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Navy Constellation (FFG-62) Class Frigate Program: Background and Issues for Congress

Updated May 11, 2022

Congressional Research Service
https://crsreports.congress.gov
R44972

CRS REPORT
Prepared for Members and
Committees of Congress

Summary

The Navy began procuring Constellation (FFG-62) class frigates (FFGs) in FY2020, and wants to procure a total of 20 FFG-62s. Congress funded the first FFG-62 in FY2020, the second in FY2021, and the third in FY2022. The Navy's proposed FY2023 budget requests the procurement of the fourth FFG-62.

The Navy's FY2023 budget submission estimates the procurement cost of the fourth FFG-62 at $1,091.2 (i.e., about $1.1 billion). The ship has received $6.0 million in prior-year advance procurement (AP) funding. The Navy's proposed FY2023 budget requests the remaining $1,085.2 million needed to complete the ship's estimated procurement cost. The Navy's proposed FY2023 budget also requests $74.9 million in AP funding for FFG-62s to be procured in future fiscal years.

Four industry teams competed for the FFG-62 program. On April 30, 2020, the Navy announced that it had awarded the FFG-62 contract to the team led by Fincantieri/Marinette Marine (F/MM) of Marinette, WI. F/MM was awarded a fixed-price incentive (firm target) contract for Detail Design and Construction (DD&C) for up to 10 ships in the program—the lead ship plus nine option ships. The other three industry teams reportedly competing for the program were led by Austal USA of Mobile, AL; General Dynamics/Bath Iron Works (GD/BIW) of Bath, ME; and Huntington Ingalls Industries/Ingalls Shipbuilding (HII/Ingalls) of Pascagoula, MS.

As part of its action on the Navy's FY2020-FY2022 budgets, Congress has passed provisions relating to U.S. content requirements for certain components of each FFG-62 class ship, as well as a provision requiring the Navy to conduct a land-based test program for the FFG-62's engineering plant (i.e., its propulsion plant and associated machinery).

The FFG-62 program presents several potential oversight issues for Congress, including the following:

- the Navy's emerging force-level goal for frigates and other small surface combatants;
- the reduction in the FFG-62 program's programmed procurement rate under the Navy's FY2023 five-year (FY2023-FY2027) shipbuilding plan;
- the accuracy of the Navy's estimated unit procurement cost for FFG-62s, particularly when compared to the known unit procurement costs of other recent U.S. surface combatants;
- whether to build FFG-62s at a single shipyard at any one time (the Navy's baseline plan), or at two shipyards;
- whether the Navy has appropriately defined the required capabilities and growth margin for FFG-62s;
- whether to take any further legislative action regarding U.S. content requirements for the FFG-62 program;
- technical risk in the FFG-62 program; and
- the potential industrial-base impacts of the FFG-62 program for shipyards and supplier firms in the context of other Navy and Coast Guard shipbuilding programs.

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Introduction

This report provides background information and discusses potential issues for Congress regarding the Navy's Constellation (FFG-62) class frigate program, a program to procure a new class of 20 guided-missile frigates (FFGs). The Navy's proposed FY2023 budget requests the procurement of the fourth ship in the program.

The FFG-62 program presents several potential oversight issues for Congress. Congress's decisions on the program could affect Navy capabilities and funding requirements and the U.S. shipbuilding industrial base.

Background

Navy's Force of Small Surface Combatants (SSCs)

SSCs in General

In discussing its force-level goals and 30-year shipbuilding plans, the Navy organizes its surface combatants into *large surface combatants* (LSCs), meaning the Navy's cruisers and destroyers, and *small surface combatants* (SSCs), meaning the Navy's frigates, Littoral Combat Ships (LCSs), mine warfare ships, and patrol craft.[1] SSCs are smaller, less capable in some respects, and individually less expensive to procure, operate, and support than LSCs. SSCs can operate in conjunction with LSCs and other Navy ships, particularly in higher-threat operating environments, or independently, particularly in lower-threat operating environments.

SSC Force Level at End of FY2021

The Navy's force of SSCs at the end of FY2021 included no frigates, 22 LCSs, and 8 mine warfare ships.

Current and Potential Future SSC Force-Level Goal

Current SSC Force-Level Goal Within 355-Ship Plan of December 2016

In December 2016, the Navy released a goal to achieve and maintain a Navy of 355 ships, including 52 SSCs, of which 32 are to be LCSs and 20 are to be FFG-62s. Although patrol craft are SSCs, they do not count toward the 52-ship SSC force-level goal, because patrol craft are not considered battle force ships, which are the kind of ships that count toward the quoted size of the Navy and the Navy's force-level goal.[2]

Successor Force-Level Goal to Replace 355-Ship Goal of 2016

The Navy and the Department of Defense (DOD) have been working since 2019 to develop a successor for the 355-ship force-level goal. The Navy's FY2023 30-year (FY2023-FY2052)

[1] See, for example, CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

[2] For more on the 355-ship plan and additional discussion of battle force ships, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

shipbuilding plan, released on April 20, 2022, includes a table summarizing the results of studies that have been conducted on the successor force-level goal. These studies outline potential future fleets with 40 to 60 SSCs.[3]

U.S. Navy Frigates in General

In contrast to cruisers and destroyers, which are designed to operate in higher-threat areas, frigates are generally intended to operate more in lower-threat areas. U.S. Navy frigates perform many of the same peacetime and wartime missions as U.S. Navy cruisers and destroyers, but since frigates are intended to do so in lower-threat areas, they are equipped with fewer weapons, less-capable radars and other systems, and less engineering redundancy and survivability than cruisers and destroyers.[4]

The most recent class of frigates operated by the Navy was the Oliver Hazard Perry (FFG-7) class (**Figure 1**). A total of 51 FFG-7s were procured between FY1973 and FY1984. The ships entered service between 1977 and 1989, and were decommissioned between 1994 and 2015. In their final configuration, FFG-7s were about 455 feet long and had full load displacements of roughly 3,900 tons to 4,100 tons. (By comparison, the Navy's Arleigh Burke [DDG-51] class destroyers are about 510 feet long and have full load displacements of roughly 9,700 tons.[5]) Following their decommissioning, a number of FFG-7s, like certain other decommissioned U.S. Navy ships, have been transferred to the navies of U.S. allied and partner countries.

FFG-62 Class Program

Program Name

The FFG-62 program was previously known as the FFG(X) program.[6] On October 7, 2020, the Navy announced that FFG-62 would be named *Constellation*, in honor of the first U.S. Navy

[3] For additional discussion, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

[4] Compared to cruisers and destroyers, frigates can be a more cost-effective way to perform missions that do not require the use of a higher-cost cruiser or destroyer. In the past, the Navy's combined force of higher-capability, higher-cost cruisers and destroyers and lower-capability, lower-cost frigates has been referred to as an example of a so-called high-low force mix. High-low mixes have been used by the Navy and the other military services in recent decades as a means of balancing desires for individual platform capability against desires for platform numbers in a context of varied missions and finite resources.

Peacetime missions performed by frigates can include, among other things, engagement with allied and partner navies, maritime security operations (such as anti-piracy operations), and humanitarian assistance and disaster response (HA/DR) operations. Intended wartime operations of frigates include escorting (i.e., protecting) military supply and transport ships and civilian cargo ships that are moving through potentially dangerous waters. In support of intended wartime operations, frigates are designed to conduct anti-air warfare (AAW—aka air defense) operations, anti-surface warfare (ASuW) operations (meaning operations against enemy surface ships and craft), and antisubmarine warfare (ASW) operations. U.S. Navy frigates are designed to operate in larger Navy formations or as solitary ships. Operations as solitary ships can include the peacetime operations mentioned above.

[5] This is the displacement for the current (Flight III) version of the DDG-51 design.

[6] In the designation FFG(X), FF meant frigate, G meant guided-missile ship (indicating a ship equipped with an area-defense anti-air warfare [AAW] system), and (X) indicated that the specific design of the ship had not yet been determined. FFG(X) thus meant a guided-missile frigate whose specific design has not yet been determined.

The designation FF, with two Fs, means frigate in the same way that the designation DD, with two Ds, means destroyer. FF is sometimes translated less accurately as fast frigate. FFs, however, are not particularly fast by the standards of U.S. Navy combatants—their maximum sustained speed, for example, is generally lower than that of U.S.

ships authorized by Congress in 1794—the six heavy frigates *United States*, *Constellation*, *Constitutio*n, *Chesapeake*, *Congres*s, and *President*. FFG(X)s henceforth became known as Constellation (FFG-62) class ships. Even though the program is now known as the Constellation (FFG-62) class program, some Navy documents and other sources may continue to refer to it as the FFG(X) program.

Figure 1. Oliver Hazard Perry (FFG-7) Class Frigate

Source: Photograph accompanying Dave Werner, "Fighting Forward: Last Oliver Perry Class Frigate Deployment," *Navy Live*, January 5, 2015, accessed September 21, 2017, at http://navylive.dodlive.mil/2015/01/05/fighting-forward-last-oliver-perry-class-frigate-deployment/.

Ship Capabilities and Crewing

FFG-62s (**Figure 2**, **Figure 3**, and **Figure 4**) are to be multimission small surface combatants capable of conducting anti-air warfare (AAW), anti-surface warfare (ASuW), antisubmarine warfare (ASW), and electromagnetic warfare (EMW) operations. They are to be capable of operating in both blue water (i.e., mid-ocean) and littoral (i.e., near-shore) areas, and capable of operating either independently (when that is appropriate for its assigned mission) or as part of larger Navy formations.

