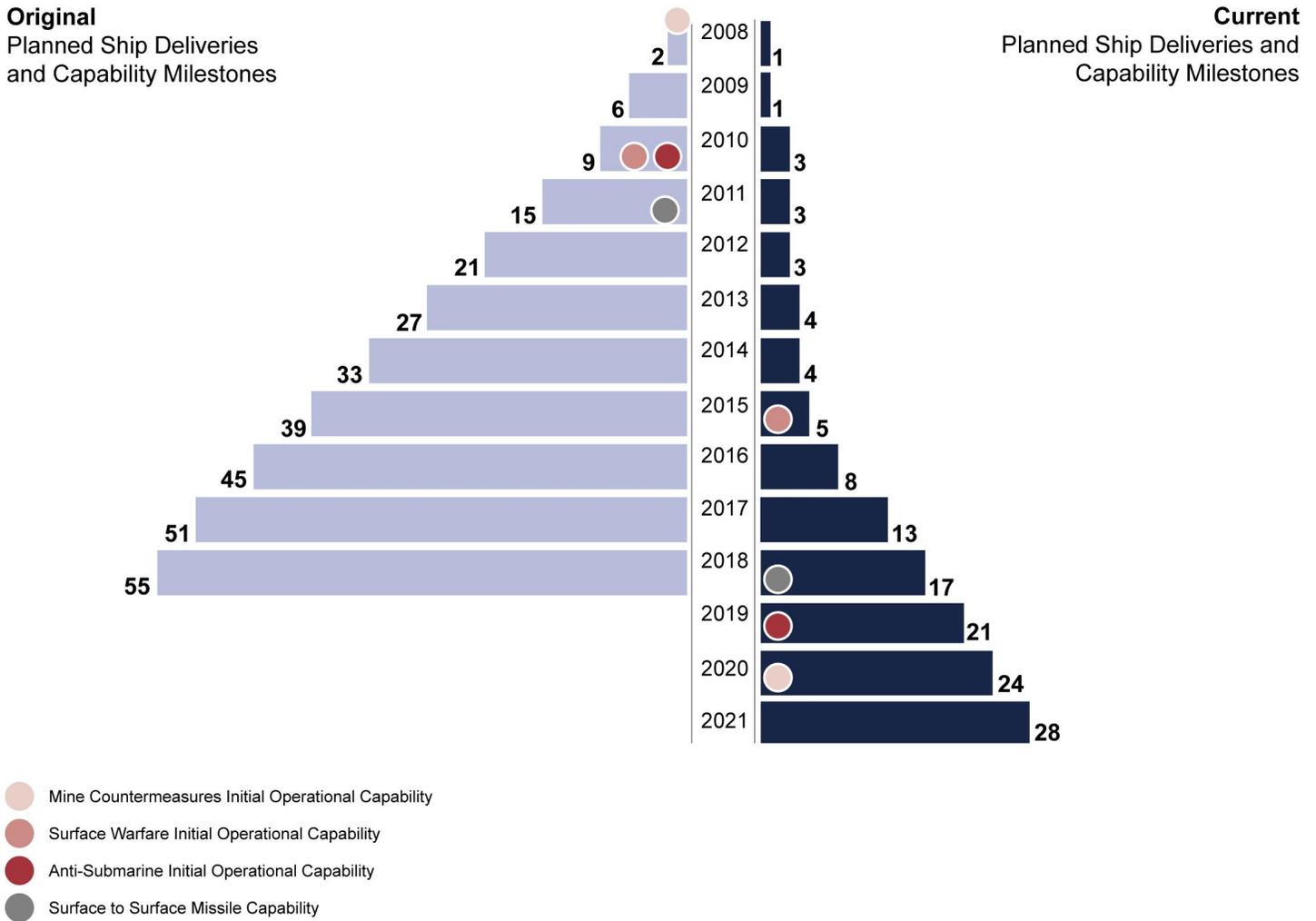
Turning to cost and schedule, our recent work has shown that LCS under construction have exceeded contract cost targets, with the government responsible for paying for a portion of the cost growth. This growth has prompted the Navy to request \$246 million in additional funding for fiscal years 2015-2017, largely to address cost overruns on 12 LCS seaframes. Similarly, deliveries of almost all LCS under contract at both shipyards (LCS 5-26) have been delayed by several months, and, in some cases, close to a year or longer. Navy officials recently reported that, despite having had 5 years of LCS construction to help stabilize ship delivery expectations, the program would not deliver four LCS in fiscal year 2016 as planned.

