



August 2019

GUIDED MISSILE FRIGATE

Navy Has Taken
Steps to Reduce
Acquisition Risk, but
Opportunities Exist to
Improve Knowledge
for Decision Makers

Revised September 5, 2019 to include an omitted page in the report section, Comments from the Department of Defense.

GAO Highlights

Highlights of [GAO-19-512](#), a report to congressional committees

Why GAO Did This Study

In response to the shortcomings of the Navy's Littoral Combat Ship program and evolving threats, the Navy began the FFG(X) program. With FFG(X), the Navy intends to deliver a multi-mission ship that will provide anti-surface, anti-submarine, and air warfare capabilities. DOD approved FFG(X) requirements in February 2019. The Navy plans for a competitive contract award to support final FFG(X) design and construction. The program is expected to cost over \$20 billion for 20 ships.

The House report accompanying the National Defense Authorization Act for Fiscal Year 2019 included a provision for GAO to review the FFG(X) program. This report addresses, among other things, the FFG(X) acquisition approach and contracting plans.

GAO reviewed requirements, acquisition, design, and cost-related documentation. GAO interviewed Navy and other defense officials, and conducted industry site visits to each shipyard participating in FFG(X) conceptual design activities. GAO also leveraged prior GAO reports and best practices guides.

What GAO Recommends

GAO recommends that the Navy provide Congress with the independent cost estimate for FFG(X) prior to the detail design and construction contract award and seek ship warranty cost information from industry as part of the request for proposal process. While DOD generally concurred with GAO's recommendations, it did not agree to update its request for proposal to solicit ship warranty pricing. GAO continues to believe this is an essential element of the recommendation, as discussed in the report.

View [GAO-19-512](#). For more information, contact Shelby S. Oakley at (202) 512-4841 or oakleys@gao.gov.

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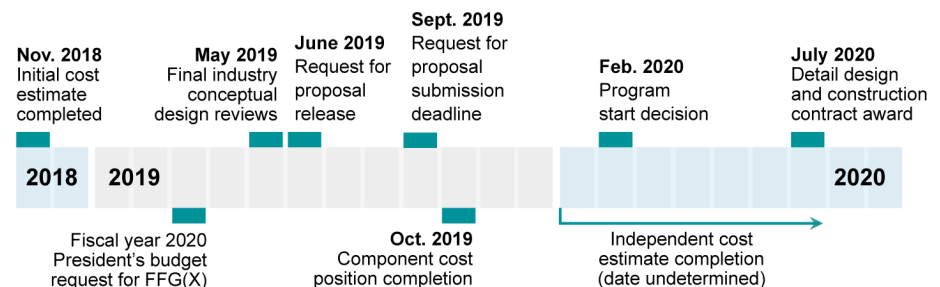
GUIDED MISSILE FRIGATE

Navy Has Taken Steps to Reduce Acquisition Risk, but Opportunities Exist to Improve Knowledge for Decision Makers

What GAO Found

The Navy undertook a conceptual design phase for the FFG(X) Guided Missile Frigate program that enabled industry to inform FFG(X) requirements, identify opportunities for cost savings, and mature different ship designs. The Navy also streamlined the FFG(X) acquisition approach in an effort to accelerate the timeline for delivering the ships to the fleet. As shown in the figure, however, the Navy has requested funding for the FFG(X) lead ship even though it has yet to complete key cost estimation activities, such as an independent cost estimate, to validate the credibility of cost expectations. Department of Defense (DOD) cost estimators told GAO the timeline for completing the independent cost estimate is uncertain. Specifically, they stated that this estimate will not be finalized until the Navy communicates to them which FFG(X) design is expected to receive the contract award. GAO-identified best practices call for requisite cost knowledge to be available to inform resource decisions and contract awards.

Timeline of FFG(X) Program Key Cost and Design Knowledge and Budgeting Activities



Source: GAO analysis of Navy information. | GAO-19-512

The Navy plans to use a fixed-price incentive contract for FFG(X) detail design and construction. This is a notable departure from prior Navy surface combatant programs that used higher-risk cost-reimbursement contracts for lead ship construction. The Navy also plans to require that each ship has a minimum guaranty of \$5 million to correct shipbuilder-responsible defects identified in the 18 months following ship delivery. However, Navy officials discounted the potential use of a warranty—another mechanism to address the correction of shipbuilder defects—stating that their use could negatively affect shipbuilding cost and reduce competition for the contract award. The Navy provided no analysis to support these claims and has not demonstrated why the use of warranties is not a viable option. The Navy's planned use of guarantees helps ensure the FFG(X) shipbuilder is responsible for correcting defects up to a point, but guarantees generally do not provide the same level of coverage as warranties. GAO found in March 2016 that the use of a guaranty did not help improve cost or quality outcomes for the ships reviewed. GAO also found the use of a warranty in commercial shipbuilding and certain Coast Guard ships improves cost and quality outcomes by requiring the shipbuilders to pay to repair defects. The FFG(X) request for proposal offers the Navy an opportunity to solicit pricing for a warranty to assess the cost-effectiveness of the different mechanisms to address ship defects.

Contents

Letter		1
	Background	4
	Navy Expects That FFG(X) Requirements Will Provide a More Capable Small Surface Combatant, but at Increased Cost	8
	Streamlined Acquisition Approach Accelerates Planned FFG(X) Schedule, but Reduces Knowledge Available for Key Program Decisions	16
	The Navy Has Taken Steps to Reduce Design and Technical Risk, but Technology Integration and Testing Will be Key to Meeting Program Expectations	27
	Contracting Plans for FFG(X) May Help Mitigate Some Risk, and Use of Warranties Could Potentially Further Reduce Costs	33
	Conclusions	38
	Recommendations for Executive Action	39
	Agency Comments and Our Evaluation	39
Appendix I	Comments from the Department of Defense	43
Appendix II	GAO Contact and Staff Acknowledgments	46
Tables		
	Table 1: Small Surface Combatant Requirements Evolution from Littoral Combat Ship (LCS) to Frigate (FF) to Guided Missile Frigate (FFG(X))	11
	Table 2: FFG(X) Acquisition Process Streamlining of Early Program Activities	19
	Table 3: Examples of Existing Systems Planned for the FFG(X) Guided Missile Frigate Used by Other Navy Ship Classes	29
Figures		
	Figure 1: Knowledge Attainment in the Shipbuilding Process	5
	Figure 2: Notional Acquisition Framework for Navy Shipbuilding Programs	7
	Figure 3: Key Events Contributing to FFG(X) Guided Missile Frigate Requirements Development	9
	Figure 4: GAO Assessment of Average Small Surface Combatant Acquisition Cost	12

Figure 5: Key Information for Industry Teams Participating in FFG(X) Guided Missile Frigate Conceptual Design Phase	14
Figure 6: FFG(X) Guided Missile Frigate Acquisition Schedule	17
Figure 7: Timeline of Key Cost and Design Knowledge and Budgeting for FFG(X) Guided Missile Frigate Program Detail Design and Construction	23
Figure 8: Department of Defense Fixed-Price Incentive Contract Shareline and Price Ceiling Risk	35

Abbreviations

ACAT	Acquisition category
CAPE	Office of Cost Assessment and Program Evaluation
CNO	Chief of Naval Operations
DOD	Department of Defense
EASR	Enterprise Air Surveillance Radar
FF	Frigate program
FFG(X)	Guided Missile Frigate
FRET	Frigate Requirements Evaluation Team
LCS	Littoral Combat Ship
nAILES	New Advanced Integrated Line-of-Sight Equipment System
OWLD	Obligation work limiting date
RFP	Request for proposal
TRL	Technology readiness level

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August 9, 2019

Congressional Committees

With its new Guided Missile Frigate program, FFG(X), the Navy intends to develop and deliver a ship with enhanced ability to destroy enemy targets and avoid, withstand, or recover from damage as compared to its current active small surface combatant—the Littoral Combat Ship (LCS).¹

Following significant cost increases, schedule delays, and reduced capabilities for LCS, the Secretary of Defense directed the Navy in 2014 to explore other options for a new small surface combatant. After multiple studies focused on a ship with enhanced lethality and survivability capabilities, the Navy established its current design and construction plan for the new frigate. In February 2018, the FFG(X) program initiated a conceptual design phase to help solidify program requirements and mature competitive ship designs. The Navy is scheduled to formally begin the FFG(X) program in February 2020 and award a detail design and construction contract in July 2020 through full and open competition. The Navy's fiscal year 2020 President's budget request supports this contract award plan, with nearly \$1.3 billion requested for the lead ship construction and over \$20 billion projected to construct 20 planned frigates.²

The House Armed Services Committee report to accompany the National Defense Authorization Act for Fiscal Year 2019 contained a provision for GAO to review the FFG(X) program.³ This report addresses (1) the requirements development process and results for FFG(X); (2) the Navy's efforts to streamline the FFG(X) acquisition approach; (3) any design and technical risks for the program and how the Navy plans to address them;

¹The Navy organizes its surface combatant ships into large surface combatants, including cruisers and destroyers, and small surface combatants, including frigates, LCS, mine warfare ships, and patrol craft. Frigates have been identified as typically being open-ocean, multi-role ships capable of performing surface, anti-submarine, and anti-air warfare. The 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.

²The \$20 billion projected FFG(X) cost is in then-year dollars; we use then-year dollars throughout this report, unless otherwise specified. Then-year dollars reflect the effects of inflation, including escalation up to and during the year of the appropriation, and throughout the period during which dollars are expended from the Treasury.

³See H.R. Rep. No. 115-676, at 17 (2018).

and (4) the Navy's contracting plans for the detail design and construction award.

To assess the requirements development process and results for FFG(X), we evaluated the Navy's requirements development process beginning with the Secretary of Defense's direction to the Navy in 2014 to review alternatives to LCS. This included reviewing the scope and methodology used by the Navy across several studies to analyze capability needs, as well as the approved requirements for LCS, the frigate (FF) program that was planned immediately prior to FFG(X), and FFG(X). As part of our requirements assessment, we interviewed relevant officials from the FFG(X) program office, Chief of Naval Operations Surface Warfare Directorate, and the Joint Chiefs of Staff to gain insight into the activities undertaken to generate and refine FFG(X) requirements. We also interviewed the prime contractors leading the five industry teams that participated in the FFG(X) conceptual design phase and visited the associated shipyards to learn about their efforts to align their ship designs with the Navy's requirements and identify potential cost reduction initiatives associated with those designs. The prime contractors we met with at their shipyards include Austal USA in Mobile, Alabama; General Dynamics Bath Iron Works in Bath, Maine; Fincantieri Marinette Marine in Marinette, Wisconsin; and Huntington Ingalls Industries, Ingalls Shipbuilding in Pascagoula, Mississippi. We met with Lockheed Martin—the fifth prime contractor—in Washington, D.C. Lockheed Martin teamed up with the Fincantieri Marinette Marine shipyard for its conceptual design work.

To assess the program's efforts to streamline its acquisition approach, we reviewed program documentation outlining the Navy's acquisition approach and associated tailoring and streamlining plans for the program. This included a review of the July 2018 FFG(X) acquisition streamlining and tailoring memorandum and related acquisition decision memorandum from November 2018, as well as the acquisition strategy approved in November 2018. We also reviewed efforts to meet statutory requirements and adhere to Department of Defense (DOD) and Navy acquisition policy. This focused on DOD Instruction (DODI) 5000.02 acquisition guidance and Secretary of the Navy Instruction 5000.2 guidance—both the March 2019 Secretary of the Navy Instruction (5000.2F) and the prior Secretary of the Navy Instruction (5000.2E). We also assessed the program's plans compared to acquisition best practices, including those discussed in GAO's shipbuilding best practices work and the GAO Cost Estimating and

Assessment Guide.⁴ We also interviewed relevant officials from the Navy and Office of the Secretary of Defense about their efforts to develop and support the FFG(X) acquisition approach. This included DOD and Navy officials from the Office of Cost Assessment and Program Evaluation (CAPE); the FFG(X) program; Naval Sea Systems Command; and the Program Executive Office for Integrated Warfare Systems.