To help maximize the time that each ship spends at sea, the Navy reportedly is considering operating FFG-62s eventually with dual crews—an approach, commonly called blue-gold crewing, that the Navy uses for operating its ballistic missile submarines and LCSs.[7] The Navy plans to operate the first few FFG-62s, however, with single crews.[8]

The FFG-62 design is based on the design of the Italian-French FREMM (Fregata Europea Multi-Missione) frigate, a ship that has been built in two variants, one for the Italian navy and one for

Navy aircraft carriers, cruisers, and destroyers. In addition, there is no such thing in the U.S. Navy as a slow frigate.

Some U.S. Navy surface combatants are equipped with a point-defense AAW system, meaning a short-range AAW system that is designed to protect the ship itself. Other U.S. Navy surface combatants are equipped with an area-defense AAW system, meaning a longer-range AAW system that is designed to protect no only the ship itself, but other ships in the area as well. U.S. Navy surface combatants equipped with an area-defense AAW system are referred to as guided-missile ships and have a "G" in their designation.

[7] See, for example, David B. Larter, "The US Navy Is Planning for Its New Frigate to Be a Workhorse," *Defense News*, January 30, 2018.

[8] Richard R. Burgess, "CNO: First Few New Frigates to Have Single Crews," *Seapower*, January 11, 2021.

the French navy. The FREMM design, in other words, served as what is known as the "parent" design for the FFG-62 design. The use of a parent design for the FFG-62 program is discussed further in the section below on the FFG-62 program's acquisition strategy.

Figure 2. Constellation (FFG-62) Class Frigate

Artist's rendering of F/MM design

Source: Cropped version of illustration accompanying Fincantieri Marinette Marine, "Fincantieri Marinette Marine Awarded Second Constellation-class Frigate," May 20, 2021.

Figure 3. Constellation (FFG-62) Class Frigate

Computer rendering of F/MM design

Source: Fincantieri/Marinette Marine, screen capture from video entitled "Constellation Class Frigate 360° View," posted at https://futurefrigate.com/, accessed December 8, 2020.

Figure 4. Constellation (FFG-62) Class Frigate

Computer rendering of F/MM design

Source: U.S. Navy rendering shown on slide 2 of in Navy briefing entitled "Guided Missile Frigate (FFG 62) Update, Sea Air Space [Exposition]," Captain Kevin Smith, April 5, 2022.

Procurement Quantities and Schedule

Total Procurement Quantity

The Navy wants to procure 20 FFG-62s, which in combination with a force of 32 LCSs would meet the Navy's 52-ship SSC force-level goal within the Navy's current 355-ship plan. A total of 35 LCSs were procured, but the Navy is proposing early retirements for a number of them, which would reduce the eventual LCS force to less (and perhaps substantially less) than 32 ships.[9]

Annual Procurement Quantities

Table 1 compares programmed annual procurement quantities for the FFG-62 program under the Navy's FY2020-FY2023 budget submissions and a long-range shipbuilding document released by the Navy on December 9, 2020.

Procurement Cost

Congress funded the procurement of the first FFG-62 in FY2020 at a cost of $1,281.2 million (i.e., about $1.3 billion), the second FFG-62 in FY2021 at a cost of $1,053.1 million (i.e., about $1.1 billion), and the third in FY2022 at a cost of $1,090.9 million (i.e., about $1.1 billion). The lead ship in the program will be more expensive than the follow-on ships because the lead ship will be at the top of the production learning curve for the class, and because the lead ship's procurement cost incorporates most or all of the detailed design/nonrecurring engineering (DD/NRE) costs for the class. (It is a traditional Navy budgeting practice to attach most or all of the DD/NRE costs for a new ship class to the procurement cost of the lead ship in the class.)

[9] For further discussion of the proposed early retirements of LCSs, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

Table 1. Annual FFG-62 Procurement Quantities

	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27
FY2020 budget submission	1	2	2	2	2			
FY2021 budget submission		1	1	2	2	3		
Dec. 9, 2020, shipbuilding document			1	3	3	4	4	
FY2022 budget submission			1	n/a	n/a	n/a	n/a	
FY2023 budget submission				1	2	1	2	1

Source: Table prepared by CRS based on Navy's FY2020-FY2023 budget submissions and December 9, 2020, long-range Navy shipbuilding document.

Note: n/a means not available. DOD's FY2022 budget submission was a single-year budget that did not contain line-item details for subsequent fiscal years.

Acquisition Strategy

Number of Builders

The Navy's baseline plan for the FFG-62 program envisages using a single builder at any one time to build FFG-62s, but Navy officials have also spoken about the option of bringing a second shipyard into the program at some point, particularly if annual procurement rates for FFG-62s rise above two ships per year. The annual procurement quantities of three and four ships per year that are shown in **Table 1** under the December 9, 2020, long-range Navy shipbuilding document would be executed by two shipyards.[10] An August 3, 2021, press report quoting a Navy official states

> "It's pre-decisional in the Navy right now but we do have in our contract a Technical Data Package (TDP) that we can exercise that option all the way into the 10th ship. So our intent is that, at some point based on a profile, we can exercise that TDP and then work with candidate yards interested and then start building up on a second source and doing a competition in the future," [Capt. Kevin Smith, program manager of the new frigate class, PMS-51] said during a briefing at the Navy League's annual 2021 Sea Air Space expo Monday [August 2] here.[11]

Parent-Design Approach

As noted earlier, FFG-62s are to be built to a modified version of an existing ship design—an approach, called the parent-design approach, that can reduce design time, design cost, and cost, schedule, and technical risk in building the ship. The Coast Guard and the Navy are currently using the parent-design approach for the Coast Guard's Polar Security Cutter (i.e., polar icebreaker) program.[12] The parent-design approach has also been used in the past for other Navy

[10] The December 9, 2020, document states that the shipbuilding plan presented in the document "makes investments in FY2022 in long lead time material and the stand up of a 'follow yard' [i.e., a second shipyard] in FY2023 to increase FFG 62 production to three ships in FY2023 and to four ships by FY2025." (U.S. Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels*, December 9, 2020, p. 6.)

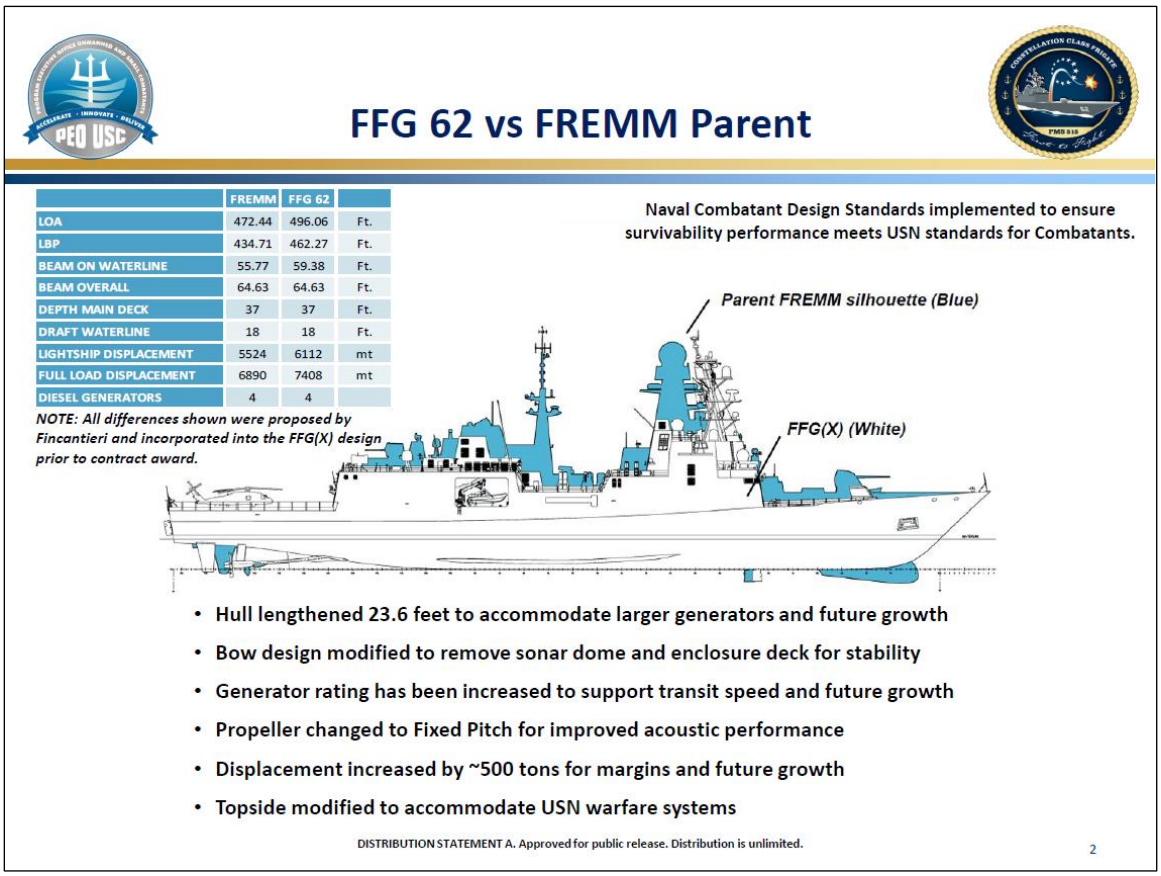
[11] Rich Abott, "Navy Outlines Plan For Second Frigate Shipyard," *Defense Daily*, August 3, 2021.