The LCS mission packages have also lagged behind expectations. The Navy has fallen short of demonstrating that the LCS with its mission packages can meet the minimum level of capability defined at the beginning of the program. As figure 2 shows, 24 LCS seaframes will already be delivered by the time all three mission packages achieve only a minimum level of capability.

⁵Warranty provisions, as are outlined in the Federal Acquisition Regulation (FAR), normally provide that the government may direct the contractor to repair or replace defective items at the contractor's expense. Guarantees are Navy-specific contractual mechanisms that provide for the correction of defects but the responsibility for paying for these corrections varies depending upon contract terms. GAO, *Navy and Coast Guard Shipbuilding: Navy Should Reconsider Approach to Warranties for Correcting Construction Defects*, [GAO-16-71](#) (Washington, D.C.: Mar. 3, 2016).

⁶We are currently reviewing the Navy's post-delivery policies and practices, including the condition of Navy vessels at the time they are delivered from the shipyard and passed to the fleet. LCS is in our scope of work and we expect to issue our report in the spring of 2017.

Figure 2: Littoral Combat Ship Mission Package Operational Capability Delays Since 2007



Source: GAO analysis of Department of Defense data. | GAO-17-279T

Since 2007, delivery of the total initial mission package operational capability has been delayed by about 9 years (from 2011 to 2020) and the Navy has lowered the level of performance needed to achieve the initial capability for two packages—surface warfare and mine countermeasures. As the Navy continues to concurrently deliver seaframes and develop mission packages, it has become clear that the seaframes and mission package technologies were not mature and remain largely unproven.

Another area of concern is changes to the LCS concept of operations as a consequence of less than expected lethality and survivability. LCS was

designed with reduced requirements as compared to other surface combatants, and over time the Navy has lowered several survivability and lethality requirements further and removed some design features—making the ships less survivable in their expected threat environments and less lethal than initially planned. This has forced the Navy to redefine how it plans to operate the ships. Our previous work highlighted the changes in the LCS’s expected capability, as shown in table 3.

Table 3: Evolution of Littoral Combat Ship (LCS) Capability

Concept	Initial	Current
LCS’s capability against adversaries	LCS was primarily planned to be used in major combat operations, enter contested spaces, and be employable and sustainable throughout the battlespace regardless of anti-access or area denial environments.	The Navy acknowledges current LCS weapon systems are under-performing and offer little chance of survival in a combat scenario. LCS lacks the ability to operate independently in combat and should not be employed outside a benign, low-threat environment unless escorted by a multi-mission combatant providing credible anti-air, anti-surface, and anti-submarine protection.
How LCS will deploy	LCS will be a self-sufficient combatant designed to fight and win in shallow water and near-land environments without risking larger combatants in constricted areas.	LCS’s dependencies in combat require it to be well-protected by multi-mission combatants. Multiple LCS will likely have to operate in a coordinated strike attack group fashion for mutual support.
How mission packages swaps will be utilized	Mission packages will be quickly swapped out in an expeditionary theater in a matter of days.	Mission packages can be swapped within 72 hours only if all the equipment and personnel are in theater. An LCS executing a package swap could be unavailable for between 12-29 days. The Navy now expects mission package swaps will be more infrequent than initially envisioned.

Source: GAO analysis of Navy documentation. | GAO-17-279T

Further capability changes may be necessary as the Navy continues to test the seaframes and mission packages, as well as gain greater operational experience. For example, the Navy has not yet demonstrated that LCS will achieve its survivability requirements and does not plan to complete survivability assessments until 2018—after more than 24 ships are either in the fleet or under construction. The Navy has identified unknowns related to the Independence variant’s aluminum hull, and conducted underwater explosion testing in 2016, but the Navy has yet to compile and report the results. Both variants also sustained some damage in trials in rough sea conditions, but the Navy has not completed its analytical reports of these events. Results from air defense and cybersecurity testing also indicate capability concerns, and both seaframe variants were found to have significant reliability and maintainability issues during several tests and trials.

A final issue I will comment on regarding testing is that the Navy's Chief of Naval Operations recently determined that LCS 1-4 will be test ships. This decision supports an aggressive testing schedule between fiscal years 2017 and 2022. The Navy noted that testing requirements have contributed to limited operational availability for delivered LCS. Because operational testing was not conducted in a timely manner to inform any needed design changes to seaframes, additional deficiencies discovered during upcoming tests could require expensive changes to the seaframes and mission packages that have already been delivered.

Frigate Acquisition Strategy Rushes Procurement in Light of Continued Unknowns

The Navy has elected to pursue an acquisition strategy that starts with getting what it calls block buy pricing from both shipyards for 12 LCS.⁷ These basic LCS will then be converted to frigates at a later point in time. The frigate, as planned, will provide multi-mission capability—which is an improvement over LCS—and offers modest improvements to some other capabilities, such as the air search radar. Still, many questions remain to be settled about the frigate's design, cost, schedule, and capabilities.