To assess any design and technical risks for the program and how the Navy plans to address them, we reviewed program documentation including the acquisition strategy and systems engineering plan—both approved in November 2018—to understand the Navy’s plans to mitigate technical risk. This involved assessing factors like technology maturity, systems engineering and integration plans, ship designs, and any risks identified by DOD or industry. As part of this analysis, we interviewed officials from the Navy and organizations under the Office of the Secretary of Defense. This included officials from the offices of the Deputy Assistant Secretary of Defense for Systems Engineering; Deputy Assistant Secretary of Defense for Development, Test, and Evaluation; Director, Operational Test and Evaluation; Navy’s Commander Operational Test and Evaluation Force; Naval Operations Test and Evaluation Directorate; and Office of Naval Research. We also used the aforementioned interviews and site visits with industry to learn about their design and facility plans if selected by the Navy for the detail design and construction contract award.⁵

To assess the FFG(X) contracting plans, we reviewed the program’s acquisition strategy and March 2019 draft request for proposal for the detail design and construction award. We also interviewed Navy officials from the FFG(X) program office and Naval Sea Systems Command to discuss different elements of contracting plans and the basis for the Navy’s decisions supporting contracting plans. We also assessed the program’s plans against the results of our prior work related to contract types used for Navy shipbuilding and the use of warranties and guarantees in contracts.

⁴GAO, *Best Practices: High Levels of Knowledge at Key Points Differentiate Commercial Shipbuilding from Navy Shipbuilding*, [GAO-09-322](#) (Washington, D.C.: May 13, 2009); and *GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs*, [GAO-09-3SP](#) (Washington, D.C.: March 2009).

⁵The Lockheed Martin industry team for FFG(X) conducted conceptual design activities, but, according to a Lockheed Martin representative, the company is not planning to submit a proposal for the detail design and construction contract award competition based on its LCS-based ship design.

We conducted this performance audit from August 2018 to August 2019 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.

Background

In the early 2000s, the Navy conceived of a new small surface combatant concept known as LCS. This ship was intended to offer the Navy an affordable, flexible platform that would be able to swap out surface warfare, anti-submarine warfare, or mine countermeasure mission packages to provide for one of those mission needs. As we found in multiple reports, the Navy's vision for LCS evolved significantly over time in response to diminished capability expectations and significant cost and schedule growth.⁶ In 2014, the Secretary of Defense directed the Navy to evaluate alternatives to LCS, citing survivability and lethality concerns. This represented the beginning of the Navy's pursuit of a solution to address LCS shortcomings and the evolving threat environment acknowledged by the department.

The Navy initially envisioned quickly fielding a frigate—referred to as the FF program—based on a minor modified LCS design. The ship was expected to provide a more lethal and survivable multi-mission ship capable of simultaneous surface and anti-submarine warfare, with a planned contract award for the lead ship in 2018. In 2016, we found that the Navy's planned upgrades for FF did not significantly improve certain survivability areas and lacked capabilities that were prioritized by fleet operators, such as the ship's range of travel without refueling.⁷ Then, in April 2017 we found the Navy's aggressive FF acquisition schedule increased risk to the government because it included a commitment to

⁶GAO, *Littoral Combat Ship and Frigate: Delaying Planned Frigate Acquisition Would Enable Better-Informed Decisions*, [GAO-17-323](#) (Washington, D.C.: Apr. 18, 2017); *Littoral Combat Ship and Frigate: Congress Faced with Critical Acquisition Decisions*, [GAO-17-262T](#) (Washington, D.C.: Dec. 1, 2016); and *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).

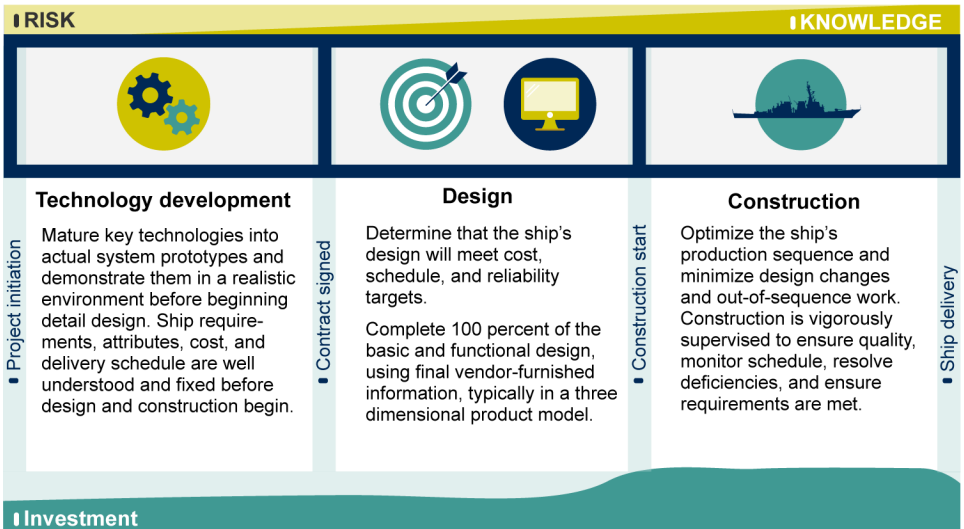
⁷GAO, *Littoral Combat Ship: Need to Address Fundamental Weaknesses in LCS and Frigate Acquisition Strategies*, [GAO-16-356](#) (Washington, D.C.: June 9, 2016).

buy ships in advance of adequate knowledge.⁸ In May 2017, the Navy announced it was revising its frigate plans and began pursuing FFG(X).

Shipbuilding Best Practices

In 2009, we identified commercial shipbuilding best practices that could be adapted for use by the Navy.⁹ We found that successful shipbuilding programs have sound business cases built on attaining critical levels of knowledge at key points in the shipbuilding process before significant investments are made, as shown in figure 1.

Figure 1: Knowledge Attainment in the Shipbuilding Process



Source: GAO depiction of notional shipbuilding process. | GAO-19-512

Regardless of the differences between Navy and commercial shipbuilding, knowledge attainment is crucial to success. Executable business cases use realistic cost and schedule targets to meet performance and quality expectations by balancing inherent uncertainties in acquisition programs. A solid business case provides for the resources necessary to mitigate challenges, such as immature technologies and design requirements. The greater the potential for challenges to occur, the more time and money should be factored into the business case to address them. The Navy has previously agreed, in principle, that

⁸GAO-17-323.

⁹GAO-09-322.

knowledge should be attained prior to key milestones to better ensure ships are built to established cost, schedule, quality, and performance standards.¹⁰

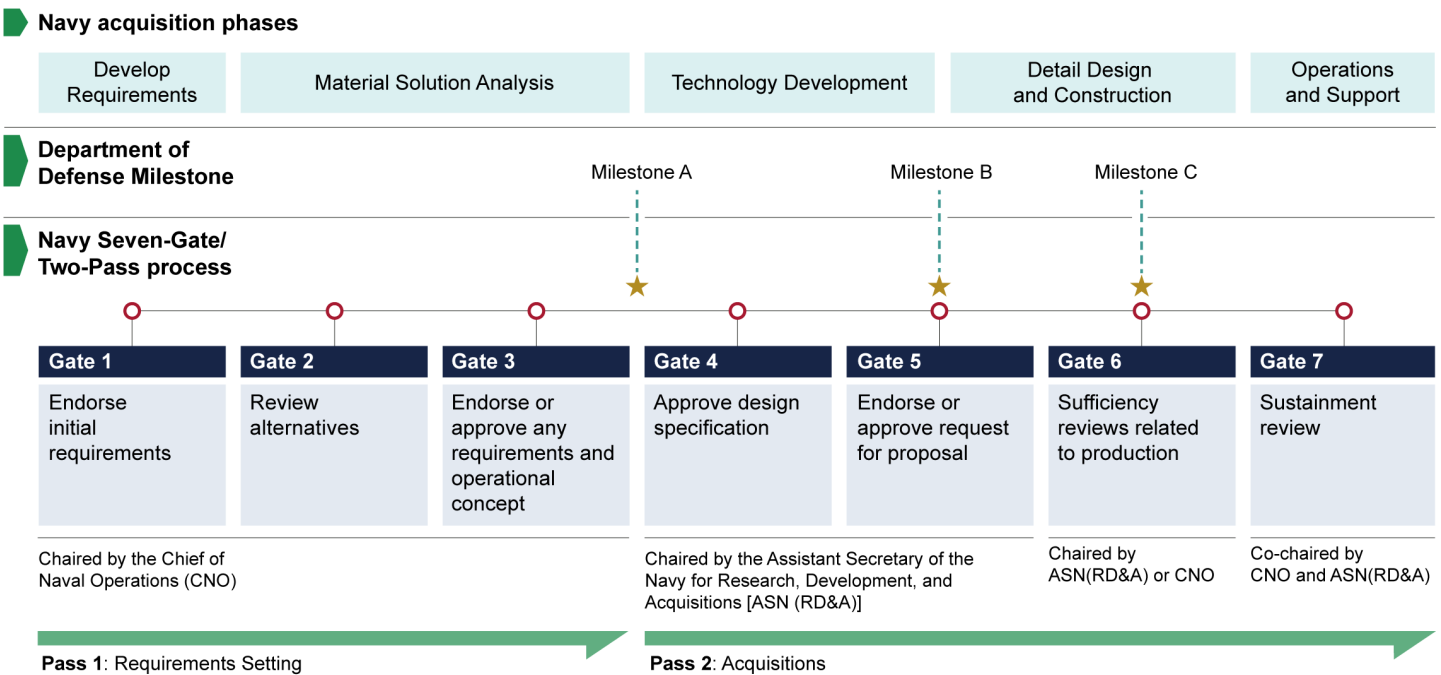
Navy Shipbuilding Acquisition Framework

In general, the Department of Defense (DOD) acquires new weapon systems, such as Navy surface combatants, through a management process known as the Defense Acquisition System. Under this system, programs typically complete a series of milestone reviews and other key decision points that authorize entry into a new acquisition phase. To execute shipbuilding acquisition programs, the Navy uses the acquisition processes included in the DOD Instruction 5000 series, as well as acquisition instructions established by the Secretary of the Navy.¹¹ The Navy's guidance supports a seven-gate review process intended to ensure that requirements align with acquisition plans, and to improve collaboration among stakeholders. Figure 2 provides an overview of the notional framework for Navy shipbuilding acquisition programs described by the DOD and Navy guidance.

¹⁰GAO, *Navy Shipbuilding: Past Performance Provides Valuable Lessons for Future Investments*, [GAO-18-238SP](#) (Washington, D.C.: June 6, 2018).

¹¹DOD Instruction (DODI) 5000.02, *Operation of the Defense Acquisition System* (Jan. 7, 2015), serves as the overall DOD acquisition guidance for weapon system programs. Secretary of the Navy Instruction 5000.2F, *Defense Acquisition System and Joint Capabilities Integration and Development System Implementation* (Mar. 26, 2019), establishes a seven-gate review process specific to Department of the Navy weapon system programs.

Figure 2: Notional Acquisition Framework for Navy Shipbuilding Programs



Source: GAO analysis of DOD and Navy documentation. | GAO-19-512

This acquisition framework includes decision reviews and milestones at key junctures in the acquisition cycle. The Milestone Decision Authority is the individual responsible for determining what events and documentation requirements will apply to an acquisition program, as well as providing approval for a program to proceed to the next acquisition phase. The acquisition framework and Milestone Decision Authority’s purpose is to support careful assessment of a program’s readiness to proceed to the next stage of acquisition activities.

The gates and milestones that will be included in an acquisition program’s schedule can be customized based on its circumstances and needs. We have previously found that shipbuilding programs typically have different decision points than other DOD weapon systems.¹² For example, Milestone B for ship programs usually occurs after development of ship specifications and system diagrams is well under way and is typically

¹²[GAO-09-322](#).

aligned with the decision to authorize the start of detail design. While Milestone C generally represents the decision to start production for weapon systems, several of the Navy's more recent shipbuilding programs either do not include a Milestone C review or changed the sequencing of the review to occur after delivery of the lead ship. Programs can receive approval to tailor the requirements for information that must be developed to support this process and to have the decision-making authority delegated to other individuals for acquisition decisions and approvals.