[12] For more on the polar security cutter program, including the parent-design approach, see CRS Report RL34391, *Coast Guard Polar Security Cutter (Polar Icebreaker) Program: Background and Issues for Congress*, by Ronald O'Rourke.

and Coast Guard ships, including Navy mine warfare ships[13] and the Coast Guard's new Fast Response Cutters (FRCs).[14]

Figure 5 shows a U.S. Navy briefing slide summarizing what the U.S. Navy says are the "primary differences between the FFG 62 Class [design] and the FREMM Parent design." The Navy states that the design differences "were proposed by [the shipbuilding firm] Fincantieri and incorporated [into Fincantieri's proposed design for the FFG-62] prior to [the Navy's] contract award [for the FFG-62 program to Fincantieri]."[15]

Figure 5. FFG-62 Design Compared to FREMM Design



	FREMM	FFG 62	
LOA	472.44	496.06	Ft.
LBP	434.71	462.27	Ft.
BEAM ON WATERLINE	55.77	59.38	Ft.
BEAM OVERALL	64.63	64.63	Ft.
DEPTH MAIN DECK	37	37	Ft.
DRAFT WATERLINE	18	18	Ft.
LIGHTSHIP DISPLACEMENT	5524	6112	mt
FULL LOAD DISPLACEMENT	6890	7408	mt
DIESEL GENERATORS	4	4	

Source: Navy briefing slide provided to CRS and Congressional Budget Office (CBO) by Navy Office of Legislative Affairs, August 27, 2021, with accompanying Navy information paper dated August 18, 2021.

An August 4, 2021, press report states

> The Navy has chosen to elongate and widen the hull of its next-generation Constellation-class frigate relative to the [FREMM] parent design, but the officer overseeing its production says the internal layout will largely remain the same.

[13] The Navy's Osprey (MCM-51) class mine warfare ships are an enlarged version of the Italian Lerici-class mine warfare ships.

[14] The FRC design is based on a Dutch patrol boat design, the Damen Stan Patrol Boat 4708.

[15] Source: Navy information paper dated August 18, 2021, on differences between FFG-62 design and FREMM parent design, provided to CRS and the Congressional Budget Office (CBO) by Navy Office of Legislative Affairs on August 27, 2021.

> "The Italians did a very good job in the design of the internal spaces, and the flow of a lot of those spaces," Capt. Kevin Smith, program manager for the Constellation class, told attendees at the Sea Air Space exposition on Monday [August 2]. "You could say we bought a bigger house, [but] from a modeling and simulation perspective, it's exactly the same."…
>
> While some changes are to be expected to meet the Navy's needs, enlarging the hullform itself has the potential to change where components in the ship must be placed, as well as the overall cost.
>
> Asked about how possible changes in the ship's hull could affect the internal design, Smith said Fincantieri Marinette Marine, the Constellation's prime contractor, worked with Naval Surface Warfare Center Carderock to develop a scale model of the ship and that most elements will stay true to the parent design. He cited the bridge and propulsion plant as areas where the Navy has not made any significant changes to the layout.[16]

No New Technologies or Systems

As an additional measure for reducing cost, schedule, and technical risk in the FFG-62 program, the Navy envisages developing no new technologies or systems for FFG-62s—the ships are to use systems and technologies that already exist or are already being developed for use in other programs.

FY2021 Legislation Regarding Land-Based Test Program for Engineering Plant

Section 125 of the FY2021 National Defense Authorization Act (H.R. 6395/P.L. 116-283 of January 1, 2021) requires the Navy to commence, prior to the delivery of the first FFG-62, a land-based test program for the FFG-62 engineering plant (i.e., its propulsion system and related machinery). The provision specifies how the test program is to be conducted and requires the Navy to complete the test program not later than the date on which the first FFG-62 is scheduled to be available for tasking by operational military commanders.[17]

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[16] Justin Katz, "Navy Says Constellation Hull Change Won't Affect Internal Design," *Breaking Defense*, August 4, 2021.

[17] Regarding Section 125, the conference report (H.Rept. 116-617 of December 3, 2020) on H.R. 6395/P.L. 116-283 of January 1, 2021 states

> Given that the Constellation-class will play a significant role in the Navy battle force for many decades and the current program of record calls for building 20 frigates, the conferees believe a strong technical foundation for this program is critically important.
>
> The conferees note that the winning Constellation-class ship design is based on a foreign design. While recognizing an existing parent design can reduce design, technical, and integration risks, the conferees are concerned that significant risks remain in the FFG-62 program, including: cost realism; shifting to predominantly U.S. component suppliers instead of the mainly foreign suppliers used in the parent vessel design; and a complex Combined Diesel Electric and Gas Hull, Mechanical and Electrical (HM&E) drive train that has not previously been used on U.S. Navy ships.
>
> The conferees believe land based engineering and test sites (LBETS) are critical resources for the Department of Defense, particularly for Navy ship HM&E systems.…
>
> Since 1972, NSWCPD LBETS testing has reduced the acquisition risk of five of the seven Navy surface combatant classes (Spruance-class, Oliver Hazard Perry-class, Ticonderoga-class, Arleigh Burke-class, and Zumwalt-class).… The littoral combat ship (LCS) classes, the Freedom- and Independence-classes, are the two recent classes that have not had the benefit of a LBETS. Since lead ship deliveries in 2008 and 2010, both LCS classes have encountered significant, costly, and debilitating engineering failures. The conferees believe many of these LCS engineering failures

U.S. Content Requirements for Components

Congress has passed provisions relating to U.S. content requirements for certain components of each FFG-62.

Section 856 of the FY2020 National Defense Authorization Act (S. 1790/P.L. 116-92 of December 20, 2019) states

> SEC. 856. APPLICATION OF LIMITATION ON PROCUREMENT OF GOODS OTHER THAN UNITED STATES GOODS TO THE FFG–FRIGATE PROGRAM.
>
> Notwithstanding any other provision of law, amounts authorized to carry out the FFG–Frigate Program may be used to award a new contract that provides for the acquisition of the following components regardless of whether those components are manufactured in the United States:
>
> (1) Auxiliary equipment (including pumps) for shipboard services.
>
> (2) Propulsion equipment (including engines, reduction gears, and propellers).
>
> (3) Shipboard cranes.
>
> (4) Spreaders for shipboard cranes.

Section 8103(b) of the FY2022 DOD Appropriations Act (Division C of H.R. 2471/P.L. 117-103 of March 15, 2022) states

> SEC. 8103....
>
> (b) None of the funds provided in this Act for the FFG(X) Frigate program shall be used to award a new contract that provides for the acquisition of the following components unless those components are manufactured in the United States: Air circuit breakers; gyrocompasses; electronic navigation chart systems; steering controls; pumps; propulsion and machinery control systems; totally enclosed lifeboats; auxiliary equipment pumps; shipboard cranes; auxiliary chill water systems; and propulsion propellers: Provided, That the Secretary of the Navy shall in corporate United States manufactured propulsion engines and propulsion reduction gears into the FFG(X) Frigate program beginning not later than with the eleventh ship of the program.

Provisions similar to Section 8103(b) were included in the FY2020 and FY2021 DOD Appropriations Acts.[18]

In addition to the above provisions, a permanent statute—10 U.S.C. 2534—requires certain components of U.S. Navy ships to be made by a manufacturer in the national technology and industrial base. The paragraph in the annual DOD Appropriations Act that makes appropriations for the Navy's shipbuilding account (i.e., the Shipbuilding and Conversion, Navy, or SCN, appropriation account), moreover, has in recent years included this proviso

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> would have been discovered, analyzed, and corrected faster with less negative operational impact had the Navy established a LCS LBETS.
>
> Accordingly, the provision would require the Secretary of the Navy to establish a FFG-62 class LBETS as soon as possible.…
>
> In addition, the conferees direct the Secretary to submit to the congressional defense committees a plan to implement this section with the budget materials that accompany the President's Budget request for fiscal year 2022. This plan shall include the costs, activities, and test plan necessary to meet the requirements under this section. (Pages 1523-1524)

[18] See Section 8113(b) of the FY2020 DOD Appropriations Act (Division A of H.R. 1158/P.L. 116-93 of December 20, 2019) and Section 8113(b) of the FY2021 DOD Appropriations Act (Division C of H.R. 133/P.L. 116-260 of December 27, 2020).

> … *Provided further*, That none of the funds provided under this heading for the construction or conversion of any naval vessel to be constructed in shipyards in the United States shall be expended in foreign facilities for the construction of major components of such vessel….

10 U.S.C. 2534 explicitly applies to certain ship components, but not others. The meaning of "major components" in the above proviso from the annual DOD Appropriations Act might be subject to interpretation.

Contract Award

Four industry teams competed for the FFG-62 program. On April 30, 2020, the Navy announced that it had awarded the FFG-62 contract to the team led by Fincantieri/Marinette Marine (F/MM) of Marinette, WI. F/MM was awarded a fixed-price incentive (firm target) contract for Detail Design and Construction (DD&C) for up to 10 ships in the program—the lead ship plus nine option ships. The other three industry teams reportedly competing for the program were led by Austal USA of Mobile, AL; General Dynamics/Bath Iron Works (GD/BIW) of Bath, ME; and Huntington Ingalls Industries/Ingalls Shipbuilding (HII/Ingalls) of Pascagoula, MS.