Despite these uncertainties, the Navy's current acquisition strategy indicates it intends to request authorization from Congress for all of the planned frigates—12 in total—and for funding the lead frigate before establishing realistic cost, schedule, and technical parameters. Further, the frigate will inherit many of the shortcomings or uncertainties of the LCS and does not address all of the priorities that the Navy had identified for its future frigate.

⁷The Navy plans to request authorization to use what it calls a block buy contract to purchase the frigate—the same contracting approach used for LCS—and funding in the fiscal year 2018 budget request for the lead frigate. Our past analysis of the LCS contracts found that a block buy approach could affect Congress's funding flexibility. For example, the LCS block buy contracts provide that a failure to fully fund a purchase in a given year would make the contract subject to renegotiation, which provides a disincentive to the Navy or Congress to take any action that might disrupt the program because of the potential for the government to have to pay more for ships. If similar terms are included in the frigate contract, the same potential effect may apply.

Frigate Cost Uncertainty and a Compressed Schedule Contribute to Gaps in Program Knowledge

The costs for the frigate are still uncertain. Navy officials have stated that the frigate is expected to cost no more than 20 percent—approximately \$100 million—more per ship than the average LCS seaframes, though this is still just an initial estimate. In addition to the continued cost uncertainty, the schedule and approach for the frigate acquisition have undergone substantial changes in the last year, as shown in table 4.

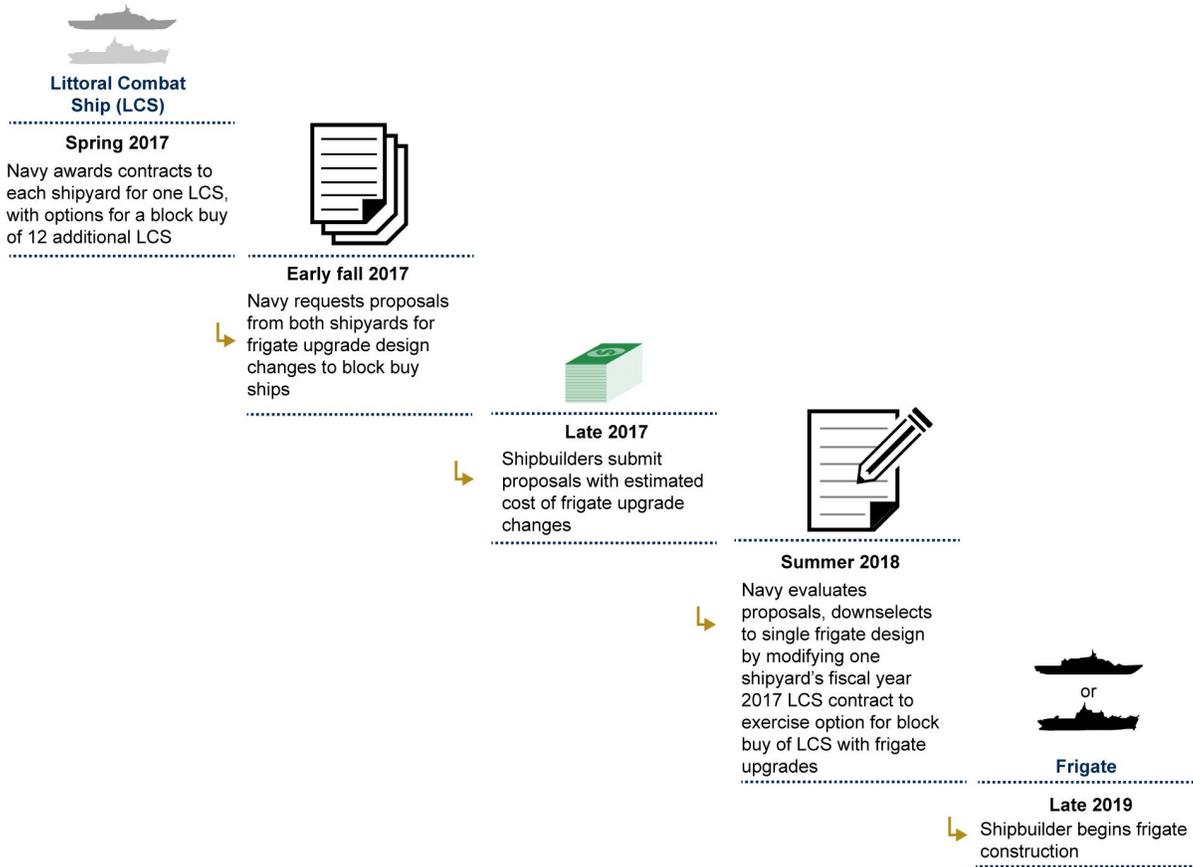
Table 4: Changes in Frigate Acquisition Plan