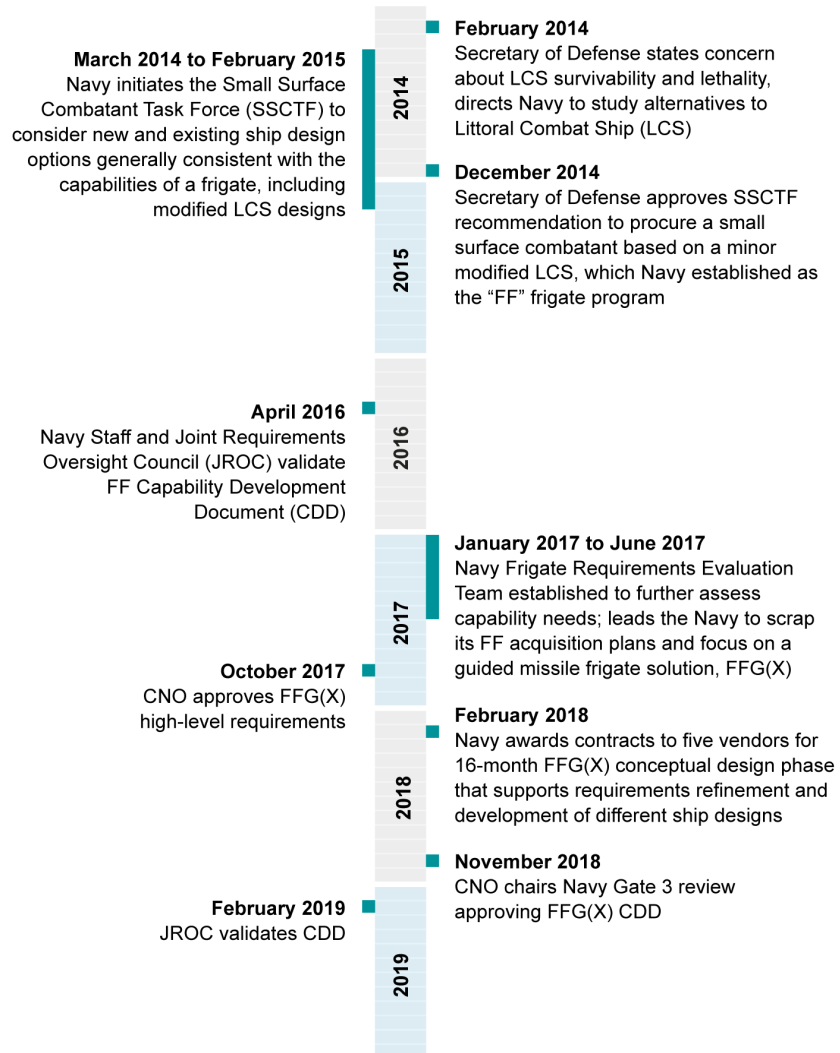
Navy Expects That FFG(X) Requirements Will Provide a More Capable Small Surface Combatant, but at Increased Cost

The Navy expects that its current plans for FFG(X) will result in a small surface combatant with considerable capability improvements compared to LCS. To achieve this increased capability, the Navy is committing to construct a larger, more expensive ship than LCS. To help refine FFG(X) requirements and identify opportunities for cost savings, the Navy used a conceptual design phase, in which it awarded \$75 million in contracts to industry.

FFG(X) Requirements Reflect Limitations of LCS and Evolution in Capability Needs

The Navy's FFG(X) requirements represent the department's recognition of its need for a more capable small surface combatant and the limitations of LCS. For LCS and its mission packages, the Navy has devoted nearly \$28 billion (constant fiscal year 2018 dollars) to develop and buy a ship that has fallen far short of demonstrating it can meet the minimum level of capability defined at the beginning of the program. Specifically, LCS was designed with reduced survivability requirements as compared to other surface combatants. Over time the Navy 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. As shown in figure 3, the Navy arrived at its FFG(X) plans after spending several years developing and evaluating a variety of inputs to address problems with LCS and emerging capability needs.

Figure 3: Key Events Contributing to FFG(X) Guided Missile Frigate Requirements Development



Source: GAO analysis of Navy information. | GAO-19-512

The Small Surface Combatant Task Force study report maintained the Navy's need for 52 small surface combatants, which was revalidated in the Navy's 2016 Force Structure Assessment. In recognition of LCS's shortcomings, the Navy significantly reduced the total number of LCS, and began planning for the new frigate based on minor modifications to an LCS design—referred to as FF—to fulfill the 52-ship need.

While the FF program was developing its acquisition plans and moving toward a contract award for the lead ship scheduled for 2018, the maritime operating environments continued to rapidly evolve, becoming increasingly complex and contested. In recognition of this, the Chief of Naval Operations directed the Navy to conduct another study, increasing air defense and survivability beyond the FF baseline. In response, the Navy convened a Frigate Requirements Evaluation Team from January to June 2017. The purpose of this team was to build upon FF requirements by analyzing options for air defense and vulnerability upgrades to help determine top-level mission requirements that would yield a more capable frigate. The results of this review led the Navy to cancel its FF acquisition plans and focus on meeting increased requirements through a new FFG(X) Guided Missile Frigate program.

Both the FF and FFG(X) requirements reflect the 2015 Small Surface Combatant Task Force report findings that identified a need for increased capabilities for small surface combatants to address evolving threats. As we reported in June 2016, an FF based on a minor modified LCS only partially fulfilled the small surface combatant capabilities that the task force identified as most valued by the fleet.¹³ In particular, FF requirements supported a multi-mission ship with some of the fleet's highest priority mission capabilities, such as surface and anti-submarine warfare, but did not provide air warfare capability. For FFG(X), the Navy maintained the FF requirements and added local air defense as a capability.¹⁴ Table 1 outlines the requirements evolution that the Navy undertook to support a more lethal and capable small surface combatant.

¹³[GAO-16-356](#).

¹⁴In general, air warfare is the capability to protect a ship against aircraft and anti-ship cruise missiles, and local air defense is the capability to provide air warfare protection of escorted, closely stationed ships.

Table 1: Small Surface Combatant Requirements Evolution from Littoral Combat Ship (LCS) to Frigate (FF) to Guided Missile Frigate (FFG(X))

Proposed change from LCS to FF	Proposed change from FF to FFG(X)	Significance of overall change
Switch from single mission to multi-mission capability (both surface warfare and anti-submarine warfare).	Additional multi-mission capability by adding air warfare and electronic warfare/information operations missions. May also augment anti-submarine warfare capability. ^a	Ship will be multi-mission capable, allowing for engagement of different threats at all times. In contrast, LCS is single-mission capable, with capability at any given time dependent on which single mission package is available for use.
Improve air warfare systems for self-defense with an improved air-search radar and defensive countermeasures.	Provide local air defense capability through addition of improved air-search radar and vertical launch system.	Reduces susceptibility to attacks from air-based threats (e.g., aircraft, missiles), and increases air warfare capability, with ability for FFG(X) to provide air defense for other ship classes. Vertical launch system provides flexibility for future weapons systems.
Decrease in unrefueled range from 3,500 nautical miles to a minimum range of 3,000 nautical miles.	Increase unrefueled range to 4,000-6,000 nautical miles.	Increases range consistent with fleet operator priorities in the 2015 Small Surface Combatant Task Force study; reduces demands for the limited number of refueling platforms.
Reduce sustained speed from 40+ knots for LCS to 32 knots.	Reduce sustained speed to 26-28 knots based on mission need and cost considerations.	Navy officials determined that the high speed of LCS was not essential to FFG(X) mission performance, which allowed for additional weapons and sensors.
Add armor to vital spaces and magazines. Improve shock-hardening.	Further reduce vulnerability via additional armoring and shock hardening, and separation of critical systems within the ship design.	Reduces vulnerability, resulting in a ship with survivability standards similar to current Navy destroyers.
Add over-the-horizon missile system for long range, anti-surface missile capability.	Provisions for 8-16 over-the-horizon missiles.	Increases lethality by providing the ability to strike surface targets further from the ship.
Upgrade electronic warfare capabilities by improving defensive alert capabilities.	Further upgrade electronic warfare capabilities via Surface Electronic Warfare Improvement Program system, signature reduction, and spectral system for signals intelligence.	Reduces susceptibility and increases capacity for electronic warfare mission via early detection, signals analysis, threat warning, and protection from anti-ship missiles.
Increase crew from 98 personnel on LCS to 130 on FF.	Increase crew to a range of 165-200, depending on ship design selected.	Moves from “minimally manned” crewing concept of LCS to more traditional crewing; adds endurance and self-sufficiency, including enabling a robust onboard engineering department to facilitate a high operational availability and ship-level maintenance. Navy-acknowledged byproduct of additional crew is increased life cycle costs.

Source: GAO analysis of Navy documentation. | GAO-19-512

Note: LCS includes mine countermeasures capability that was not planned for either of the frigate programs.

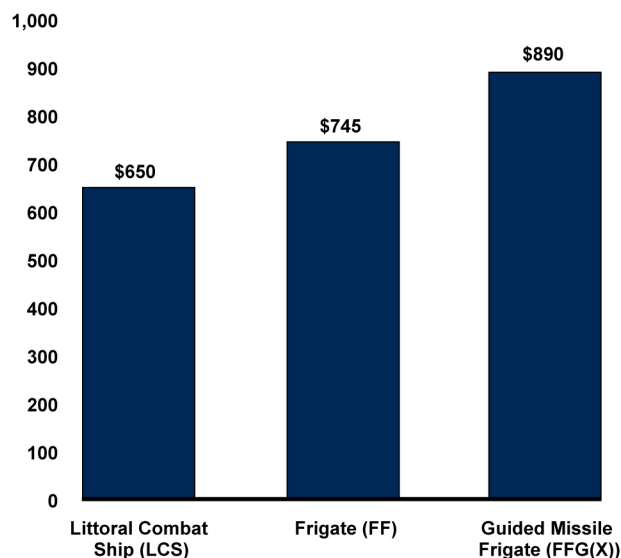
^aDepending on the final configuration of the FFG(X) design the Navy selects, the ship may have both a variable depth sonar—a moveable sonar towed from a ship—and a low-band hull array—a fixed sonar fitted to the bow of a ship. The Navy’s preferred requirement is for both, but having only one of these types of sonar meets the minimum requirement.

Requirements Drive Higher FFG(X) Cost than for Previous Small Surface Combatants

To achieve the increased capability expectations for FFG(X), the Navy committed to acquiring a larger, more expensive ship than LCS or the previously planned FF. Figure 4 provides average shipbuilding cost estimates for the three different ships, with costs shown in same-year dollars for comparison.

Figure 4: GAO Assessment of Average Small Surface Combatant Acquisition Cost

Average cost per ship (constant fiscal-year 2018 dollars in millions)



Source: GAO analysis of Navy budget and program documentation. | GAO-19-512

Note: FF and FFG(X) average costs are rounded to the nearest \$5 million and are based on estimated costs derived from analysis of Navy budget requests. For FFG(X), the average is based on the first nine ships, as the budget request data did not provide sufficient funding detail for the 11 additional ships planned for the program. FF average cost is based on the ships listed in the fiscal year 2017 President's budget request. LCS average cost does not include the costs of the ship's mission packages. Navy officials stated that the total average cost for the anti-submarine warfare and surface warfare mission packages on LCS is \$85 million per ship in constant year 2018 dollars.

Although the FFG(X) requirements have been finalized, the Navy plans to make final cost and capability tradeoffs through the process of evaluating proposed designs before selecting which one will be built.