Under the DD&C contract, the Navy has the option of recompeting the program at any point prior to the 19th ship. The Navy also has the option of seeking to convert the DD&C at some point into a multiyear contract known as a block buy contract to procure the ships.[19]

Issues for Congress

Future SSC Force-Level Goal

One issue for Congress concerns the future SSC force-level goal. As noted earlier, the Navy and the Department of Defense (DOD) have been working since 2019 to develop a successor for the 355-ship force-level goal. The Navy's FY2023 30-year (FY2023-FY2052) shipbuilding plan, released on April 20, 2022, includes a table summarizing the results of studies that have been conducted on the successor force-level goal. These studies outline potential future fleets with 40 to 60 SSCs. An SSC force-level goal closer to the high end of that range could increase the likelihood of the Navy increasing its desired number of FFG-62s to something higher than 20, and its desired FFG-62 procurement rate to something more than two ships per year.

Reduction in Planned Procurement Rate

Another potential issue for Congress concerns the reduction in the FFG-62 program's programmed procurement rate under the Navy's FY2023 five-year (FY2023-FY2027) shipbuilding plan. Earlier Navy plans called for the FFG-62 program to achieve a sustained annual procurement rate of two ships per year. As shown in **Table 1**, under the Navy's FY2023 five-year (FY2023-FY2027) shipbuilding plan, the planned procurement rate for FY2023-FY2027 has been reduced to three ships every two years (a 1-2-1-2 pattern), or an average of 1.5 ships per year, which is 25% less than a rate of two ships per year. Potential oversight questions for Congress include the following:

- Why does the FY2023 five-year shipbuilding plan reduce the planned procurement rate during FY2023-FY2027 to 1.5 ships per year? To what degree

[19] For more on block buy contracting, see CRS Report R41909, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, by Ronald O'Rourke.

was this decision driven by affordability considerations (i.e., limits on Navy budgets combined with competing Navy program priorities)? To what degree was it driven by concerns over industrial-base capacity for executing a procurement rate of two ships per year during FY2023-FY2027?[20]

- To what degree, if any, would a reduction to 1.5 ships per year increase FFG-62 unit procurement costs by reducing FFG-62 production economies of scale?
- What impact would a reduction to 1.5 ships per year have on the date for achieving the SSC force-level goal?
- FFG-62s are to have an expected service life (ESLs) of 25 years.[21] With an ESL of 25 years, a sustained annual procurement rate of 1.5 ships per year would over the long run achieve and maintain a steady-state force of 37 ships. By reducing the programmed FFG-62 procurement in FY2023-FY2027 to 1.5 ships per year, is the Navy indicating that the next SSC force-level goal might be closer to 40 ships than 60 ships?

Accuracy of Navy's Estimated Unit Procurement Cost

Introduction

Another potential issue for Congress concerns the accuracy of the Navy's estimated unit procurement cost for FFG-62s, particularly when compared to the known unit procurement costs of other recent U.S. surface combatants. As detailed by the Congressional Budget Office (CBO)[22] and the Government Accountability Office (GAO),[23] lead ships in Navy shipbuilding programs in many cases have turned out to be more expensive to build than the Navy had estimated.

CRS and CBO Analyses

Overview

Ships of the same general type and complexity that are built under similar production conditions tend to have similar costs per weight and consequently unit procurement costs that are more or less proportional to their displacements. An initial analysis of the issue of the accuracy of the Navy's estimated unit procurement cost for FFG-62s that was done by CRS following the Navy's April 30, 2020, contract award in the FFG-62 program, and which has been presented in this CRS report since May 4, 2020, suggested that if FFG-62s were to wind up costing about the same to construct per thousand tons of displacement as other recent U.S. military surface combatants, then the third and subsequent FFG-62s could cost 17% to 56% more than the estimate for those ships shown in the Navy's FY2021 budget submission.

[20] For apress report discussing these questions, see Rich Abott, "Fincantieri Can Meet Frigate Demand For Now, Second Shipyard Decision Not Imminent," *Defense Daily*, April 7, 2022.

[21] Source: Slide 6 of Navy briefing entitled "Guided Missile Frigate (FFG 62) Update, National Symposium Surface Navy Association," Captain Kevin Smith, January 12, 2021.

[22] See Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2019 Shipbuilding Plan*, October 2018, p. 25, including Figure 10.

[23] See Government Accountability Office, *Navy Shipbuilding[:] Past Performance Provides Valuable Lessons for Future Investments*, GAO-18-238SP, June 2018, p. 8.

A follow-on and more-refined analysis of the issue of the accuracy of the Navy's estimated unit procurement cost for FFG-62s that was done by CBO and released on October 13, 2020,[24] and which also compared the Navy's FFG-62 cost estimate to actual costs for building other recent U.S. military surface combatants, estimates that the first 10 FFG-62s would cost 40% more than the Navy estimates. The initial analysis by CRS and the follow-on analysis by CBO are discussed in the two sections that follow.

Depending on the exact terms of the fixed-price incentive (firm target) contract for Detail Design and Construction (DD&C) that the Navy awarded to F/MM for the FFG-62 program, some portion (perhaps much) of any cost growth that might occur on the first 10 FFG-62s could be borne by F/MM rather than the Navy, although F/MM under such a circumstance might also have the option of seeking some form of contractual relief from the Navy, which if granted could shift at least some of the cost growth back to the government.[25] If F/MM were to bear most or all of any cost growth that might occur on the first 10 FFG-62s, then cost growth in the FFG-62 program might not affect Navy budgeting substantially until the 11th ship in the program.

Initial (May 2020) Analysis by CRS

The Navy's FY2021 budget submission estimated that the third and subsequent FFG-62s would cost roughly $940 million each in then-year dollars to procure. This equates to a cost of about $127 million per thousand tons of full load displacement, a figure that is

- about 36% less than the cost per thousand tons of full load displacement of Flight III DDG-51s;
- about 15% less than the cost per thousand tons of full load displacement of the Freedom (LCS-1) variant Littoral Combat Ships (LCSs) that F/MM currently builds; and
- about 15% less than the cost per thousand tons of full load displacement of Coast Guard's National Security Cutters (NSCs).[26]

Put another way, FFG-62s have

- an estimated full load displacement that is about 76% as great as that of Flight III DDG-51s, and an estimated unit procurement cost that is about 49% as great as that of Flight III DDG-51s;
- an estimated full load displacement that is about 120% greater than that of LCS-1 variant LCSs, and an estimated unit procurement cost that is about 80% greater than that of LCS-1 variant LCSs; and

[24] Congressional Budget Office, *The Cost of the Navy's New Frigate*, October 2020, 11 pp.

[25] For example, in 2019, Eastern Shipbuilding Group of Panama City, FL, requested and received contractual relief for Offshore Patrol Cutters (OPCs) that it is building for the Coast Guard. The relief was granted under P.L. 85-804 as amended (50 U.S.C. 1431-1435), a law that authorizes certain federal agencies to provide certain types of extraordinary relief to contractors who are encountering difficulties in the performance of federal contracts or subcontracts relating to national defense. ESG reportedly submitted a request for extraordinary relief on June 30, 2019, after ESG's shipbuilding facilities were damaged by Hurricane Michael, which passed through the Florida panhandle on October 10, 2018. For additional discussion of the OPC program, including the contractual relief provided under P.L. 85-804, see CRS Report R42567, *Coast Guard Cutter Procurement: Background and Issues for Congress*, by Ronald O'Rourke. See also Congressional Budget Office, *The Cost of the Navy's New Frigate*, October 2020, p. 11.

[26] For more on the NSC program, see CRS Report R42567, *Coast Guard Cutter Procurement: Background and Issues for Congress*, by Ronald O'Rourke.

- an estimated full load displacement that is about 64% greater than that of NSCs, and an estimated unit procurement cost that is about 40% greater than that of NSCs.[27]

As mentioned above, ships of the same general type and complexity that are built under similar production conditions tend to have similar costs per weight and consequently unit procurement costs that are more or less proportional to their displacements. Setting the estimated cost per thousand tons of displacement of FFG-62s about equal to those of LCS-1 variant LCSs or NSCs would increase the estimated unit procurement cost of the third and subsequent FFG-62s from the Navy's estimate of about $940 million to an adjusted figure of about $1,100 million, an increase of about 17%. Setting the estimated cost per thousand tons of displacement of FFG-62s about equal to that of Flight III DDG-51s would increase the estimated unit procurement cost of the third and subsequent FFG-62s from the Navy's estimate of about $940 million to an adjusted figure of about $1,470 million, an increase of about 56%.

Follow-on (October 2020) Analysis by CBO

CBO's follow-on and more-refined analysis was done at the direction of the Senate Armed Services Committee.[28] CBO's analysis states

> • CBO estimates the cost of the [first] 10 FFG(X) ships would be $12.3 billion in 2020 (inflation-adjusted) dollars, [or an average of] about $1.2 billion per ship, on the basis of its [CBO's] own weight-based cost model. That amount is 40 percent more than the Navy's estimate.
>
> • The Navy estimates that the 10 ships would cost $8.7 billion in 2020 dollars, an average of $870 million per ship.
>
> • If the Navy's estimate turns out to be accurate, the FFG(X) would be the least expensive [U.S.] surface combatant program of the past 50 years (measured in cost per thousand tons when the ship is mostly empty), even in comparison to much less capable ships.
>
> Several factors support the Navy's estimate:
>
> • The FFG(X) is based on a[n Italian] design that has been in production [in Italy and France] for many years.
>
> • Little if any new technology is being developed for it.
>
> • The contractor is an experienced builder of small surface combatants.