Previous plan (December 2015)	Current plan (October 2016)
Dual contract award in fiscal year 2019	Downselect award to one shipbuilder in summer 2018
20 frigates (10 per shipbuilder)	12 frigates
Government-led, prescribed design	Contractor-driven design process based on build specifications; increased government furnished equipment
Multiple frigate upgrade packages, with a fiscal year 2019 bid to mature frigate design	Single frigate upgrade package expected from each contractor in fiscal year 2018
Detail design in fiscal year 2018 to increase design knowledge prior to contract award	Detail design begins after downselect award in 2018

Source: GAO analysis of Navy documentation. | GAO-17-279T

According to frigate program officials, under the current acquisition approach, the Navy will award contracts in fiscal year 2017 to each of the current LCS contractors to construct one LCS with a block buy option for 12 additional LCS—not frigates. Then, the Navy plans to obtain proposals from both LCS contractors in late 2017 that would upgrade the block buy option of LCS to frigates using frigate-specific design changes and modifications. The Navy will evaluate the frigate upgrade packages 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 to one shipyard is planned to occur in summer 2018. Figure 3 illustrates how the Navy plans to modify the fiscal year 2017 LCS contract to convert the ships in the block buy options to frigates.

Figure 3: Navy Block Buy Option Contract Modification Process for Frigate Procurement



Source: GAO analysis of Navy data. | GAO-17-279T

The Navy's current plan, which moves the frigate award forward from fiscal year 2019 to fiscal year 2018, is an acceleration that continues a pattern of committing to buy ships in advance of adequate knowledge. Specifically, the Navy has planned for its downselect award of the frigate to occur before detail design of the ship begins. As we previously reported, awarding a contract before detail design is completed—though common in Navy ship acquisitions—has resulted in increased ship prices.⁸ Further, without a year of frigate detail design that had been previously planned before the contract award, the Navy plans to rely on a

⁸GAO-16-356 and GAO, *Defense Acquisitions: Improved Management Practices Could Help Minimize Cost Growth in Navy Shipbuilding Programs*, GAO-05-183 (Washington, D.C.: Feb. 28, 2005).

contractor-driven design process that is less prescriptive than a government-driven design process. This approach is similar to what the Navy used for the original LCS program, whereby the shipyards were given performance specifications and requirements, selecting the design and systems that they determined were best suited to fit their designs in a producible manner. Program officials told us that this new approach should yield efficiencies; however, history from LCS raises concern that this approach for the frigate similarly could lead to the ships having non-standard equipment, with less commonality with the other design and the rest of the Navy.

Frigate Does Not Address All Navy Priorities and Will Likely Carry Forward Some LCS Design Limitations

As LCS costs grew and capabilities diluted, the Secretary of Defense directed the Navy in February 2014 to explore alternatives to the LCS to address key deficiencies. In response, the Navy created the Small Surface Combatant Task Force and directed it to consider new and existing frigate design options, including different types of modified LCS designs. As we reported in June 2016, the task force concluded that the Navy's desired capability requirements could not be met without major modifications to an LCS design or utilizing other non-LCS designs.⁹ When presented with this conclusion, senior Navy leadership directed the task force to explore what capabilities might be more feasible on a minor modified LCS. This direction led the task force to develop options with diminished capabilities, such as reduced speed or range, resulting in some capabilities becoming equal to or below expected capabilities of the current LCS. Ultimately, the department chose a frigate concept based on a minor modified LCS in lieu of more capable—and more expensive—small surface combatant options. Navy leadership indicated this decision was based on LCS's relatively lower cost and quicker ability to field, as well as the ability to upgrade remaining LCS and maintain stability in the industrial base and vendor supply chain.

Table 5 presents an analysis from our June 2016 report, which found that the Navy's proposed frigate will offer some improvements over LCS. For example, the Navy plans to equip the frigates with the mission systems from both the surface and anti-submarine warfare mission packages simultaneously instead of just one at a time (e.g., in a modular fashion) like LCS. However, the Navy's planned frigate upgrades will not result in significant improvements in survivability areas related to vulnerability—the

⁹[GAO-16-356](#).

ability to withstand initial damage effects from threat weapons—or recoverability—the ability of the crew to take emergency action to contain and control damage.