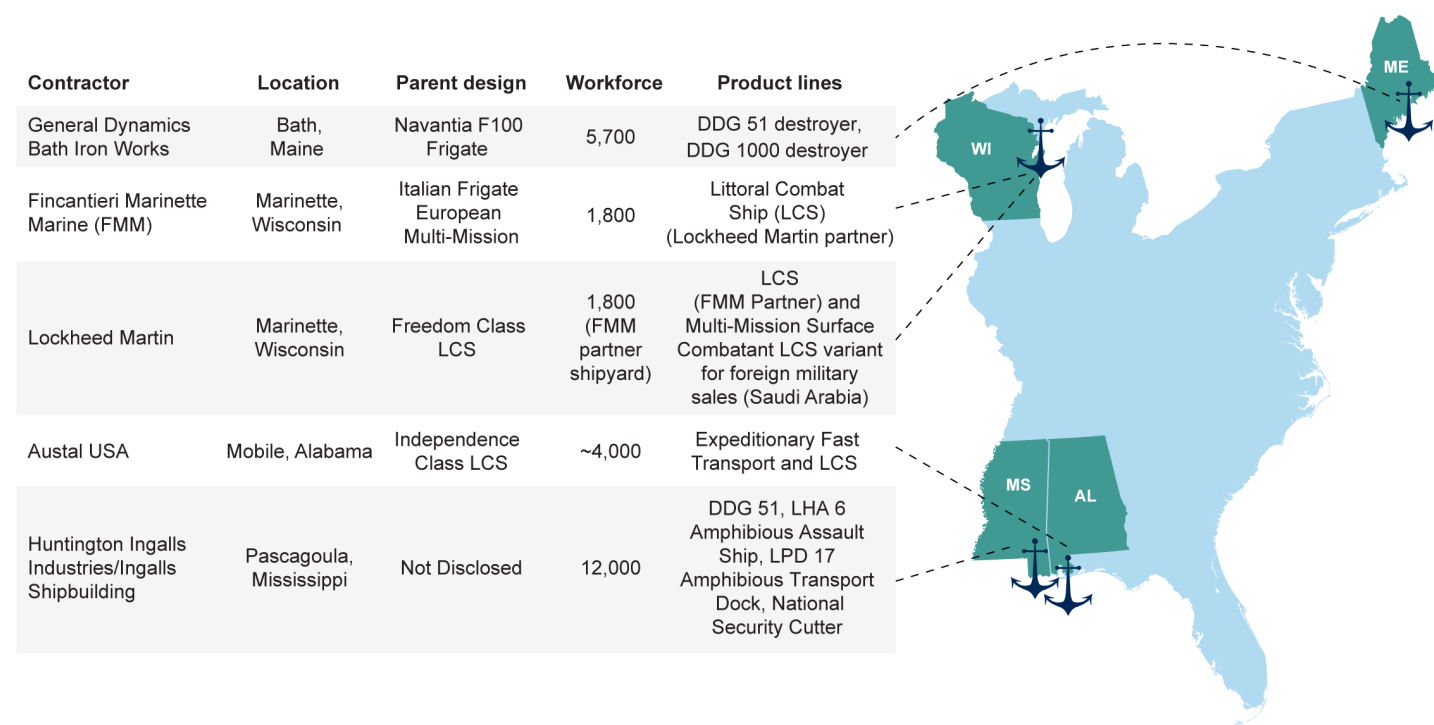
The Navy Used Conceptual Design Phase to Better Understand Ship Requirements and Associated Costs

In an effort to focus on the relationship between requirements and cost, the Navy undertook a conceptual design phase for FFG(X), which enabled industry to inform requirements and identify opportunities for cost savings. In February 2018, the Navy competitively-awarded FFG(X) conceptual design contracts valued at nearly \$15 million each to five industry teams. These 16-month contracts were intended to enable industry to mature parent ship designs—designs for FFG(X) that are based on ships have been built and demonstrated at sea—and help refine technical and operational program requirements.

The purpose of the conceptual design phase has parallels with the purpose of pre-contractual negotiations in commercial shipbuilding. As we previously have reported, these pre-contractual practices minimize ship buyer risk prior to awarding construction contracts by developing the ship concept and specifications based on negotiations between the ship buyer and the shipyard. The practices include specifying the expected performance and the major equipment on the ship. As part of these activities, commercial shipbuilders and ship buyers analyze one or more ship concepts to identify areas of potential risk and either mitigate these risks or remove the risky elements from the ship before signing a contract.¹⁵ Figure 5 provides an overview of the industry teams and shipyards participating in the FFG(X) conceptual design.

¹⁵[GAO-09-322](#).

Figure 5: Key Information for Industry Teams Participating in FFG(X) Guided Missile Frigate Conceptual Design Phase



Source: GAO analysis of contractor information. | GAO-19-512

Note: Ingalls Shipbuilding elected to not publicly disclose its parent design for FFG(X) based on the impending full and open competition for detail design and construction.

Each industry team performed ship development, ship design, workforce planning, and shipyard improvement planning, among other activities, in support of FFG(X) requirements refinement and cost reduction efforts. Industry teams updated the Navy regularly on their design progress and technical approach to fulfill requirements through monthly technical exchange meetings and two design review meetings. Navy officials stated that these meetings were intended to provide information to support the program's Preliminary Design Review in May 2019 and mitigate risk prior to the Navy's release of its request for proposal in June 2019 for the FFG(X) detail design and construction competition.

Our prior work on shipbuilding best practices emphasizes the importance of having a full understanding of the effort needed to design and construct a ship before awarding a contract for ship construction in order to reduce cost and schedule risk. Navy and industry officials stated that the

conceptual design phase facilitated dialogue and information sharing that helped ensure FFG(X) requirements were more fully understood by industry and the government. Specifically, industry officials noted that communication and activities during conceptual design improved their understanding of the impetus for specific Navy requirements, allowing industry the opportunity to get clarification on the intent of some requirements, propose less costly alternatives, and get government feedback on the proposed alternatives. It also improved their understanding of the linkages between FFG(X)'s approved capability requirements and system specifications. In particular, industry officials told us that one-on-one opportunities with the Navy aided knowledge sharing and provided them with a means to ask questions without concern that disclosing such information could jeopardize their competitive position. They emphasized that in other cases where the request for proposals process is their primary means for communicating with the Navy (as opposed to having a conceptual design phase), submitting questions about requirements or system specifications can be challenging because those inquiries are available to the public. As a consequence, contractors may opt to infer more about the intent of requirements to avoid compromising their competitive interests.

The conceptual design phase included a formal cost savings effort, with the Navy seeking proposals internally and from industry participants to reduce cost through requirement and system specification refinement. To support this effort, Navy officials stated they established a Frigate Affordability Board to review potential cost reduction measures submitted by both contractors and government that responded directly to Navy requirements and specifications. Navy officials said the Board—co-chaired by the Program Executive Office for Unmanned and Small Combatants and the Naval Sea System Command's Naval Systems Engineering Directorate, as well as the Chief of Naval Operations' Surface Warfare Directorate—assessed the potential cost and capability trade-offs of these proposed changes to requirements, and accepted or declined them. Before going to the Board, relevant Navy subject matter experts reviewed the technical and requirements implications of cost reduction measures. The program office subsequently worked with Navy engineering and requirements officials to balance cost with capabilities. If the program office, Navy engineers, and requirements officials could not reach agreement on the appropriate cost and capability mix, then their different positions were presented to the Board.

For cost reduction initiatives submitted by industry, the Navy provided feedback on the Board's decision, and incorporated fully or partially

accepted cost reduction initiatives into the FFG(X) system specifications. Navy officials said they informed all industry teams of any changes to the specifications on a monthly basis. Navy officials also stated that industry submitted about 350 cost reduction ideas, with roughly 60 percent partially or fully accepted by the Navy. They estimated \$86 million in savings per ship (constant year 2018 dollars) based on changes made in response to the cost reduction measures submitted by industry or government-initiated cost savings measures influenced by engagement with industry.¹⁶

Streamlined Acquisition Approach Accelerates Planned FFG(X) Schedule, but Reduces Knowledge Available for Key Program Decisions

In an effort to accelerate the time between FFG(X) acquisition planning and the fielding of ships, the Navy streamlined the program's acquisition approach and leveraged knowledge obtained from industry during the conceptual design phase. While the program may benefit from the streamlining efforts, the acquisition approach for FFG(X) required the Navy to submit its budget request for lead ship construction before the program had a comprehensive understanding of the potential ship designs and cost. Recent Navy policy changes have created some uncertainty for Navy cost estimation activities by altering roles and responsibilities within the Navy for completing component cost positions and independent cost assessments.

Navy Streamlined FFG(X) Program Acquisition Approach in an Effort to Accelerate Fielding of Ships

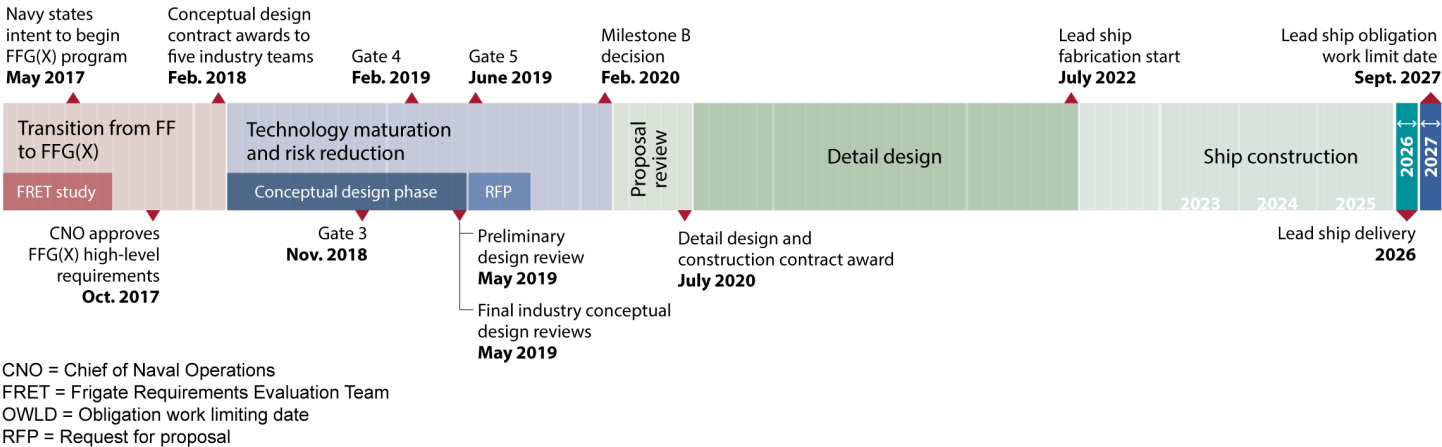
As permitted by DOD and Navy policy, the Navy has streamlined the FFG(X) acquisition approach to move from planning to ship delivery and fielding quicker than in a more traditional acquisition program.¹⁷ The accelerated schedule reflects the Navy's desire to field a minimum of 52 small surface combatants, which the Navy's long-range shipbuilding plan states will be achieved by fiscal year 2034. Navy officials stated that the significant amount of knowledge that already existed to inform the program's early activities and the use of parent designs helped enable the streamlined approach for FFG(X). For example, Navy officials cited

¹⁶Navy officials stated the FFG(X) program office developed a notional frigate design to analyze requirements feasibility, provide a starting point for trade studies, and support cost estimating efforts. This included estimates for cost savings associated with requirements changes. The program office used data received from industry during the conceptual design phase to calibrate models and verify cost savings estimates. Navy officials noted that not all changes based on cost savings measures were applicable to the specific FFG(X) designs developed by the five conceptual design industry teams. We did not assess the reliability of this cost savings estimate.

¹⁷DODI 5000.02 and Secretary of the Navy Instruction 5000.2F.

previous efforts by the Small Surface Combatant Task Force and the Frigate Requirements Evaluation Team to determine appropriate ship requirements, as well as activities performed in support of the FF frigate acquisition plan that immediately preceded the shift to FFG(X). The Navy also leveraged industry input received from a request for information in 2017 to understand cost drivers and the potential shipbuilders' abilities to meet top level FFG(X) requirements and incorporate Navy-defined equipment into ship designs. Figure 6 provides a high-level schedule of key activities for the program.

Figure 6: FFG(X) Guided Missile Frigate Acquisition Schedule



Source: GAO analysis of Navy information. | GAO-19-512

Note: All dates beyond the July 2020 contract award are Navy estimates and may be adjusted depending on the FFG(X) design the Navy selects for contract award. Ship delivery is when the Navy takes custody of a new construction ship from the shipbuilder. At that point, a variety of tests, trials, and construction remains to be completed in what is called a post-delivery period. OWLD generally concludes the post-delivery period and is when full financial responsibility for maintaining and operating a ship is transferred from the acquisition command to the operational fleet. Gates are Navy review points for acquisition programs outlined in the Secretary of the Navy Instruction 5000.2F.

To support its decision to pursue an accelerated acquisition schedule, the Navy used the previously discussed conceptual design phase as well as its decisions to limit FFG(X) to parent ship designs and minimize technology development. Navy officials noted the use of parent designs is allowing the program to proceed at a much faster pace from early assessment of capability options to detail design and construction contract award. They added that the parent designs provided a higher-fidelity design baseline from which the conceptual design industry teams incorporated Navy systems and other requirements. Use of parent designs is consistent with our best practices work in shipbuilding, which

has found that commercial shipbuilders use previous ship designs to the extent possible.¹⁸ Doing so can reduce technical, schedule, and cost risk in building a ship as compared to a “clean sheet” new ship design. FFG(X) program officials noted the latter approach can take up to 9 years to complete an analysis of alternatives and move through the acquisition process to construction contract award.

Navy officials said the program also used opportunities available as an Acquisition Category (ACAT) 1B program to shorten the approval timeline for specific acquisition requirements.¹⁹ For an ACAT 1B program, the head of the DOD component is generally the Milestone Decision Authority but, as appropriate, may delegate approval authorities to lower level offices under its jurisdiction. In the case of FFG(X), the Assistant Secretary for the Navy for Research, Development, and Acquisition serving as the Milestone Decision Authority delegated specific approval authorities to the Program Executive Office for Unmanned and Small Combatants. These approval authorities applied to the program’s life cycle sustainment plan, independent logistics assessment, program protection plan, and a compliance schedule addressing environmental considerations.