[27] Source: CRS analysis of full load displacements and unit procurement costs of FFG-62, Flight III DDG-51, LCS-1 variant of the LCS, and the NSC.

[28] In its report (S.Rept. 116-236 of June 24, 2020) on the FY2021 National Defense Authorization Act (S. 4049), the Senate Armed Services Committee stated

> **Guided missile frigate**
>
> The committee notes that a contract for up to 10 guided missile frigates (FFG(X)) was awarded in April 2020 with a potential cumulative value of $5.6 billion. Given that this is a new class of ships that will have a significant role in the Navy battle force, the committee seeks additional information on the program.
>
> Accordingly, the committee directs the Director of the Congressional Budget Office to submit to the congressional defense committees, not later than October 1, 2020, a report analyzing the FFG(X) program. The report shall include (1) An analysis of the estimated costs of the program in the context of other current and past Navy shipbuilding programs; (2) An independent cost estimate of the FFG(X) program based on the specific winning ship design; and (3) Other related matters the Director deems appropriate. (Pages 51-52)

• An independent [cost] estimate [for the FFG(X) that was done] within the Department of Defense (DoD) was lower than the Navy's estimate.

Other factors suggest the Navy's estimate is too low:

• The costs of all [U.S. Navy] surface combatants since 1970, as measured per thousand tons, were higher.

• Historically the Navy has almost always underestimated the cost of the lead ship, and a more expensive lead ship generally results in higher costs for the follow-on ships.

• Even when major parts of the ship's estimated cost are known, as they were for the Arleigh Burke [DDG-51 class] destroyer, costs have turned out to be higher than initially estimated.

• Compared with the [Italian] design on which it is based, the FFG(X) will be more densely built and will have somewhat more complex weapon systems.

In addition, although the Navy's contract with Fincantieri is for a fixed price, which limits the government's financial liability, that fixed-price contract does not guarantee that costs will not increase [for the government] for three reasons:

• The terms of the Navy's contract permit the ship's contract price to be increased under certain circumstances.

• The Navy could make changes to the ship's design during construction that would increase costs, as it did, for example, in the littoral combat ship (LCS) program.

• If costs rise enough to threaten the financial viability of the shipbuilder, the Navy may opt to cover some of those higher costs rather than experience a disruption in a shipbuilding program that it considers essential.[29]

Potential Oversight Questions

Potential oversight questions for Congress include the following:

- What is the Navy's basis for its view that FFG-62s—ships about three-quarters as large as Flight III DDG-51s, and with installed capabilities that are in many cases similar to those of DDG-51s—can be procured for about one-half the cost of Flight III DDG-51s?
- DDG-51s are procured using multiyear procurement (MYP), which reduces their procurement cost by several percent, while the FFG-62 DD&C contract is a contract with options, which operates as a form of annual contracting and consequently does not achieve the kinds of savings that are possible with an MYP contract.[30] Would adjusting for this difference by assuming the use of annual contracting for procuring DDG-51s mean that the difference between Flight III DDG-51s and FFG-62s in cost per thousand tons displacement, other things held equal, is greater than the figure of 36% shown above in the initial CRS analysis?
- What is the Navy's basis for its view that FFG-62s—ships with a full collection of permanently installed combat system equipment—can be procured for a cost

[29] Congressional Budget Office, *The Cost of the Navy's New Frigate*, October 2020, pp. 1-2.

[30] For additional discussion of the savings that are possible with MYP contracts, see CRS Report R41909, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, by Ronald O'Rourke.

per thousand tons of full load displacement that is (by CRS's initial analysis) about 15% less than that of LCS-1 variant LCSs, which are ships built by the same shipyard that features only a partial collection of permanently installed combat system equipment?[31]

- What is the Navy's basis for its view that FFG-62s—ships built to Navy combat survivability standards and featuring a full collection of installed Navy combat system equipment—can be procured for a cost per thousand tons of full load displacement that is (by CRS's initial analysis) 15% less than that NSCs, which are ships built to a Coast Guard rather than Navy combat-survivability standard and featuring a more-modest collection of combat system equipment?
- To what degree can differences in costs for building ships at F/MM compared to costs for building ships at the shipyards that build DDG-51s and NSCs account for the FFG-62s' lower estimated cost per thousand tons displacement?
- To what degree can the larger size of FFG-62s compared to LCS-1 variant LCSs or NSCs account for the FFG-62s' lower estimated cost per thousand tons displacement?
- To what degree will process improvements at F/MM, beyond those that were in place for building LCSs at F/MM, permit FFG-62s to be built at the Navy's estimated cost per thousand tons?
- How much might the cost of building FFG-62s be reduced by converting the FFG-62 contract into a block buy contract (i.e., a multiyear contract)?
- Under the terms of the fixed-price incentive (firm target) contract for Detail Design and Construction (DD&C) that the Navy awarded to F/MM for the FFG-62 program, what portion of any cost growth that might occur on the first 10 FFG-62s might be borne by F/MM, and what portion might be borne by the Navy?

Number of FFG-62 Builders

Another issue for Congress is whether to build FFG-62s at a single shipyard (the Navy's baseline plan), or at two shipyards, and if the latter, when to bring the second builder into the program. The Navy's FFG-7s, which were procured at annual rates of as high as eight ships per year, were built at three shipyards. The Navy states that in terms of having a technical data package ready for a second builder, the Navy could introduce a second builder into the FFG-62 program with a ship procured as early as FY2024.[32]

In considering whether to build FFG-62s at a single shipyard or at two shipyards, Congress may consider several factors, including but not limited to the annual FFG-62 procurement rate, shipyard production capacities and production economies of scale, the potential costs and benefits in the FFG-62 program of employing recurring competition between multiple shipyards, and how the number of FFG-62 builders might fit into a larger situation involving the production of other

[31] Some of the combat system equipment of a deployed LCS consists of a modular mission package is not permanently built into the ship. These modular mission packages are procured separately from the ship, and their procurement costs are not included in the unit procurement costs of LCSs. For additional discussion, see CRS Report RL33741, *Navy Littoral Combat Ship (LCS) Program: Background and Issues for Congress*, by Ronald O'Rourke.

[32] Source: Navy FY2023 program briefing for CRS and CBO, May 10, 2022.

Navy and Coast Guard ships, including Navy DDG-51 destroyers, Navy amphibious ships, Coast Guard National Security Cutters (NSCs), and Coast Guard Offshore Patrol Cutters (OPCs).[33]

Regarding when a second builder could be brought into the FFG-62 program, the explanatory statement for the FY2022 DOD Appropriations Act (S. XXXX) that the Senate Appropriations Committee released on October 18, 2021, stated (emphasis added):

> While the Committee recognizes the significant role that CCF [Constellation-class frigate] will have in the future Navy battle force, and is based on a proven hull design and mature shipboard technologies, it remains a new class and presents typical first-in-class production challenges. The Committee notes the past challenges of the Navy and shipbuilding industrial base in managing costs, technical concurrency, design changes, and schedule of lead ships of a class. The Committee is concerned that prematurely adding a second CCF shipyard before the first shipyard has identified and corrected technical and production issues will inject unneeded risk and complexity into the program. **Therefore, prior to award of a contract for a second CCF shipyard, the Committee directs the Secretary of the Navy to prioritize the following objectives: technology maturation and risk reduction for critical shipboard components; major systems integration; full ship technical data package creation; and successful operationally realistic testing for the first ship.** The Committee also understands that setting up the CCF manufacturing capacity, workforce, and supply chain requires consistent year-over-year funding to meet the demand for production ramp up. Therefore, the Committee directs the Secretary of the Navy to submit a report not later than 90 days prior to awarding a contract for the second CCF shipyard to the congressional defense committees outlining the acquisition strategy for achieving the full Frigate Program of Record and meeting these technology maturation and risk reduction objectives. (PDF page 108 of 253)

The Navy states that the above report language, particularly the requirement for successful operationally realistic testing for the first ship, could be read as barring the introduction of a second builder into the FFG-62 until sometime after the first FFG-62 ship is delivered,[34] which is scheduled under the Navy's FY2023 budget submission for September 2026. Under that schedule, operationally realistic testing of the ship might begin in 2027, a year when Congress will consider the Navy's proposed FY2028 budget. Another possible perspective on the above report language is that it would bar the introduction of a second builder into the program until the Secretary of the Navy *prioritizes the objective* of successful operationally realistic testing of the first ship, which is not the same as *conducting* successful operationally realistic testing. Under this interpretation, prioritizing this objective (i.e., designating it as an important objective) is something that the Secretary of the Navy could do immediately.

An April 6, 2022, press report stated

> Shipbuilder Fincantieri Marinette Marine "can meet the demand" of the Constellation-class frigate program for the time being, but the Navy still deciding whether to select a second contractor for the 20-ship class, according to the service's program manager.
>
> Capt. Kevin Smith told attendees at the Sea Air Space exposition on Tuesday [April 5] that when the time is right, the Navy plans to purchase the ship's technical data package from Fincantieri and begin to qualify alternate shipyards so that the program office is ready to move forward if senior leadership chooses....