Table 5: Proposed Frigate Capability Changes

Proposed change	Description	Significance
Switch from single to multi-mission capability	Frigate will be able to embark surface and anti-submarine warfare mission packages at one time instead of just a single mission package, like LCS.	A multi-mission capability was recognized in Navy analysis as a key characteristic of a frigate. A frigate will be able to engage different types of threats at all times, unlike LCS which depends on the mission package embarked.
Improve air warfare systems	Frigate will be equipped with an improved air search radar and defensive countermeasures.	This reduces susceptibility to attacks from air-based threats (e.g., aircraft or missiles). The Navy also is considering these improvements for LCS.
Add armor to vital spaces and magazines. Improve shock hardening in anti-air missile system	Armor reduces vulnerability; intended to lessen risk of magazine detonation. Shock hardening reduces vulnerability of missile system.	LCS already has some armor in these areas; shock hardening is limited to anti-air missile system. The Navy believes adjusting the concept of operations for the frigate is more cost-effective and feasible than a further increase in armor and shock hardening.

Source: GAO analysis of Navy documentation. | GAO-17-279T

Further, the Navy sacrificed capabilities that were prioritized by fleet operators. For example, fleet operators consistently prioritized a range of 4,000 nautical miles, but the selected frigate concept is as much as 30 percent short of achieving such a range.

The Director, Operational Test and Evaluation has noted that the Navy’s 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. Further, the Navy plans to make some similar capability improvements to existing and future LCS, narrowing the difference between LCS and the frigate. We found that the proposed frigate does not add any new offensive anti-submarine or surface warfare 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. While specific details are classified, there are only a few areas where there are differences in frigate warfighting capability compared to the LCS.

Since it will be based on the LCS designs, the frigate will likely carry forward some of the limitations of those designs. For example, LCS was designed to carry a minimally-sized crew of approximately 50. The Navy

has found in various studies that the crew is undersized and made some modest increases in crew size. A frigate design based on LCS may not be able to support a significant increase in crew size due to limited space for berthing and other facilities. Additionally, barring Navy-directed changes to key mechanical systems, the frigate will carry some of the more failure-prone LCS equipment, such as some propulsion equipment, and will likely carry some of the non-fleet-standard, LCS-unique equipment that has challenged the Navy’s support and logistics chain. Uncertainties or needs that remain with the surface and anti-submarine warfare mission packages, such as demonstrating operational performance of the surface-to-surface missile and the anti-submarine warfare package, also pose risk for the frigate based on the Navy’s planned timeframes.

Limited Opportunities Remain to Shape LCS and Frigate Programs

Over the past 10 years, we have made recommendations to DOD on a number of issues with the LCS program. We have also suggested actions for Congress to consider. Now, with the fiscal year 2018 budget request imminent, opportunities for Congress to affect the way forward for this program are becoming limited. This upcoming request, which will include the start of frigate acquisition, presents Congress with an opportunity to ensure the Navy possesses sufficient knowledge before making a substantial commitment to the frigate.

Our recommendations to DOD since 2005 have largely focused on LCS combat capability shortfalls and the Navy’s acquisition strategy. While DOD agreed, at times, with these recommendations, it seldom took action if a consequence would be to slow LCS procurement, even when doing so would enable the Navy to build and demonstrate sufficient knowledge in critical areas. Table 6 highlights some of our past recommendations and the department’s response.

Table 6: Department of Defense (DOD) Responses to Selected GAO Recommendations for the Littoral Combat Ship (LCS) and Frigate Programs

Year	GAO recommendation	DOD response
2005	<ul style="list-style-type: none"> Revise LCS acquisition strategy to ensure that the Navy has sufficiently experimented with both ship designs, captured lessons learned, and mitigated operational and technology risks before award of a detail design and construction contract. 	<ul style="list-style-type: none"> DOD partially agreed with this recommendation stating that it would review the acquisition strategy before award of contracts for additional ships. DOD noted, however, that the LCS program entailed risk by design, and that DOD seeks to balance the program’s acquisition risks with the risk of delaying closure of the warfighting gaps that LCS will fill.