The Navy also took advantage of opportunities to alter or waive some significant early acquisition activities. For example, the Milestone Decision Authority waived the formal Analysis of Alternatives and Affordability Analysis, decided not to conduct a Milestone A review, and deferred the full “Should-Cost” Analysis to later in the acquisition process.²⁰ Table 2 defines the purpose of these DOD acquisition program elements and provides an overview of the Navy’s actions related to them.

¹⁸[GAO-09-322](#).

¹⁹See DODI 5000.02; Secretary of the Navy Instruction 5000.2F. For ACAT 1D programs, the Defense Acquisition Executive—the Under Secretary of Defense for Acquisition and Sustainment—is generally the Milestone Decision Authority. For programs designated as ACATs 1C and 1B, the head of the DOD component (e.g. Navy, Army, or Air Force) is generally the Milestone Decision Authority.

²⁰In general, a “should-cost” analysis is intended to develop an estimated cost that is based on bottoms-up assessments of what programs should cost, if reasonable efficiency and productivity enhancing efforts are undertaken. These cost targets are intended to be used as a basis for contract negotiations and contract incentives, as well as to track contractor and program management performance.

Table 2: FFG(X) Acquisition Process Streamlining of Early Program Activities

Acquisition element	Defined purpose in Department of Defense acquisition guidance	FFG(X) acquisition approach to fulfill requirement and rationale
Analysis of Alternatives	Assess potential materiel solutions to satisfy validated capability requirements and support a decision on the most cost effective solution.	Requirement waived. The Navy predetermined that it would pursue a ship-based solution to provide desired capabilities as opposed to a potential range of materiel solutions to meet capability needs. Navy and Office of the Secretary of Defense officials stated that the Navy used studies from the 2015 Small Surface Combatant Task Force and the 2017 Frigate Requirements Evaluation Team (FRET), a requirements gap analysis of the former FF frigate requirements, and independent Navy force structure assessments to address the intent of the Analysis of Alternatives. Navy officials confirmed this approach was accepted by the Office of the Secretary of Defense and the Joint Staff. Office of the Secretary of Defense officials said FFG(X) requirements are being further evaluated and analyzed within the ongoing Future Surface Combatant Force Structure Analysis of Alternatives. Navy officials noted that the study will likely support increasing FFG(X) quantities beyond the 20 planned ships.
Affordability Analysis	Develop affordability constraints for procurement unit cost and sustainment costs; conduct Navy portfolio affordability analysis that demonstrates the ability of the Navy's estimated budgets to fund the new program over its planned life cycle.	Requirement waived. The Navy cites cost development activities for the FFG(X) capability development document and component cost estimate plans for the Gate 5 review as replacements for a more typical affordability analysis.
Should-Cost Analysis	Proactively target cost reduction and drive productivity improvement into programs.	Requirement deviates from the guidance for should-cost targets to be completed to support the detail design and construction request for proposal release. The Navy established initial, limited should-cost figures as part of acquisition strategy for average follow-on ship costs to support the program through the detail design and construction request for proposal release. The acquisition strategy states the should-cost targets will be established after component cost position completion. This includes more complete targets that account for research, development, test and evaluation; procurement; and sustainment prior to incorporation into the program baseline.
Milestone A	Evaluate product options and approve the preferred solution, as well as authorize entry into the technology development phase.	Milestone not conducted and all associated documentation requirements for the milestone waived. The Navy stated the FFG(X) program will enter the defense acquisition system at Milestone B because the program is not developing critical technologies and the ships will be based on a proven parent design.

Source: GAO analysis of DOD and Navy documentation. | GAO-19-512

As the first major milestone for many major acquisition programs, Milestone A is a review by the Milestone Decision Authority of key program documents that support the materiel solution and risk reduction. We have previously found that DOD officials place a high value on the information developed for some of these documents, including the Analysis of Alternatives, Affordability Analysis, and Should-Cost

Analysis.²¹ The Navy's decision to not conduct a Milestone A review also eliminated a formal opportunity to bring the broad set of FFG(X) stakeholders within the Navy and the Office of the Secretary of Defense together at a relatively early stage to assess the program's acquisition strategy and affordability and feasibility, as well as technical, cost, and schedule risks. Further, it reduced the FFG(X) acquisition approach to a single milestone decision point—Milestone B—for the broader group of DOD stakeholders to evaluate program progress and readiness to proceed to the detail design and construction contract award planned in July 2020.

In the absence of Milestone A, the Navy's Gate 3 review for FFG(X) provided an opportunity to communicate the program's progress toward developing requirements and acquisition expectations, albeit to a more limited audience than typically would participate in a Milestone A. In particular, the Navy used Gate 3 to discuss top-level requirements changes and receive capability development document approval from the Chief of Naval Operations. It also included cost discussion related to FFG(X) affordability within the overall Navy shipbuilding portfolio. The gate's participants included officials from the Navy and the Office of Cost Assessment and Program Evaluation (CAPE) within the Office of the Secretary of Defense.

The Navy's Gate 4 conducted in February 2019 focused on a review of the FFG(X) system specification before the draft detail design and construction request for proposal release. Gate 4 documentation for FFG(X) indicates that participants were limited to stakeholders from the office of the Deputy Assistant Secretary of the Navy for Ships; Naval Sea Systems Command Cost and Design Directorates; Program Executive Office for Unmanned and Small Combatants; the FFG(X) program office; and the Chief of Naval Operations Surface Warfare Directorate. This excludes a number of key stakeholders that Navy guidance calls on to attend and certify gate reviews, such as the Assistant Secretary of the Navy (Financial Management and Comptroller) and the testing community. As a result, the Navy would not have received insight from several key stakeholders during the Gate 4 review for acquisition activities, such as the program life cycle cost estimate development and release of the draft request for proposal. These activities are generally

²¹GAO, *Acquisition Reform: DOD Should Streamline Its Decision-Making Process for Weapon Systems to Reduce Inefficiencies*, [GAO-15-192](#) (Washington, D.C.: Feb. 24, 2015).

relevant to this gate review, as Navy guidance notes program affordability as a focus and the Navy's streamlining documentation indicates that the gate was focused on reviewing the FFG(X) system specification before releasing the draft request for proposal. Navy officials noted that stakeholders have regularly received insight into FFG(X) activities through other prior program reviews and will have additional opportunities to review program costs and sustainment plans leading up to Milestone B.

We also found that some key stakeholders did not provide formal approval for the initial FFG(X) life cycle sustainment plan that was approved in March 2019. Specifically, only FFG(X) program officials and the Program Executive Officer for Unmanned and Small Combatants—the delegated approval authority—signed the plan. However, as stated in DOD guidance, representatives from the relevant sustainment command and the Program Executive Office for Integrated Warfare Systems are key stakeholders that should provide their signed concurrence when approving the life cycle sustainment plan. The FFG(X) life cycle sustainment plan is a key document outlining the Navy's plans to address the program's sustainment needs and costs, as typically around 70 percent of a weapon system program's total cost is in the sustainment phase after procurement. Navy officials stated that the plan has been reviewed by the independent logistics assessment team members that are evaluating the FFG(X) program's integrated product support activities, and noted that the Program Executive Office for Integrated Warfare Systems has separate life cycle sustainment plans for government furnished equipment systems included in the FFG(X) design. Navy officials also said that FFG(X) sustainment plans would be reviewed by stakeholders as part of Gate 5 and the Milestone B independent logistics assessment.

Budget Request for FFG(X) Lead Ship Preceded the Completion of Key Cost Estimation Activities That Should Inform Funding Decisions

The FFG(X) acquisition approach required the Navy to submit its nearly \$1.3 billion budget request for lead ship construction before the program had established a comprehensive understanding of the potential ship designs and estimated cost for the program. Our shipbuilding and acquisition best practices call for resource decisions to be timed to align with the availability of requisite cost, schedule, and technical knowledge in order to inform key program decisions.²² Navy officials stated that they

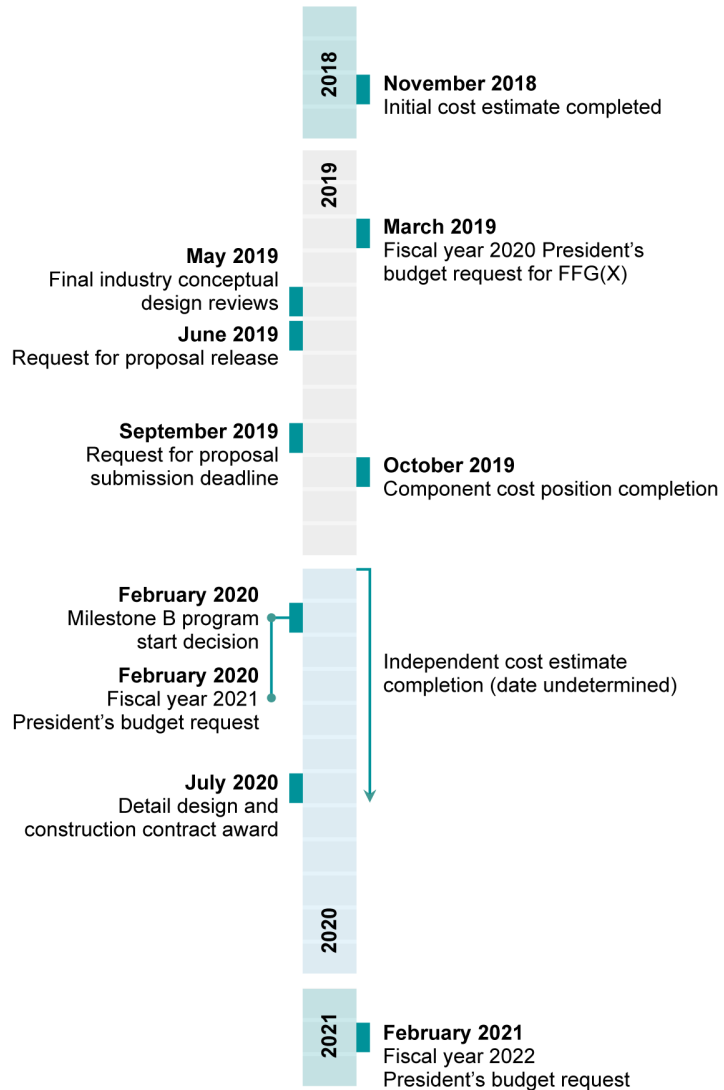
²²GAO, *Best Practices: Capturing Design and Manufacturing Knowledge Early Improves Acquisition Outcomes*, [GAO-02-701](#) (Washington, D.C.: July 15, 2002); and [GAO-18-238SP](#).

had sufficient knowledge to inform key program decisions based on cost estimation and conceptual design efforts that had previously been completed. Navy officials said this included development of an FFG(X) cost estimate by November 2018 to support a realistic budget request for the lead ship. However, at the time of the Navy's fiscal year 2020 budget request to fund detail design and the lead ship, the Navy had not completed its component cost position, which will formalize the life cycle cost expectations for FFG(X). Further, CAPE had not completed the independent cost estimate for the program. The GAO Cost Estimating and Assessment Guide says that comparing the component cost position with an independent cost estimate to validate methodologies produce similar results reinforces the credibility of a cost estimate.²³

In addition to key cost estimating best practices that had not been completed, the Navy had not received final design review information from the industry teams participating in the conceptual design phase before requesting lead ship funds from Congress. Figure 7 reflects the budget request timeline for the FFG(X) detail design and lead ship contract award, as well as notable cost and design-related program activities that were planned to be completed after the request.

²³[GAO-09-3SP](#).

Figure 7: Timeline of Key Cost and Design Knowledge and Budgeting for FFG(X) Guided Missile Frigate Program Detail Design and Construction



Source: GAO analysis of Navy information. | GAO-19-512

The considerable cost growth that we have previously reported is common to many shipbuilding programs, as well as challenges in deviating from shipbuilding plans once a program has begun procuring ships, emphasize the importance of having a strong understanding of

program expectations to back the initial procurement decision for FFG(X).²⁴ Given the timing of the Navy's budget request for lead ship funding, Congress faces a decision on whether to authorize funding for FFG(X) detail design and lead ship based on a budget request that was not informed by key cost and design information.