[33] For more on the DDG-51 program, see CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke. For more on Navy amphibious shipbuilding programs, see CRS Report R43543, *Navy LPD-17 Flight II and LHA Amphibious Ship Programs: Background and Issues for Congress*, by Ronald O'Rourke. For more on the NSC and OPC programs, see CRS Report R42567, *Coast Guard Cutter Procurement: Background and Issues for Congress*, by Ronald O'Rourke.

[34] Source: Navy FY2023 program briefing for CRS and CBO, May 10, 2022.

> At a basic level, the biggest incentive the Navy has to establish a second shipyard is that it increases the number of ships it can produce each year and also adds a level of stability to the supply chain: If production at one shipyard stops for any reason, then the other will still be working.
>
> But the strategy comes with its own costs, especially amid concerns about the program's maturity. The introduction of a new contractor could complicate the program, and the Navy must also consider whether its future budgets, which most expect to be flat-lining or declining compared to previous years, will be able to support enough work for both shipyards to keep their production lines moving.
>
> Lawmakers' appetite for a second shipyard are mixed. On one hand, a second yard means more jobs for their constituents—always a positive for those from states that house major shipbuilders such as Austal USA in Alabama or General Dynamics Bath Iron Works in Maine.
>
> On the other hand, language in the fiscal 2022 defense spending bill indicated some on Capitol Hill are apprehensive that establishing a second yard too early could lead to costly mistakes in the future.
>
> "There is concern that prematurely adding a second [frigate] shipyard before the first shipyard has identified and corrected technical and production issues will inject unneeded risk and complexity into the program," according to a report accompanying the recently signed spending bill.
>
> For now though, Fincantieri, based in Wisconsin, will continue to work with the Navy on solidifying the new ship's final design, which will go through an important review in the near future, Smith added.[35]

U.S. Content Requirements

Another issue for Congress is whether to take any further legislative action regarding U.S. content requirements for FFG-62s. Potential options include amending, repealing, or replacing the previously mentioned U.S. content provisions for the FFG-62 program that Congress passed in FY2020 and FY2021; passing a new, separate provision of some kind; or doing none of these things.

Required Capabilities and Growth Margin

Another issue for Congress is whether the Navy has appropriately defined the required capabilities and growth margin of FFG-62s.

Analytical Basis for Desired Ship Capabilities

One aspect of this issue is whether the Navy has an adequately rigorous analytical basis for its identification of the capability gaps or mission needs to be met by FFG-62s, and for its decision to meet those capability gaps or mission needs through the procurement of a FFG with the capabilities outlined earlier in this CRS report. The question of whether the Navy has an adequately rigorous analytical basis for these things was discussed in greater detail in earlier editions of this CRS report.[36]

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[35] Justin Katz, "A Second FFG-62 Shipyard? Fincantieri 'Can Meet Demand' for Now," *Breaking Defense*, April 6, 2022. See also Rich Abott, "Fincantieri Can Meet Frigate Demand For Now, Second Shipyard Decision Not Imminent," *Defense Daily*, April 7, 2022.

[36] See, for example, the version of this report dated February 4, 2019.

Number of VLS Tubes

Another potential aspect of this issue concerns the planned number of Vertical Launch System (VLS) missile tubes on FFG-62s. The VLS is the FFG-62's principal (though not only) means of storing and launching missiles. FFG-62s are to each be equipped with 32 Mark 41 VLS tubes. (The Mark 41 is the Navy's standard VLS design.)

Supporters of requiring each FFG-62 to be equipped with a larger number of VLS tubes, such as 48, might argue that FFG-62s are to be roughly three-quarters as large, and at least half as expensive to procure, as DDG-51s, and might therefore be more appropriately equipped with at least 48 VLS tubes, which is one-half the number on recent DDG-51s. They might also argue that in a context of renewed great power competition with potential adversaries such as China, which is steadily improving its naval capabilities,[37] it might be prudent to equip each FFG-62 with 48 rather than 32 VLS tubes each, and that doing so might only marginally increase FFG-62 unit procurement costs. They might also argue that equipping each FFG-62 with 48 rather than 32 VLS tubes will permit the Navy to more fully offset a substantial reduction in VLS tubes that the Navy's surface fleet is projected to experience when the Navy's 22 Ticonderoga (CG-47) class cruisers, which are each equipped with 122 VLS tubes, are retired,[38] and provide a hedge against the possibility that Navy plans to field VLS tubes on Large Unmanned Surface Vehicles (LUSVs)[39] will be slowed or curtailed for technical or other reasons.

Supporters of having each FFG-62 be equipped with 32 VLS tubes might argue that the analyses indicating a need for 32 VLS tubes already took improving adversary capabilities (as well as other U.S. Navy capabilities) into account. They might also argue that FFG-62s, in addition to having 32 VLS tubes, will also to have separate, deck-mounted box launchers for launching 16 anti-ship cruise missiles, as well as a separate, 21-cell Rolling Airframe Missile (RAM) AAW missile launcher; that Navy plans continue to call for eventually deploying additional VLS tubes on LUSVs, which are to act as adjunct weapon magazines for the Navy's manned surface combatants; and that increasing the number of VLS tubes on each FFG-62 from 32 to 48 would increase (even if only marginally) the procurement cost of a ship that is intended to be an affordable supplement to the Navy's cruisers and destroyers.

A May 14, 2019, Navy information paper on expanding the cost impact of expanding the FFG-62 VLS capacity from 32 cells to 48 cells states

> To grow from a 32 Cell VLS to a 48 Cell VLS necessitates an increase in the length of the ship with a small beam increase and roughly a 200-ton increase in full load displacement. This will require a resizing of the ship, readdressing stability and seakeeping analyses, and adapting ship services to accommodate the additional 16 VLS cells.

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[37] For more on China's naval modernization effort, see CRS Report RL33153, *China Naval Modernization: Implications for U.S. Navy Capabilities—Background and Issues for Congress*, by Ronald O'Rourke.

[38] See, for example, Megan Eckstein and Joe Gould, "Lawmakers Crunching the Numbers on Potential Surface Navy Additions to FY22 Spending Plan," *Defense News*, June 17, 2021; Mallory Shelbourne, "Lawmakers Probe Navy's Plan to Decommission Cruisers, Navy Says Cuts Will Save $5B Across FYDP," *USNI News*, June 17 (updated June 18), 2021; Megan Eckstein, "Lawmakers Are Worried About the US Navy's Spending Plan and a Near-Term China Threat," *Defense News*, June 15, 2021; Mallory Shelbourne, "CNO Gilday: Flat or Declining Navy Budgets 'Will Definitely Shrink' the Fleet," *USNI News*, June 15, 2021; Blake Herzinger, "The Budget (and Fleet) That Might Have Been," *War on the Rocks*, June 10, 2021; David B. Larter, "As the US Navy Scrambles to Field More Missiles in Asia, a Tough Decision Looms for Aging Cruisers," *Defense News*, April 12, 2021.

[39] For more on the LUSV program, see CRS Report R45757, *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress*, by Ronald O'Rourke.

> A change of this nature would unnecessarily delay detail design by causing significant disruption to ship designs. Particularly the smaller ship designs. Potential competitors have already completed their Conceptual Designs and are entering the Detail Design and Construction competition with ship designs set to accommodate 32 cells.
>
> The cost is estimated to increase between $16M [million] and $24M [million] per ship. This includes ship impacts and additional VLS cells.[40]

Compared to an FFG-62 follow-on ship unit procurement cost of about $1.0, the above estimated increase of $16 million to $24 million would equate to an increase in unit procurement cost of about 1.6% to about 2.4%.

Growth Margin

Another potential aspect of this issue is whether the Navy more generally has chosen the appropriate amount of growth margin to incorporate into the FFG-62 design. The Navy wants the FFG-62 design to have a growth margin (also called service life allowance) of 5%, meaning an ability to accommodate upgrades and other changes that might be made to the ship's design over the course of its service life that could require up to 5% more space, weight, electrical power, or equipment cooling capacity. The Navy also wants the FFG-62 design to have an additional growth margin (above the 5% factor) for accommodating a future directed energy system (i.e., a laser or high-power microwave device) or an active electronic attack system (i.e., electronic warfare system).

Supporters could argue that a 5% growth margin is traditional for a ship like a frigate, that the FFG-62 design's 5% growth margin is supplemented by the additional growth margin for a directed energy system or active electronic attack system, and that requiring a larger growth margin could make the FFG-62 design larger and more expensive to procure.

Skeptics might argue that a larger growth margin (such as 10%—a figure used in designing cruisers and destroyers) would provide more of a hedge against the possibility of greater-than-anticipated improvements in the capabilities of potential adversaries such as China, that a limited growth margin was a concern in the FFG-7 design,[41] and that increasing the FFG-62 design's growth margin from 5% to 10% would have only a limited impact on the FFG-62's procurement cost.

A potential oversight question for Congress might be: What would be the estimated increase the FFG-62's unit procurement cost of increasing the ship's growth margin from 5% to 10%?

Technical Risk

Another potential oversight issue for Congress concerns technical risk in the FFG-62 program. The Navy can argue that the program's technical risk has been reduced by use of the parent-design approach, by the decision to use only systems and technologies that already exist or are already being developed for use in other programs, rather than new technologies that need to be developed, and by the congressionally mandated requirement to conduct a land-based test program for the ship's engineering plant. Skeptics, while acknowledging these points, might

[40] Navy information paper entitled "FFG(X) Cost to Grow to 48 cell VLS," dated May 14, 2019, received from Navy Office of Legislative Affairs on June 14, 2019.