2010	<ul style="list-style-type: none"> Update the LCS acquisition strategy to account for operational testing delays in the program and re-sequence planned purchases of ships and mission packages, as appropriate. 	<ul style="list-style-type: none"> DOD agreed with this recommendation; however, since issuance of the report, the Navy significantly altered its acquisition strategy resulting in the award of block buy contracts in 2010 without demonstrating knowledge related to, among other things, operational testing of at least one of the mission packages on each variant.
2013	<ul style="list-style-type: none"> Procure the minimum quantity and rate of ships required to preserve the mobilization of the production base until the successful completion of the full-rate production decision review. Report to Congress on the relative advantages of each seaframe variant for each of the three mission areas. 	<ul style="list-style-type: none"> DOD did not agree with our recommendation regarding the quantity and rate of ships to be purchased, stating that it would unnecessarily decrease production and result in higher pricing for individual seaframes with no value added to the program. DOD agreed with this recommendation, and Congress directed the Navy to provide additional information on some of the risk areas GAO identified, but the Navy essentially suggested that since the two variants are built to the same requirements they perform the same way.
2014	<ul style="list-style-type: none"> Before approving the release of the request for proposals for future contracts for either seaframe variant, require both variants to, among other things, deploy to a forward overseas location and complete rough water, ship shock, and total ship survivability testing. 	<ul style="list-style-type: none"> DOD partially agreed with this recommendation, stating its intention to complete as many of the tests and demonstrations as possible before releasing the request for proposals. The department, however, maintained that the release of the request for proposals should not hinge on these actions.
2015	<ul style="list-style-type: none"> Ensure that the Navy's acquisition strategy for the modified LCS does not place industrial base concerns ahead of demonstrating the ship's lethality, survivability, and affordability 	<ul style="list-style-type: none"> DOD agreed with this recommendation, stating that the Secretary will ensure that industrial base concerns are balanced against cost, schedule and fleet requirements. In March 2016, however, the department approved the Navy's strategy to acquire a minor modified LCS, or frigate—a ship concept it had previously recommended to the department based in large part on industrial base considerations.
2016	<ul style="list-style-type: none"> Before a downselect decision for the frigate, require the program to submit milestone documentation, which could include an independent cost estimate, an acquisition program baseline, and a plan to incorporate the frigate into DOD's Selected Acquisition Reports to Congress. 	<ul style="list-style-type: none"> DOD partially agreed, 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, including an independent cost estimate and an updated acquisition program baseline. The response did not address our concerns about transparency in the Selected Acquisition Reports.

Source: GAO analysis of prior GAO reports and DOD actions taken or planned. | GAO-17-279T

In addition to these recommendations to DOD, our past reports have made suggestions to Congress on actions to support better LCS program outcomes. For instance, in 2013, we asked Congress to consider restricting construction funding for additional LCS seaframes until the Navy had adequate knowledge to mitigate substantial unknowns about LCS capabilities, use, and costs. Congress responded to our suggestion in the National Defense Authorization Act for Fiscal Year 2014, restricting the use of funds for LCS seaframes until the Navy submitted information to the defense committees on LCS requirements, maturity, testing, and concept of operations. In other cases, however, Congress has opted to take alternative routes. For example, we suggested in June 2016 that the

Congress consider a pause in LCS procurement funding for fiscal year 2017. In doing so, we noted such a pause would provide the Navy with an opportunity to address unresolved LCS performance concerns without creating production problems at the shipyards. However, the Conference Report accompanying the National Defense Authorization Act for Fiscal Year 2017 reflects funding for two more LCS, suggesting that LCS procurement will continue as planned.

The Navy's plans for fiscal year 2018 involve significant decisions for Congress in terms of the way forward in the immediate future the frigate program, including potential future commitments of about \$9 billion based on early budget estimates. On the heels of the decision to fund two LCS in fiscal year 2017 is a decision on whether to authorize the frigate contracting approach and fund the lead frigate.