If Congress authorizes and appropriates FFG(X) funding as the Navy requested in March 2019, it will be critical that the Navy demonstrate the program's acquisition program baseline reflects the results of the component cost position and independent cost estimate before awarding the detail design and construction contract. Doing so before the contract award will help ensure a more reliable acquisition program baseline upon which future costs and variances are measured and funding decisions are made. Further, it will help mitigate remaining risk that stems from the Navy not being able to account for the actual FFG(X) design and associated estimated cost for ship construction until after the planned July 2020 contract award. Specifically, as currently planned, the Navy's budget requests for fiscal years 2020 and 2021—which are intended to fund the first 3 ships—will be made before the Navy has agreed to contract pricing for FFG(X).

Navy officials stated that they have completed a robust program life cycle cost estimate. They noted that the estimate was informed by Navy modeling of a notional ship design that leveraged data received from industry during conceptual design and reflected ship design elements needed to meet program requirements. Navy officials also said that, as of May 2019, some additional work remains for the cost estimate to account for training and military construction considerations, as well as address any needed changes related to the final industry design reviews for the conceptual design phase. They also said that the program life cycle cost estimate informed the Gate 4 review in February 2019, and an updated version of the estimate will provide a basis for the Navy's efforts to establish the component cost position in October 2019. As of the issuance of this report, we have requested the program life cycle cost estimate from the Navy, including the estimate's criteria and underlying assumptions, but have not yet received this information.

²⁴[GAO-18-238SP](#).

Recent Navy Changes in Cost Estimation Policy and the FFG(X) Program Schedule Create Uncertainty for Remaining Cost Estimation Activities

Recent policy changes by the Navy related to cost analysis and estimation have created some uncertainty for Navy cost estimation activities going forward. Specifically, a March 2019 Secretary of the Navy instruction for acquisition program cost analysis shifts the Naval Center for Cost Analysis's role and responsibilities for Navy cost estimation to the Navy's systems commands.²⁵ Previously, the Naval Center for Cost Analysis—organizationally residing completely outside of the systems command structure—would provide an independent cost assessment of the program life cycle cost estimate. The Naval Center for Cost Analysis and the acquisition program, in coordination with the relevant systems command, would discuss and adjudicate any differences between the program life cycle cost estimate and the independent cost assessment to produce the Navy's component cost position. This independent cost assessment by the Naval Center for Cost Analysis was an important verification of the program office estimates, which were often found to be too optimistic, prior to the Navy finalizing its component cost position. The Navy's recent changes for cost estimation and analysis may pose a risk of overly optimistic estimates carrying forward in programs.

Navy officials stated that they believe Naval Sea Systems Command cost estimators can provide an independent cost estimate, as they are intended to provide technical support to acquisition programs independent of programmatic authority and report to a separate chain of command. However, as stated by the Naval Sea Systems Command, the collective mission of its organizations is to build, buy, and maintain the Navy's ships. Based on this, we believe, as do CAPE officials with whom we spoke, that shifting independent cost assessment activities to the systems commands diminishes the Navy's ability to independently verify a program life cycle cost estimate. As a result, the program life cycle cost estimate essentially will become the component cost position based on the lack of additional cost estimation input, such as what the Naval Center for Cost Analysis previously provided.

Furthermore, CAPE officials stated that having a systems command execute cost analysis responsibilities for an acquisition program within the same system command effectively eliminates the Navy's capacity to perform independent cost estimates for its programs based on their shared overarching mission. This position is consistent with the GAO Cost Estimating and Assessment Guide, which states that an

²⁵Secretary of the Navy Instruction 7110.12, *Acquisition Program Cost Analysis* (Mar. 28, 2019).

independent cost estimate should be conducted by an organization independent of the acquisition chain of command.²⁶ The Director of CAPE is required to conduct or approve independent cost estimates and cost analyses for all major defense acquisition programs. As noted by CAPE officials, CAPE has previously delegated certain cost estimation responsibilities to the Naval Center for Cost Analysis. With the recent Navy policy changes, CAPE may no longer choose to delegate independent cost estimation activities to Navy cost estimators.²⁷

For FFG(X), CAPE intends to complete an independent cost estimate to verify the Navy's component cost position. These plans include site visits and data collection from the shipyards participating in the conceptual design contracts. CAPE confirmed that the final independent cost estimate will reflect the content of the winning proposal, indicating that any FFG(X) proposals that the Navy receives from contractors not involved in the conceptual design phase will be evaluated to ensure the independent cost estimate accounts for those cost and design plans.

CAPE officials also stated that their timeline for finalizing the independent cost estimate for FFG(X) is tied to when the Navy decides on the winning proposal for detail design and construction and communicates this information to CAPE. Specifically, CAPE's final independent cost estimate will reflect only the winning FFG(X) design, so completion of the estimate will occur after the Navy informs CAPE about the FFG(X) design for which it intends to pursue a contract award. CAPE officials said that because the Navy's decision may not be made in advance of the planned February 2020 Milestone B review for FFG(X), CAPE would likely just

²⁶ [GAO-09-3SP](#).

²⁷ Pursuant to 10 U.S.C. § 2334, the Director of CAPE is required to conduct or approve independent cost estimates and cost analyses for all major defense acquisition programs in advance of any decision to grant milestone approval pursuant to 10 U.S.C. § 2366b, which addresses certification requirements before Milestone B approval. See 10 U.S.C. § 2334(a)(6); 10 U.S.C. § 2336b(a). CAPE may decide to delegate certain independent cost estimation responsibilities to a military service cost agency. See DODI 5000.73, *Cost Analysis Guidance and Procedures* (June 9, 2015).

provide input to support the milestone and complete the independent cost estimate after that review.²⁸

The Navy Has Taken Steps to Reduce Design and Technical Risk, but Technology Integration and Testing Will be Key to Meeting Program Expectations

The Navy's decision to pursue a parent ship design for FFG(X) was intended to reduce design uncertainty for the program. The Navy's planned use of existing technologies for the ship's mission and combat systems also supports reduced technical risk, though further maturation of some key systems and successful integration and testing will be critical to demonstrate the ship provides required capability within cost and schedule expectations.

Use of a Parent Ship Design Was Intended to Increase Design Certainty

Adopting a parent design requirement for FFG(X) provided the conceptual design industry teams with a proven baseline ship design. This enabled them to focus on incorporating modifications to meet the Navy's specific FFG(X) requirements rather than designing a new ship. The Navy did not set any limitations on the extent contractors could modify or deviate from the parent design. However, Navy officials stated they actively reviewed parent design modifications through contract deliverables, technical exchange meetings, and design reviews with industry teams. The design reviews included an interim report in October 2018 and a final report in May 2019 from each industry team on their design progress.

FFG(X) program officials noted that the design maturity reviews provided sufficient information to support the Navy's decision that the designs were mature enough to release the request for proposals for the detail design and construction contract award. In addition, some industry officials told us that the conceptual design work on parent designs enabled them to

²⁸In major defense acquisition programs and major subprograms, the independent cost estimate is a statutory requirement at Milestone A and Milestone B. See 10 U.S.C. §§ 2334(a)(6), 2366a, and 2366b. DODI 5000.02 directs MDAs to tailor program strategies and oversight, including program information, acquisition phase content, the timing and scope of decision reviews and decision levels, based on the specifics of the product being acquired. To this end, 10 U.S.C. § 2366b allows the MDA to waive any of the Milestone B certification and determination requirements—including the independent cost estimate—before Milestone B if the MDA determines that, but for such a waiver, DOD would be unable to meet critical national security objectives.

develop more mature and refined designs than typical for this stage of the shipbuilding acquisition process. They also noted that continuing work in response to the pending competition should move at least some design elements closer to a detail design-level of maturity, and may provide the Navy with greater confidence in the contract proposals it receives from industry.

Technology Re-Use Should Reduce Some Risk, but Integration and Testing Remain to Demonstrate Critical Systems

The FFG(X) program's design concept requires the use of many existing, more mature combat and mission systems to reduce technical risk. As stated in the approved acquisition strategy for FFG(X), the program has a requirement for all integrated systems to have achieved maturity of a technology readiness level (TRL) 6 or higher.²⁹ TRL 6 is defined by GAO as the capability to produce a prototype system in a production-relevant environment.³⁰ Program officials confirmed that, as of May 2019, many but not all FFG(X) integrated systems were at TRL 6 or higher. For selected key systems planned for FFG(X), Navy officials stated they will have achieved TRL 7 or higher by the planned July 2020 detail design and construction contract award. Doing so would be consistent with our acquisition best practices, which include maturing new key ship technologies into actual system prototypes and demonstrating them in a realistic environment—achieving a TRL 7—before the award of the contract for lead ship design and construction. This practice helps reduce the likelihood of costly design changes later.³¹

Technology Re-Use

Many of the systems planned for FFG(X) have been demonstrated and are in use on other Navy ship classes, which helps the program fulfill capability needs while avoiding developmental risks. Table 3 provides an overview of some of the key existing systems planned for the ship.

²⁹FFG(X) program officials defined an integrated system as a system that has combined different functions together in order to work as one entity. The concept of the integrated system is used in systems engineering, systems analysis, and operations research. An integrated system can be broken down—not necessarily uniquely—into a finite number of parts called subsystems.

³⁰GAO, *Technology Readiness Assessment Guide: Best Practices for Evaluating the Readiness of Technology for Use in Acquisition Programs and Projects—Exposure Draft*, [GAO-16-410G](#) (Washington, D.C.: August 2016).

³¹[GAO-09-322](#).

Table 3: Examples of Existing Systems Planned for the FFG(X) Guided Missile Frigate Used by Other Navy Ship Classes

Existing system	Description of system	Other Navy ship classes using system
Mk 41 Vertical Launch System	Missile launching system	CG 47 Cruiser, DDG 51 Destroyer
Mk 110 57-Millimeter Gun	Gun system based on a 57-millimeter gun; fires up to 220 rounds per minute, with a 9-mile range	Littoral Combat Ship (LCS)
Mk 53 Decoy Launching System	Ship defense system using decoys to defeat anti-ship missiles	CG 47, CVN 68 Aircraft Carrier, DDG 51, LHA 6 Amphibious Assault Ship, LPD 17 Amphibious Transport Dock
RIM-116 Rolling Airframe Missile	Ship self-defense system employing short-range missiles designed to destroy anti-ship cruise missiles or air and surface threats	CVN 68, LCS, LHA 6, LPD 17
Surface Electronic Warfare Improvement Program, Block 2	Provides for early detection, signal analysis, threat warning and protection from anti-ship missiles	CG 47, CVN 68, DDG 51, LHA 6, LPD 17

Source: GAO analysis of Navy documentation. | GAO-19-512

Developmental Systems

In addition to the systems that have been utilized by other Navy ships, the FFG(X) program plans to incorporate some systems that are still in development, such as the Enterprise Air Surveillance Radar (EASR) and a new version of the Aegis Weapon System.

- Navy officials stated that EASR—a complex radar system expected to provide long-range detection and engagement of advanced threats—is critical to FFG(X)’s air and surface warfare missions. It is a scaled down version of the Navy’s Air and Missile Defense Radar that is in production and scheduled for initial integration with the Aegis combat system on a DDG 51 Flight III destroyer in fiscal year 2020. In early 2019, the Navy began testing a full-scale, single-face EASR array engineering developmental model—the full system planned for FFG(X) will have three array faces—at a land-based test site to further demonstrate its functionality.³² The Navy expects to complete land-based testing of the EASR engineering development model by February 2020. The Navy also plans to integrate a rotating version of EASR and a fixed-face version on other ship classes prior to integrating the radar on the lead FFG(X). The Navy’s results from

³²An engineering development model—which can be viewed as an advanced prototype of a system—is acquired during the engineering and manufacturing development phase of the DOD acquisition process and is built from approved critical design review drawings. It may be used for developmental and operational testing to demonstrate maturing performance during the latter stages of development and to finalize proposed production specifications and drawings.

planned EASR developmental testing at the land-based site will be integral to achieving a TRL 7 and reducing risk prior to the start of FFG(X) detail design.

- The Navy is developing a new version of the Aegis Weapon System—FFG(X)'s combat management system—to coordinate radar and weapons system interactions from threat detection to target strike. For example, the system will support the ship's ability to employ the Naval Strike Missile for over-the-horizon offensive capability as well as a 32-cell vertical launch system to employ missiles for air defense. The Aegis Weapon System for FFG(X) will leverage the Aegis common source software that supports the combat systems found on the Navy's DDG 51-class destroyers and CG 47-class cruisers.³³ Navy officials noted that they anticipate at least 70 percent of the Aegis Weapon System software for FFG(X) will be common to the Aegis software used for DDG 51 Flight III ships.