[41] See, for example, See U.S. General Accounting Office, Statement of Jerome H. Stolarow, Director, Procurement and Systems Acquisition Division, before the Subcommittee on Priorities and Economy in Government, Joint Economic Committee on The Navy's FFG-7 Class Frigate Shipbuilding Program, and Other Ship Program Issues, January 3, 1979, pp. 9-11.

argue that lead ships in Navy shipbuilding programs nevertheless pose technical risk, because they serve as the prototypes for their programs.

Recent Press Reports

April 2022 Press Report Regarding Date for Starting Construction

An April 13, 2022, press report stated

> The Navy will begin construction on the first Constellation-class frigate this summer or fall, later than the program's goal to begin construction in April.
>
> The program won't start construction until the critical design review is completed, according to Capt. Kevin Smith, the frigate program manager.
>
> "You may say, 'you've been working on design for a while.' We want to make sure we get it right before we start cutting steel. Lead ships are hard," Smith said last week at the Navy League's Sea-Air-Space conference.[42]

March 2022 Press Report Regarding Ship's Variable Depth Sonar

> Following an announcement earlier this week that the Navy would cancel a key anti-submarine warfare effort bound for the Littoral Combat Ship, the service today also said it would replace that technology with an alternative system onboard the new Constellation-class frigate.
>
> Rear Adm. Casey Moton, a senior officer overseeing both ship classes, told a small group of reporters that "following an assessment," the Navy chose the CAPTAS-4 variable depth sonar (VDS) made by Advanced Acoustics Concepts, a subsidiary of DRS and Thales, as the new frigate VDS.
>
> "The Navy assessed CAPTAS-4 as a low risk VDS option for FFG-62 due to its proven performance, overall technical readiness level, low risk integration with the SQQ-89 ASW combat system, ability to integrate with the frigate platform design and ability to meet the in-yard need date for FFG-62," Moton said....
>
> The consequences for the last-minute change to the Navy's contract with Raytheon are still being worked out, Moton said, but he added that the company had been "professional" throughout the process to date. The admiral also said he does not anticipate "very much of a change" to the ship's cost as a result of the new VDS.[43]

January 2022 Press Report Regarding Changes to Parent Design

A January 2022 press report about whether changes made to FREMM parent design introduce technical risk to the FFG-62 program stated

> Experts told Breaking Defense that not all changes [from a parent design] are as inherently risky as they might seem, and the Navy appears to have heeded lessons from previous controversies....
>
> "In terms of changes from a parent design… as you start to drive further away from a parent design, there is the risk of cost increase, especially if you have immature equipment that requires testing or fails testing," said Steven Wills, a Navy strategy and policy expert at

[42] Audrey Decker, "Frigate Construction Pushed Back from April Target Start Date," *Inside Defense*, April 13, 2022.

[43] Justin Katz, "Navy to Swap Sonar on New Frigate Following Years of Struggles with Testing," *Breaking Defense*, March 31, 2022. See also Megan Eckstein, "US Navy to Terminate DART Sonar Development with Raytheon," *Defense News*, March 31, 2022.

CNA, a federally funded research and development center that provides advice to the Pentagon....

When asked this month at the Surface Navy Association's annual symposium about how those changes could impact the program's risk calculus, Capt. Kevin Smith, the Constellation-class program manager, said the parent design is a starting point, but nothing more.

"I think it was clear to everyone in Navy leadership as well as congressional leadership that the parent is there as just that… think of it as a DNA," he said. "But you do have to take US Navy standards and apply those, and also the requirements."...

"The only thing that we've [the Navy] done actually—it's a change to the requirements—is buy American, because that was a statute from Congress," Smith said, referring to legislation mandating certain parts and percentages of US warships be manufactured domestically....

But CNA's Wills said one major difference between the FREMM and the Constellation, the elongated hull form, is not surprising because of differences in how Europeans and the United States go about building warships.

"You don't incur a lot of costs in making the ship bigger. That shouldn't slow you down. That shouldn't cause testing to fail," he said. "You're going to have to buy more steel and there will be some changes. The benefit that they seem to be going for… is they're looking for some additional margins throughout the life of the ship."

Matthew Collette, who teaches naval architecture and marine engineering at the University of Michigan, said fully adopting a parent design without modification is "exceptionally rare" especially for the US Navy, which has developed standards for internal layouts and adheres to congressional policy dictating supply chain options.

"Changing the overall dimensions of the ship is probably lowering the overall risk to the program, not raising it," Collette told Breaking Defense. "Given that we are changing the internals of the design, adhering strictly to the old hull form would actually increase the overall risk to the program, as you end up adding complexity by trying to shoehorn in components in a less-than-ideal layout."

He cited the Ticonderoga-class cruisers and Whidbey Island-class dock landing ships as examples where Navy programs have historically suffered because the service attempted to maintain the ships' external design while altering its internal layout.

Collette said there are three principles a shipbuilding program should follow to reduce the risk of modifying a parent design. The first is choosing proven systems when swapping out components. In the Constellation's case, the Navy has done just that by choosing systems such as Aegis, the Mk 41 Vertical Launching System and the SLQ-32 from the Surface Electronic Warfare Improvement Program.

The second principle is to thoroughly test new components ashore, a requirement Congress codified in law after finding out the Navy failed to do this on other systems that proved troublesome for the Ford.

The last principle is having a completed definition of the parent design, such as a 3D model, a parameter for which Collette and other analysts have no way of assessing from outside the Navy's program office.

> "Even with some changes, the program is still benefiting from access to the original design models, and the knowledge gained in building and operating vessels that are highly similar, but no longer exactly the same, to the US Navy variant," Collette said.[44]

January 2022 DOT&E Report

A January 2022 report from DOD's Director, Operational Test and Evaluation (DOT&E)—DOT&E's annual report for FY2021—stated the following regarding the FFG-62 program:

> **Survivability**
>
> The Navy remains in development of the Detail Design Survivability Assessment Report M&S [modeling and simulation] Plan to include verification and validation plans for specific M&S codes following completion of the Phase I survivability testing. COVID-19 delayed classified work in FY21. These efforts intend to support the Detail Design Survivability Assessment Report scheduled to be delivered in FY25.
>
> The Navy compared the results of the Extended Distance Multiple Plate ballistic tests to available computer modeling techniques to assess M&S adequacy and determine M&S modification requirements. The results of these tests showed good correlation with existing penetration models for some metrics, but also showed a need for M&S improvement in others.
>
> Analysis of the near-contact underwater explosion tests is in progress. DOT&E expects a report in FY22.
>
> **Recommendation**
>
> 1. The Program Office PMS 515 should generate the Detail Design Survivability Assessment Report M&S Plan and individual M&S validation plans in accordance with the FFG 62 LFT&E strategy.[45]

June 2021 GAO Report

A June 2021 GAO report on the status of various DOD acquisition programs states the following about the FFG-62 program:

> **Technology Maturity**
>
> The FFG 62 program uses many existing combat and mission systems, which are intended to reduce technical risk. The Navy completed a technology readiness assessment in March 2019, identifying no critical technologies. In February 2020, the Navy also completed an independent technical risk assessment that identified 12 areas of low to moderate programmatic risk. Specifically, the assessment noted some potential risks for mission capability, integration, and testing plans related to Navy-provided equipment. One example of this equipment is the new Enterprise Air Surveillance Radar (EASR) that will provide long-range detection and engagement capability for several Navy shipbuilding programs. The Navy completed EASR development and initiated production in 2020, with plans to integrate the radar system on other ship classes before FFG 62. However, the Navy stated that if integration of EASR with software from a new Aegis combat system baseline is not completed by 2023, the FFG 62 program may require additional funding and time for capability development and testing.

[44] Justin Katz, "For Navy's New Frigate, Design Changes Carry Risks and Rewards," *Breaking Defense*, January 24, 2022.

[45] Department of Defense, Director, Operational Test & Evaluation, *FY2021 Annual Report*, January 2022, p. 156.

Design Stability and Production Readiness

The Navy worked with five industry teams during a FFG 62 conceptual design phase to mature designs based on ships already built and demonstrated at sea. The results informed the program's May 2019 preliminary design review and request for proposal. In April 2020, the program competitively awarded a detail design and construction contract for the lead ship. Program officials stated they will complete the critical design review and production readiness review in summer 2021 to support construction start in October 2021, 9 months sooner than previously estimated. The Navy said the updated schedule reflects the maturity of the ship design selected for the April 2020 award. Program officials noted they expect the Navy to review the basic and functional design for the ship's 34 design zones prior to construction start, and for each major construction module, the shipbuilder plans to complete the detail design and construction drawings before starting the module's construction.

Software and Cybersecurity

The FFG 62 program expects to have an approved software development plan in March 2021. The independent technical risk assessment identified software as a moderate risk. It noted that the program's plan for on-ship testing late in lead ship construction may identify problems that could result in design change or delays in the test program schedule. The assessment stated that the program plans to mitigate software risk through early integration testing at land-based test sites prior to initial testing on the ship.

The Navy approved the FFG 62 cybersecurity strategy in March 2019. The program reported it performed a tabletop exercise as part of its cybersecurity assessment activities.

Other Program Issues

The Navy identified the availability of high-efficiency super capacity chillers as a significant longer-term risk to the FFG 62 program's production schedule. In particular, the Navy reported that high demand for this equipment across shipbuilding programs and limitations to the vendor's production capacity could result in the FFG 62 shipbuilder's inability to procure the required amount of chillers to support the production schedule.