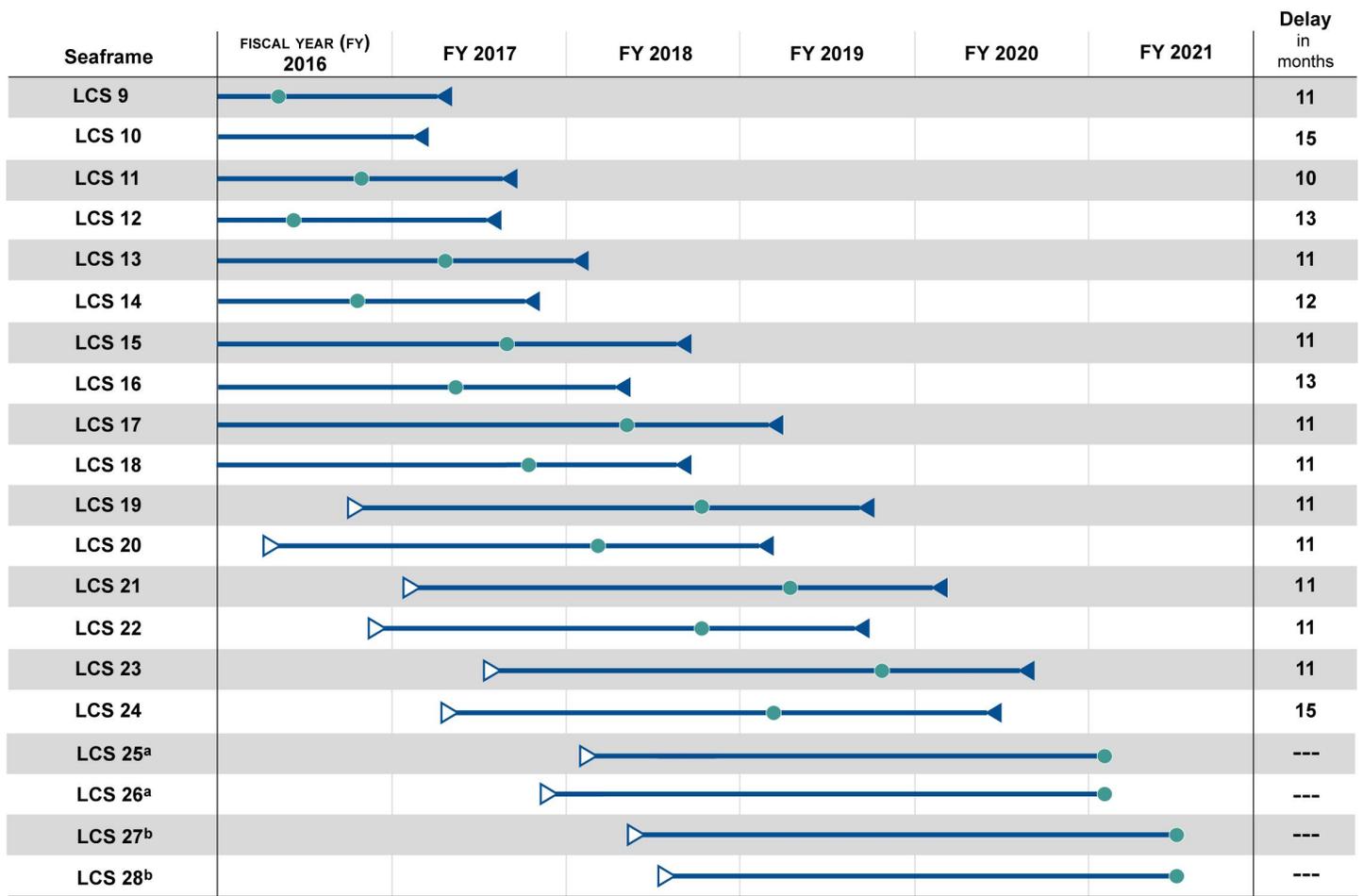
As I noted above, the current acquisition plans for the frigate have been accelerated during the past year. If these plans hold, the Navy will ask Congress in a few months to consider authorizing a block buy of 12 frigates and funding the lead frigate when the fiscal year 2018 budget is proposed. This request appears premature, as it requires Congress to make a decision on the frigate before detail design has begun and before the scope and cost of the design changes needed to turn an LCS into a frigate are well understood. The Navy will not establish its cost estimate until May 2017—months after requesting authorization from Congress for the block buy contracting approach for 12 frigates. Further, DOD's Office of Cost Assessment and Program Evaluation is not expected to complete an independent cost estimate on the frigate until fiscal year 2018. This means that the upcoming budget request is unlikely to reflect the most current costs for the program moving forward.

Similar to what we previously have advised about LCS block buy contracting, a frigate block buy approach also could reduce funding flexibility. For example, the LCS block buy contracts provide that a failure to fully fund the purchase of a ship in a given year would make the contract subject to renegotiation. DOD has pointed to this as a risk that the contractors would supersede the block buy pricing with higher prices. Thus, DOD and Congress have had a notable disincentive to take any action that might delay procurement, even when a program is underperforming as has been the case with LCS.

Also, the shipyards' existing LCS construction workload suggests that a request to authorize the frigate in early 2017 (with the fiscal year 2018 budget request) may not only be premature, but also unnecessary.

Although the Navy has argued that pausing LCS production would result in loss of production work and start-up delays to the frigate program, the schedule suggests that both shipyards have sufficient workload remaining from prior LCS contract awards that could offset the need to award the frigate in 2018 as planned. The Navy's concern also does not account for any other work that the shipyards may have from other Navy or commercial contracts and the possibility of continued delays in the delivery of LCS. As figure 4 depicts, delays that have occurred for previously funded ships have resulted in a construction workload that extends into fiscal year 2020. This prolonged workload, when combined with the two LCS awarded earlier in 2016 and the two LCS planned to be awarded in fiscal year 2017, takes construction at both shipyards into 2021.