Rigorous testing of the Aegis Weapon System with EASR will be critical for FFG(X), as the radar and combat management system must work in concert for the ship to detect, track, and assess possible targets. Given the radar and software commonalities, the risk level for both of these FFG(X) systems should be reduced once the DDG 51 Flight III radar and Aegis system baseline, upon which the FFG(X) integrated system is based, have been demonstrated through testing on a ship beginning in 2022. Specific to the Aegis Weapon System for FFG(X), software development is expected to run from fiscal year 2022 to late fiscal year 2024. The system's integration and testing with EASR is scheduled to occur through fiscal year 2024.

Integration and Testing

While the Navy is planning to use many already mature systems on FFG(X), integration and testing of those systems will be critical to demonstrate systems fit and work together as intended on the ship. The Navy completed a technology readiness assessment in spring 2019 to identify potential technical risks, and concluded that FFG(X) does not have any critical technology elements. DOD generally defines a critical technology element as one that may pose major technological risk during

³³Aegis is the current combat system used by the majority of U.S. Navy surface combatants. The system enables a ship to detect, track, and engage multiple air and surface threats simultaneously. The Aegis Weapon System for FFG(X)—a variant of Aegis baseline 10 planned for DDG 51 Flight III ships—will be limited to air and surface warfare functions and will not include Aegis's ballistic missile defense capability.

development.³⁴ Navy officials who completed the assessment stated that they reviewed about 150 systems as part of their activities and found none composed of new or novel technologies for which the Navy has insufficient knowledge to demonstrate maturity. The assessment noted one technology—the New Advanced Integrated Line-of-Sight Equipment System (nAILES) multi-coupler for antennas—as a watch item. The Navy would like to utilize nAILES for FFG(X), but according to Navy officials, it is not considered a critical technology because the Navy has identified alternative, proven technologies that will be used to meet the ship’s needs if nAILES is not available for use.

The findings of the technology readiness assessment are consistent with the FFG(X) program’s decision to use existing systems that do not require technological innovation to deliver desired capability. However, the findings do not necessarily equate to the program having no technology risk for planned systems. For example, the Aegis Weapon System for FFG(X) did not qualify under the parameters of the technology readiness assessment as a critical technology element. Still, as already discussed, the Aegis Weapon System will carry technical risk for several years until the Navy completes development and demonstrates the system works as intended for FFG(X). The Next Generation Surface Search Radar is another system that is relatively mature—FFG(X) program officials confirmed in May 2019 it is nearing a TRL 6—but requires further development to reduce risk.

The FFG(X) test and evaluation master plan and independent technical risk assessment are significant documents yet to be completed that will help to further define risks and plans to address them. The test and evaluation master plan serves to outline the program’s integrated test program and master schedule of major test events or phases. Navy officials expect the test plan to be approved in December 2019 to support the Milestone B decision. They noted that the plan may need to be updated once the FFG(X) design is selected based on the additional information that will be available to inform test planning. The independent technical risk assessment is intended to categorize risks that cover a broad range of factors, including technology maturity, integration needs, and testing. If these factors are not sufficiently accounted for, a program is likely to have difficulty meeting cost, schedule, and performance objectives. An official from the Office of the Under Secretary of Defense

³⁴DOD, *Department of Defense Technology Readiness Assessment (TRA) Guidance* (April 2011).

for Research and Engineering who is participating in the technical assessment for FFG(X) stated they plan to complete their work to identify any risks in March or April 2020. The official added that at this early stage of their activities, the potential for integration risks associated with the FFG(X) combat system is an area of interest because of the extensive number of existing systems that will need to be integrated into the new ship design.

Navy test officials as well as DOD systems engineering and test officials noted potential advantages and risks related to FFG(X) program's plans for using existing technologies. Similar to what we previously discussed about the use of a parent design, the officials stated that the use of existing systems can increase understanding of the ship and its systems, which may help the FFG(X) program achieve its planned accelerated timeline between development and delivery. However, systems engineering and test officials also indicated that, regardless of maturity, challenges typically arise when DOD takes systems from other platforms and attempts to integrate and use them in new ways on a new platform. They cautioned that programs like FFG(X) that plan to use a lot of government-furnished equipment or non-developmental systems often underestimate the amount of integration challenges they will face. The officials told us this may occur because of overconfidence that the maturity of systems demonstrated through use on other platforms eliminates most technical risk, whereas experience confirms that it is always challenging to get systems to fit and work together as intended on a new platform. Officials from the office of the Director, Operational Test and Evaluation said that the parent design approach for FFG(X) may enable the Navy to reduce some developmental testing activities; however, operational testing expectations would largely be unaffected because there will still be substantial integration to be completed and tested in order to demonstrate mission capabilities.

Contracting Plans for FFG(X) May Help Mitigate Some Risk, and Use of Warranties Could Potentially Further Reduce Costs

The draft FFG(X) request for proposal indicates that the Navy plans to use a fixed-price incentive contract to help control ship costs and special performance incentive fees.³⁵ In addition, the Navy plans to use guarantees with limited liability for the shipbuilder to correct defects after ship deliveries. Our prior work has found that using comprehensive ship warranties instead of guarantees could reduce the Navy's financial responsibility for correcting defects.

Use of Fixed-Price Incentive Contract Provides Benefits, but Planned Contract Structure Results in the Navy Absorbing More Cost Risk

After completion of a full and open competition for FFG(X) detail design and construction, the Navy plans to use a fixed-price incentive contract in combination with additional special performance incentive fees to procure the lead and follow-on ships. As we have previously reported, full and open competition allows all responsible sources—or prospective contractors that meet certain criteria—to submit proposals for a contract. The use of competition in contracting is a critical tool for achieving the best possible return on investment for taxpayers. Competitively awarded contracts can save the taxpayer money, improve contractor performance, and promote accountability for results.³⁶ The fixed-price incentive contracting approach for FFG(X) is intended to incentivize the contractor to control costs and meet performance requirements. This contracting strategy represents a significant departure from previous surface combatant programs in which the Navy negotiated cost-reimbursement contracts for construction of the lead ship. Under cost-reimbursement contracts, the Navy assumes the cost risk because the shipbuilder is

³⁵There are two types of fixed-price incentive contracts: fixed-price incentive (firm target) and fixed-price incentive (successive target). Fixed-price incentive (firm target) contracts are commonly used in Navy shipbuilding programs. In contrast, fixed-price incentive (successive target) contracts are rarely used in Navy shipbuilding programs. These contracts are used in situations involving procurement of the first or second production quantity of a newly developed item when cost or pricing information available at the time may not be adequate for the establishment of a fixed-price incentive (firm target) contract but when that information is expected at a point relatively early in performance of the contract. Our analysis did not include any fixed-price incentive (successive target) contracts. For purposes of this report, when we refer to fixed-price incentive contracts, we mean fixed-price incentive (firm target) contracts under the larger umbrella of fixed-price incentive type contracts.

³⁶GAO, *Federal Contracting: Opportunities Exist to Increase Competition and Assess Reasons When Only One Offer Is Received*, [GAO-10-833](#) (Washington, D.C.: July 26, 2010).

reimbursed for its allowable incurred costs to the extent prescribed in the contract, regardless of whether the work is performed to the exact level desired by the Navy. For example, our prior work found that the Navy's decisions to accept the first two LCS in incomplete, deficient conditions complied with federal acceptance provisions, largely due to the cost-reimbursement type contracts in place to construct these ships.³⁷

Fixed-price incentive contracts provide an incentive for the shipbuilder to control costs in order to maximize profit. Fixed-price incentive contracts generally include a profit adjustment formula referred to as a shareline, as well as a price ceiling, target cost, and target profit. The structure of the shareline establishes how cost overruns or underruns in relation to a target cost are shared between the government and shipbuilder. For example, the 70/30 shareline that the Navy is planning for FFG(X) lead ship overruns means that the government pays 70 percent of cost and the shipbuilder pays 30 percent when the cost exceeds the target cost up to the price ceiling. Generally, the shareline functions to decrease the shipbuilder's profit as actual costs exceed the target cost. The price ceiling is generally the maximum the government will pay under the contract and is typically negotiated as a percentage of the target cost.³⁸ The target cost generally informs the shareline and price ceiling.

Given the unknowns associated with design and construction, the Navy plans to account for these unresolved risks by assuming responsibility for cost growth above DOD recommended guidance. As we reported in March 2017, when the Navy assumes a greater share of cost overruns above the target cost, accepts a higher price ceiling, or both, the fixed-price incentive elements may not provide sufficient motivation for the shipbuilders to control costs.³⁹ Figure 8 depicts the how risk changes as the Navy departs from a 50/50 shareline for cost overruns and a ceiling price of 120 percent.

³⁷GAO, *Littoral Combat Ship: Navy Complied with Regulations in Accepting Two Lead Ships, but Quality Problems Persisted after Delivery*, [GAO-14-827](#) (Washington, D.C.: Sept. 25, 2014).

³⁸The government may pay for adjustments under other contract clauses that are unrelated to the contract price ceiling. See FAR § 16.403-1(a).

³⁹GAO, *Navy Shipbuilding: Need to Document Rationale for the Use of Fixed-Price Incentive Contracts and Study Effectiveness of Added Incentives*, [GAO-17-211](#) (Washington, D.C.: Mar. 1, 2017).

Figure 8: Department of Defense Fixed-Price Incentive Contract Shareline and Price Ceiling Risk



Source: GAO depiction of fixed-price contract shareline and price ceiling risk. | GAO-19-512

As we previously noted, for the FFG(X) lead ship the Navy is planning to have a shareline of 70/30 for target cost overruns. The Navy also plans to have a 60/40 target cost overrun shareline for the second ship, and a 50/50 overrun shareline for the remaining seven ships included in the detail design and construction contract award. Based on this plan, the first two FFG(X) ships will depart from DOD's guidance recommending a 50/50 point of departure for negotiations between the government and shipbuilder for cost overruns up to the price ceiling. This results in more cost risk to the government for two ships in the detail design and construction contract. The Navy's planned price ceiling for the 10 ships included in the contract award may deviate from DOD's guidance recommending a ceiling price set at 120 percent of target cost as a point of departure for fixed price incentive contracts.⁴⁰ Specifically, Navy officials stated that the maximum ceiling price could be as high as 125 percent for all of the ships. However, Navy officials stated that the request for proposal will provide incentive for industry to propose the minimum price ceiling that sufficiently accounts for the proposal's level of risk, meaning that industry may propose price ceilings below 125 percent. The Navy also plans to include options for a special performance incentive fee for each of the FFG(X) ships, which will be established for the final request for proposal. These incentives have the potential to increase shipbuilder profitability.

⁴⁰GAO-17-211.

FFG(X) Plan for Guaranty Use Is More Robust than Recent Shipbuilding Programs, but Use of Warranties Could Provide More Value to the Government

As outlined in the FFG(X) draft detail design and construction request for proposal and confirmed by program officials, each frigate will have a guaranty period that commences at ship delivery and is expected to end 18 months after delivery. Navy officials stated the guaranty is intended to formalize a period of responsibility during which the shipbuilder must correct defects, with the cost to the government and the contractor based on the contract terms (cost shareline and price ceiling) associated with the ship. During the guaranty period, the shipbuilder would be required to correct all defects for which it is responsible, with proposals required to include a minimum limitation of liability of \$5 million per ship. Once the total cost to correct identified defects reaches \$5 million, the government would pay the full cost to correct any additional guaranty period defects.

The \$5 million minimum limitation of liability planned for FFG(X) has a higher dollar value and covers a longer period of time than other recent shipbuilding programs. For example, we previously found that for the Navy's LPD 25 amphibious transport dock construction, the contract initially included a \$1 million limitation of liability.⁴¹ Navy officials stated that the final request for proposal also will include a provision allowing industry to propose a higher liability limit, up to and including no limitation of liability. Navy officials said that any additional liability amount proposed beyond the \$5 million guaranty will be assessed as part of the technical evaluation criteria used to select the winning FFG(X) design.

We found in March 2016 that the use of a guaranty did not help improve cost or quality outcomes for the Navy and Coast Guard ships we reviewed. We also found that commercial ship buyers and Coast Guard officials stated that warranties foster quality performance because the shipbuilder's profit erodes as it spends money to correct deficiencies after delivery, during the warranty period.⁴² We further reported that the Coast Guard has improved cost and quality by requiring the shipbuilder to pay to repair defects by following Federal Acquisition Regulation warranty provisions. For example, the Coast Guard paid up front for the Fast Response Cutter warranty. The cost of the warranty amounted to 41 percent of the total defect correction costs. Although this ship does not have the size and advanced systems planned for FFG(X), it serves to demonstrate the potential value to the government presented by the use

⁴¹GAO, *Navy and Coast Guard Shipbuilding: Navy Should Reconsider Approach to Warranties for Correcting Construction Defects*, [GAO-16-71](#) (Washington, D.C.: Mar. 3, 2016).