In March 2020, we reported that the Navy set the FFG 62 program's sustainment requirement for operational availability unacceptably low from the fleet's perspective. Specifically, the program can meet its operational availability requirement even if a ship is completely inoperable for several months per year. The Navy does not plan to update this sustainment requirement to better reflect the fleet's needs.

The Consolidated Appropriations Act, 2020, prohibited the frigate program from using funds provided in the act to award a new contract for the acquisition of certain ship components unless those components were manufactured in the U.S. It also provided that the Navy must incorporate U.S.-manufactured propulsion engines and reduction gears in the program by the 11th ship. In October 2020, the Navy reported that many components in the April 2020 contract award were manufactured in the U.S., and the propulsion equipment will be manufactured completely in the U.S. beginning with the second ship.

Program Office Comments

We provided a draft of this assessment to the program office for review and comment. The program office provided technical comments, which we incorporated where appropriate. In its comments, the program office said it is moving methodically through the detail design phase to deliver capability and reduce risk. The program office also noted that since identifying the availability of chillers as a longer-term risk, the Navy has coordinated across program offices and worked with the vendor to meet shipyard schedules. Regarding FFG 62's operational availability, the program office said that it coordinated with surface fleet representatives to assess the requirement against its warfare areas, where critical failures could reduce or degrade capability in one area without affecting another area. The

> program office added that it responded to recommendations from the March 2020 GAO report by mapping warfare areas to system suitability characteristics and determining the probability of mission success by warfare area through a robust modeling and simulation program.[46]

Guaranty vs. Warranty in Construction Contract

Another aspect of the issue of technical risk concerns the Navy's use of a guaranty rather than a warranty in the Detail Design and Construction (DD&C) contract for the FFG-62 program. An August 2019 GAO report on the FFG-62 program states

> 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.[47]

As discussed in another CRS report,[48] in discussions of Navy (and also Coast Guard) shipbuilding, a question that sometimes arises is whether including a warranty in a shipbuilding contract is preferable to not including one. The question can arise, for example, in connection with a GAO finding that "the Navy structures shipbuilding contracts so that it pays shipbuilders to build ships as part of the construction process and then pays the same shipbuilders a second time to repair the ship when construction defects are discovered."[49]

Including a warranty in a shipbuilding contract (or a contract for building some other kind of defense end item), while potentially valuable, might not always be preferable to not including one—it depends on the circumstances of the acquisition, and it is not necessarily a valid criticism of an acquisition program to state that it is using a contract that does not include a warranty (or a weaker form of a warranty rather than a stronger one).

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[46] Government Accountability Office, *Weapon Systems Annual Assessment[:] Updated Program Oversight Approach Needed*, GAO-21-222, June 2021, p. 173.

[47] Government Accountability Office, *Guide Missile Frigate[:] Navy Has Taken Steps to Reduce Acquisition Risk, but Opportunities Exist to Improve Knowledge for Decision Makers*, GAO-19-512, August 2019, summary page.

[48] See CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

[49] See Government Accountability Office, *Navy Shipbuilding[:] Past Performance Provides Valuable Lessons for Future Investments*, GAO-18-238SP, June 2018, p. 21. A graphic on page 21 shows a GAO finding that the government was financially responsible for shipbuilder deficiencies in 96% of the cases examined by GAO, and that the shipbuilder was financially responsible for shipbuilder deficiencies in 4% of the cases.

Including a warranty generally shifts to the contractor the risk of having to pay for fixing problems with earlier work. Although that in itself could be deemed desirable from the government's standpoint, a contractor negotiating a contract that will have a warranty will incorporate that risk into its price, and depending on how much the contractor might charge for doing that, it is possible that the government could wind up paying more in total for acquiring the item (including fixing problems with earlier work on that item) than it would have under a contract without a warranty.

When a warranty is not included in the contract and the government pays later on to fix problems with earlier work, those payments can be very visible, which can invite critical comments from observers. But that does not mean that including a warranty in the contract somehow frees the government from paying to fix problems with earlier work. In a contract that includes a warranty, the government will indeed pay something to fix problems with earlier work—but it will make the payment in the less-visible (but still very real) form of the up-front charge for including the warranty, and that charge might be more than what it would have cost the government, under a contract without a warranty, to pay later on for fixing those problems.

From a cost standpoint, including a warranty in the contract might or might not be preferable, depending on the risk that there will be problems with earlier work that need fixing, the potential cost of fixing such problems, and the cost of including the warranty in the contract. The point is that the goal of avoiding highly visible payments for fixing problems with earlier work and the goal of minimizing the cost to the government of fixing problems with earlier work are separate and different goals, and that pursuing the first goal can sometimes work against achieving the second goal.[50]

DOD's guide on the use of warranties states the following:

> Federal Acquisition Regulation (FAR) 46.7 states that "the use of warranties is not mandatory." However, if the benefits to be derived from the warranty are commensurate with the cost of the warranty, the CO [contracting officer] should consider placing it in the contract. In determining whether a warranty is appropriate for a specific acquisition, FAR Subpart 46.703 requires the CO to consider the nature and use of the supplies and services, the cost, the administration and enforcement, trade practices, and reduced requirements. The rationale for using a warranty should be documented in the contract file....
>
> In determining the value of a warranty, a CBA [cost-benefit analysis] is used to measure the life cycle costs of the system with and without the warranty. A CBA is required to determine if the warranty will be cost beneficial. CBA is an economic analysis, which basically compares the Life Cycle Costs (LCC) of the system with and without the warranty to determine if warranty coverage will improve the LCCs. In general, five key factors will drive the results of the CBA: cost of the warranty + cost of warranty administration + compatibility with total program efforts + cost of overlap with Contractor support + intangible savings. Effective warranties integrate reliability, maintainability, supportability, availability, and life-cycle costs. Decision factors that must be evaluated

[50] It can also be noted that the country's two largest builders of Navy ships—General Dynamics (GD) and Huntington Ingalls Industries (HII)—derive about 60% and 96%, respectively, of their revenues from U.S. government work. (See General Dynamics, *2016 Annual Report*, page 9 of Form 10-K [PDF page 15 of 88]) and Huntington Ingalls Industries, *2016 Annual Report*, page 5 of Form 10-K [PDF page 19 of 134]). These two shipbuilders operate the only U.S. shipyards currently capable of building several major types of Navy ships, including submarines, aircraft carriers, large surface combatants, and amphibious ships. Thus, even if a warranty in a shipbuilding contract with one of these firms were to somehow mean that the government did not have pay under the terms of that contract—either up front or later on—for fixing problems with earlier work done under that contract, there would still be a question as to whether the government would nevertheless wind up eventually paying much of that cost as part of the price of one or more future contracts the government may have that firm.

> include the state of the weapon system technology, the size of the warranted population, the likelihood that field performance requirements can be achieved, and the warranty period of performance.[51]

In response to a draft version of GAO's August 2019 report, the Navy stated

> 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 [RFP] 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 as 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.[52]

Potential Industrial-Base Impacts of FFG-62 Program

Another issue for Congress concerns the potential industrial-base impacts of the FFG-62 program for shipyards and supplier firms in the context of other Navy and Coast Guard shipbuilding programs, including the Navy's Littoral Combat Ship (LCS), DDG-51 destroyer, and amphibious shipbuilding programs, and the Coast Guard's National Security Cutter (NSC) and Offshore Patrol Cutter (OPC) programs.

Two of the teams that competed for the FFG-62 program involved shipyards (F/MM and Austal USA) that are currently building LCSs, procurement of which ended in FY2019. The two other teams that competed for the FFG-62 program involved shipyards (GD/BIW and HII/Ingalls) that currently build DDG-51 destroyers and (in the case of HII/Ingalls) Navy amphibious ships. A potential change in the Navy's fleet architecture might reduce quantities of destroyers and/or large amphibious ships being procured for the Navy.[53]

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[51] Department of Defense, *Department of Defense Warranty Guide*, Version 1.0, September 2009, accessed July 13, 2017, at https://www.acq.osd.mil/dpap/pdi/uid/docs/departmentofdefensewarrantyguide[1].doc.

[52] Government Accountability Office, *Guide Missile Frigate[:] Navy Has Taken Steps to Reduce Acquisition Risk, but Opportunities Exist to Improve Knowledge for Decision Makers*, GAO-19-512, August 2019 (revised September 5, 2019 to include an omitted page in the report section, [and] comments from the Department of Defense), pp. 44-45.

[53] See CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke, and CRS Report R43543, *Navy LPD-17 Flight II and LHA Amphibious Ship Programs: Background and Issues for Congress*, by Ronald O'Rourke.

Legislative Activity for FY2023

Summary of Congressional Action on FY2023 Funding Request

Table 2 summarizes congressional action on the Navy's FY2023 funding request for the FFG-62 program.

Table 2. Congressional Action on FY2023 Procurement Funding Request

Millions of dollars, rounded to nearest tenth.

		Authorization			Appropriation		
	Request	**HASC**	**SASC**	**Enacted**	**HAC**	**SAC**	**Enacted**
Procurement	1,085.2						
Advance procurement (AP)	74.9						
(Procurement quantity)	*(1)*						

Source: Table prepared by CRS based on FY2023 Navy budget submission, committee and conference reports, and explanatory statements on the FY2023 National Defense Authorization Act and the FY2023 DOD Appropriations Act.

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

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