Figure 4: Construction Demands for Littoral Combat Ship (LCS) Shipyards



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-17-279T

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

^bThe Navy has not awarded contracts for construction of LCS 27 or 28, so start and delivery dates represent current plans.

With 14 LCS in various phases of construction (LCS 9-22) and 3 more (LCS 23, 24, and 26) set to begin construction later in fiscal year 2017, delaying a decision on the frigate until fiscal year 2019 would enable the Navy and the shipbuilders to improve design and cost knowledge. This, in

turn, would offer Congress an opportunity to be better informed on the expectations for the frigate before making a decision on the program.

Summary

Congress is faced at this point in time with a basic oversight question: does it want to authorize an investment of a potential \$9 billion for a program that has no independent cost estimate, capabilities that are uncertain, and a compressed contract award schedule when there is no industrial base or other imperative to do so?

I will reiterate that the block buy pricing the Navy intends to seek from the LCS contractors in 2017 will be for the basic LCS seaframes that the Navy has acknowledged do not meet its needs. In 2010, the shipbuilders—when faced with the prospect of a downselect—provided the Navy with competitive pricing that propelled it to continue production at both shipyards. Subsequent history shows those prices have not been achievable. Even if LCS prices offered once again appear favorable, the ships ultimately are intended to be frigates, and the upgrade cost—to be proposed by the shipyards later—is a significant unknown.

A decision by Congress to authorize the block buy of 12 frigates is effectively the final decision for the entire buy of 40 LCS and frigates. While, according to the Navy's approved acquisition strategy, the frigates would still require annual appropriations and Congress could thus conduct oversight of the program through that process, it could be more difficult to make decisions to reduce or delay the program should that become warranted, as the Navy may point to losses in favorable block buy prices such as it has done previously with LCS.

Chairwoman Hartzler, Ranking Member Speier, and Members of the Subcommittee, this completes my prepared statement. I would be pleased to respond to any questions that you may have at this time.

GAO Contact and Staff Acknowledgments

If you or your staff has any questions about this statement, please contact Michele Mackin at (202) 512-4841 or mackinm@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement. GAO staff who made key contributions to this testimony are Diana Moldafsky (Assistant Director), Pete Anderson, Jacob Leon Beier, Laurier Fish, Laura Greifner, Kristine Hassinger, C. James Madar, Sean Merrill, LeAnna Parkey, Anne Stevens, Roxanna Sun, Abby Volk, and Robin Wilson.

Related GAO Products

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Appendix I: Accessible Data

Data Table for Figure 2: Littoral Combat Ship Mission Package Operational Capability Delays Since 2007

Year	Original Planned ship deliveries and capability milestones	Current Planned ship deliveries and capability milestones
2008	2	1
2009	6	1
2010	9	3
2011	15	3
2012	21	3
2013	27	4
2014	33	4
2015	39	5
2016	45	8
2017	51	13
2018	55	17
2019	N/A	21
2020	N/A	24
2021	N/A	28

Data Table for Figure 4: Construction Demands for Littoral Combat Ship (LCS) Shipyards

Hull	Current Construction Start	Original Delivery	Modified Delivery	Estimated delay (in months)
LCS 9	Jan-13	Feb-16	Jan-17	11
LCS 10	Mar-13	Aug-15	Nov-16	15
LCS 11	Aug-13	Aug-16	Jun-17	10
LCS 12	Sep-13	Mar-16	Apr-17	13
LCS 13	Feb-14	Jan-17	Dec-17	11
LCS 14	Feb-14	Aug-16	Aug-17	12
LCS 15	Dec-14	Jul-17	Jun-18	11
LCS 16	Sep-14	Jan-17	Feb-18	13
LCS 17	Aug-15	Jan-18	Dec-18	11
LCS 18	Mar-15	Jul-17	Jun-18	11
LCS 19	Aug-16	Jul-18	Jun-19	11
LCS 20	Feb-16	Dec-17	Nov-18	11
LCS 21	Dec-16	Jan-19	Dec-19	11
LCS 22	Sep-16	Jul-18	Jun-19	11
LCS 23	May-17	Jul-19	Jun-20	11
LCS 24	Jan-17	Nov-18	Feb-20	15
LCS 25a	Dec-17	Nov-20	Nov-20	N/A

LCS 26a	Sep-17	Nov-20	Nov-20	N/A
LCS 27b	Feb-18	May-21		N/A
LCS 28b	Mar-18	May-21		N/A