⁴²[GAO-16-71](#).

of warranties. The Coast Guard also used a fixed-price incentive contract with a warranty on its Offshore Patrol Cutter—a ship of comparable size to FFG(X). The first Offshore Patrol Cutter has a 2-year warranty, and follow-on ships will have 1-year warranties. The Coast Guard pays a set amount for these warranties, and in return, the shipbuilder must fix all applicable defects identified within the agreed-upon time period regardless of cost.

Rather than using guarantees for the FFG(X) contract to provide for the correction of defects, the Navy could help control costs to the government through the use of warranties.⁴³ Under warranties, the government generally receives a contractual right for the correction of all defects for which the shipbuilder is responsible at the shipbuilder's expense.⁴⁴ The use of warranties is typically not mandatory, but federal and defense acquisition regulations instruct contracting officers to consider various factors when deciding whether a warranty is appropriate for an acquisition. The regulations also instruct contracting officers to use a warranty when it is practicable and cost-effective to do so.⁴⁵ We previously found that, unlike a warranty, the Navy almost exclusively paid for defects that were the shipbuilder's responsibility under a guaranty because of the contract type and terms in contracts that we reviewed. Such conditions limit the incentive to discover every deficiency during the guaranty period, and may negatively affect quality improvements over time.

The Navy's FFG(X) plans suggest that the Navy may be prematurely discounting warranties as a mechanism to improve ship quality and decrease cost to the government. Navy officials told us that mandating

⁴³In January 2018, the Navy issued shipbuilding contract guidance to contracting officers in support of effective implementation and application of shipbuilding warranty and guaranty provisions.

⁴⁴See Federal Acquisition Regulation (FAR) Subpart 46.7.

⁴⁵See FAR § 46.703; Defense Federal Acquisition Regulation Supplement § 246.708. For shipbuilding contracts, Navy acquisition regulations expressly state that "contracts for new construction shipbuilding, for which funds are expended from the Shipbuilding and Conversion, Navy account, shall require, as a condition of the contract, that the work performed under the contract is covered by a warranty for a period of at least 1 year." However, the regulations allow a Navy contracting officer to waive the requirement and limit the liability of the work performed if they determine that a limited liability is in the best interest of the Government. For FFG(X), the Navy plans to limit liability to \$5 million per ship as part of its guaranty. See Navy and Marine Corps Acquisition Regulation Supplement § 5246.703.

that industry propose a warranty could result in additional costs to the government because the initial cost of the ship could be raised substantially to include the cost of the warranty. Additionally, Navy officials said a requirement for warranty pricing could serve to limit industry participation in the FFG(X) competition if offerors are unwilling to accept the risk associated with a warranty and unable to provide reasonable pricing. The Navy provided no analysis to support these claims and confirm a clear understanding of whether a warranty could provide greater value than the \$5 million guaranty the Navy is proposing for FFG(X).

As part of the competitive proposal process for FFG(X) detail design and construction, the Navy could maintain its plans to require a guaranty but also seek ship warranty pricing. The full and open competition for the FFG(X) contract award may increase the potential for receiving warranty pricing that provides a cost-effective alternative to the Navy's guaranty plans. By limiting the request for proposal to guarantees, the Navy misses an opportunity to obtain information on what comprehensive warranty coverage against defects would cost, and use it to evaluate whether warranties could further reduce risk for the FFG(X) program.

Conclusions

As the Navy approaches the Milestone B review for FFG(X), it is critical that funding and other major programmatic decisions are fully informed by the knowledge necessary to support them. This is especially important to help ensure that the FFG(X) program does not face some of the same cost, schedule, and performance shortfalls that have been faced by the LCS program. The Navy's fiscal year 2020 budget request to authorize and appropriate funding for the lead frigate was developed and submitted without the benefit of key cost and design information, such as the independent cost estimate and the final results from conceptual design. As a result, it is necessary that the Navy provide Congress with a clear understanding of FFG(X) cost expectations, including CAPE's independent cost estimate, prior to awarding the detail design and construction contract. This will help ensure that the FFG(X) program is grounded in cost and design expectations that reflect the specific aspects of the ship that the Navy selects for construction.

With the start of the planned \$20 billion FFG(X) procurement approaching, the Navy has limited time left to position the government to obtain the best deal possible to fix any deficiencies discovered upon delivery of the first 10 ships. The Navy's guaranty plan for FFG(X) offers some improvements compared to recent shipbuilding programs, but does

not offer the degree of coverage that could potentially be provided by a warranty. The competitive qualities of the FFG(X) acquisition approach present an opportunity for the Navy to, at a minimum, obtain warranty pricing from industry so that the program may use that input to evaluate whether a warranty would be a cost-effective means of reducing the government's cost risk.

Recommendations for Executive Action

We are making two recommendations to the Secretary of the Navy:

- Ensure that the Assistant Secretary of the Navy for Research, Development, and Acquisition provides to Congress the finalized independent cost estimate prior to award of the detail design and construction contract and demonstrates that the estimate is consistent with the fiscal year 2020 budget request for the lead ship. (Recommendation 1)
- Ensure that the Assistant Secretary of the Navy for Research, Development, and Acquisition directs the FFG(X) program office to request pricing for warranties for the lead ship and the nine follow-on ship options planned for FFG(X) as part of the detail design and construction request for proposals. (Recommendation 2)

Agency Comments and Our Evaluation

We provided a draft of this report to DOD for comment. DOD provided written comments, which have been reproduced in appendix I. In responding to the draft report, DOD concurred and described the actions it planned to take to address our two recommendations.

In response to the second recommendation to request pricing for warranties for the lead ship and the nine follow-on ship options planned for FFG(X) as part of the detail design and construction request for proposals, DOD acknowledged that the Navy will receive guaranty rather than warranty pricing, but stated that the solicitation allows industry to propose a higher limitation of liability amount, up to an unlimited limitation of liability, in its guaranty pricing for FFG(X). While this could allow for a better value to the government than has been typical for recent shipbuilding programs, permitting higher limitation of liability guaranty pricing but not requesting warranty pricing from offerors means the Navy will not have complete information on whether a warranty could be more cost-effective than a guaranty. Our prior work found that the use of Federal Acquisition Regulation warranty provisions improved shipbuilding program cost and quality outcomes. As a result, we maintain our belief that the FFG(X) program office should implement this recommendation by

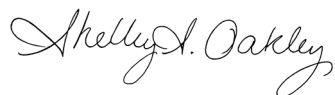
seeking warranty pricing as part of the detail design and construction request for proposals. The full and open competition for the FFG(X) contract award may increase the potential for receiving warranty pricing that provides a cost-effective alternative to the Navy's guaranty plans.

DOD stated that modifying the solicitation to incorporate a warranty pricing component would cause an unacceptable delay to the FFG(X) program, but did not provide an analysis to support this assertion or specify the extent of delay associated with adding a warranty pricing request. The current FFG(X) schedule has roughly 10 months between the request for proposals deadline and the contract award, and the program originally had been planning for the solicitation period to end in December 2019 before moving the deadline to September 2019 shortly before its release. We recognize the substantial effort the proposal development and review process requires, but we continue to believe that the government would benefit from adding a request for warranty pricing to the detail design and construction solicitation. While DOD stated that the Navy will support the recommendation after award by requesting pricing for an unlimited warranty before exercising the first ship option, doing so would eliminate any potential warranty pricing advantages that would occur as a result of the competitive conditions that currently exist for the current detail design and construction contract.

In addition to DOD's written response to the report, DOD officials and industry representatives associated with the FFG(X) conceptual design activities provided separate technical comments, which we incorporated as appropriate.

We are sending copies of this report to the appropriate congressional committees, the Secretary of Defense, and the Secretary of the Navy. This report will also be available at no charge on GAO's website at <http://www.gao.gov>.

If you or your staff members have any questions regarding this report, please contact me at (202) 512-4841 or oakleys@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to the report are listed in appendix II.



Shelby S. Oakley
Director, Contracting and National Security Acquisitions

List of Committees

The Honorable James M. Inhofe
Chairman
The Honorable Jack Reed
Ranking Member
Committee on Armed Services
United States Senate

The Honorable Richard C. Shelby
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The Honorable Mac Thornberry
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House of Representatives

The Honorable Peter J. Visclosky
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The Honorable Ken Calvert
Ranking Member
Subcommittee on Defense
Committee on Appropriations
House of Representatives

Appendix I: Comments from the Department of Defense



ACQUISITION

ASSISTANT SECRETARY OF DEFENSE
3600 DEFENSE PENTAGON
WASHINGTON, DC 20301-3600

JUL 29 2019

Ms. Shelby Oakley
Director, Contracting and National Security
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Dear Ms. Oakley:

This is the Department of Defense response to the Government Accountability Office (GAO) Draft Report, GAO-19-512, 'GUIDED MISSILE FRIGATE: Navy Has Taken Steps to Reduce Acquisition Risk, but Opportunities Exist to Improve Knowledge for Decision Makers,' dated June 24, 2019 (GAO Code 102974). The enclosure includes detailed responses to the report recommendations.

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

Sincerely,

A handwritten signature in black ink, appearing to read "Stacy A. Cummings", is written over a horizontal line.

Stacy A. Cummings
Acting

Enclosure:
As stated

**GAO DRAFT REPORT DATED JUNE 24, 2019
GAO-19-512 (GAO CODE 102974)**

**“GUIDED MISSILE FRIGATE: NAVY HAS TAKEN STEPS TO REDUCE
ACQUISITION RISK, BUT OPPORTUNITIES EXIST TO IMPROVE
KNOWLEDGE FOR DECISION MAKERS”**

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

RECOMMENDATION 1: The Secretary of the Navy should direct the Assistant Secretary of the Navy for Research, Development, and Acquisition to provide to Congress the finalized independent cost estimate prior to award of the detail design and construction contract and demonstrate that the estimate is consistent with the fiscal year 2020 budget request for the lead ship.

DoD RESPONSE: Concur. The FFG(X) program will meet the statutory requirements for reporting to Congress in accordance with 10 U.S.C. 2366b and any statutory requirements in DoD Instruction 5000.02. This will include providing the certification and determination by the Milestone Decision Authority that reasonable cost and schedule estimates have been developed to execute the product development and production plan under the program. The certification and determination will occur prior to award of the detail design and construction contract. The independent cost estimate will be provided in conjunction with the 2366b certification. For reference purposes, this item will be identified as GAO-19-512-01.

RECOMMENDATION 2: The Secretary of the Navy should direct the Assistant Secretary of the Navy for Research, Development, and Acquisition to direct the FFG(X) program office to request pricing for warranties for the lead ship and the nine follow-on ship options planned for FFG(X) as part of the detail design and construction request for proposals.

DoD RESPONSE: Concur. As a part of the planning for the procurement of detail design and construction for FFG(X), the Navy determined that a guaranty, rather than a commercial-type warranty, will be implemented for the program. As a part of the FFG(X) detail design and construction request for proposals released on June 20, 2019, the Navy asked contractors to include a limit of liability of at least \$5 million per ship and a guaranty period of 18 months beyond preliminary acceptance of each ship. Further, the solicitation allows offerors to propose an additional limit of liability amount beyond the required \$5 million amount, up to and including an unlimited liability. This arrangement represents an appropriate balance between price considerations and risks, ensuring that the shipbuilder is accountable for the correction of defects that follow preliminary acceptance, while allowing each shipbuilder to use its own business judgement in proposing the value of the limit of liability. The Navy released the solicitation prior to this GAO recommendation and is unable to modify the current solicitation because it would cause an unacceptable delay to the FFG(X) program.

To support the GAO recommendation to request pricing for an unlimited warranty, the Navy will request pricing for unlimited warranty before exercising the first ship option and evaluate the business case. For reference purposes, this item will be identified as GAO-19-512-02.

Appendix II: GAO Contact and Staff Acknowledgments

GAO Contact

Shelby S. Oakley, (202) 512-4841 or oakleys@gao.gov.

Staff Acknowledgments

In addition to the contact named above, the following staff members made key contributions to this report: Diana Moldafsky (Assistant Director), Lori Fields, Kurt Gurka, Stephanie Gustafson, Chad Johnson, Jennifer Leotta, Sean Merrill, Miranda Riemer, Jillena Roberts, Hai Tran, and Alyssa Weir.

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