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

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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 at a cost of $1,281.2 million (i.e., about $1.3 billion) and the second in FY2021 at a cost of $1,053.1 million (i.e., about $1.1 billion). The Navy's proposed FY2022 budget requests $1,087.9 million (i.e., about $1.1 billion) for the procurement of the third FFG-62, and $69.1 million in advance procurement (AP) funding for the fourth and fifth FFG-62s, which are programmed for procurement in one or more 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 and FY2021 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 goals for frigates and other surface combatants;
- 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;
- the potential impact of the COVID-19 situation on the execution of U.S. military shipbuilding programs, including the FFG-62 program;
- whether to build FFG-62s at a single shipyard at any one time (the Navy's baseline plan), or at two or three 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 FY2022 budget requests $1,087.9 million (i.e., about $1.1 billion) for the procurement of the third FFG-62, and $69.1 million in advance procurement (AP) funding for the fourth and fifth FFG-62s, which are programmed for procurement in one or more future fiscal years.

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 FY2020

The Navy's force of SSCs at the end of FY2020 included no frigates, 22 LCSs, and 8 mine warfare ships.

SSC Force-Level Goal

Current Force-Level Goal Within Navy's 355-Ship Plan

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]

[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.

New Force-Level Goal Being Developed

The Navy and the Department of Defense (DOD) since 2019 have been working to develop a new Navy force-level goal to replace the above-mentioned 355-ship force-level goal. Remarks from Navy and DOD officials since 2019 indicate that this new Navy force-level goal will introduce a once-in-a-generation change in fleet architecture, meaning basic the types of ships that make up the Navy and how these ships are used in combination with one another to perform Navy missions. This new fleet architecture is expected to be more distributed than the fleet architecture reflected in the 355-ship goal or previous Navy force-level goals. In particular, the new fleet architecture is expected to feature

- a smaller proportion of larger ships (such as large-deck aircraft carriers, cruisers, destroyers, large amphibious ships, and large resupply ships);
- a larger proportion of smaller ships (such as frigates, corvettes, smaller amphibious ships, smaller resupply ships, and perhaps smaller aircraft carriers); and
- a new third tier of surface vessels about as large as corvettes or large patrol craft that will be either lightly manned, optionally manned, or unmanned, as well as large unmanned underwater vehicles (UUVs).

Navy and DOD leaders believe that shifting to a more distributed fleet architecture is

- **operationally necessary**, to respond effectively to the improving maritime anti-access/area-denial (A2/AD) capabilities of other countries, particularly China;[3]
- **technically feasible** as a result of advances in technologies for UVs and for networking widely distributed maritime forces that include significant numbers of UVs; and
- **affordable**—no more expensive, and possibly less expensive, than the current fleet architecture for a given amount of overall navy capability, so as to fit within expected future Navy budgets.[4]

[3] See, for example, David B. Larter, "With China Gunning for Aircraft Carriers, US Navy Says It Must Change How It Fights," *Defense News*, December 6, 2019; Arthur H. Barber, "Redesign the Fleet," *U.S. Naval Institute Proceedings*, January 2019. Some observers have long urged the Navy to shift to a more distributed fleet architecture, on the grounds that the Navy's current architecture—which concentrates much of the fleet's capability into a relatively limited number of individually larger and more expensive surface ships—is increasingly vulnerable to attack by the improving A2/AD capabilities (particularly anti-ship missiles and their supporting detection and targeting systems) of potential adversaries, particularly China. Shifting to a more distributed architecture, these observers have argued, would

- complicate an adversary's targeting challenge by presenting the adversary with a larger number of Navy units to detect, identify, and track;
- reduce the loss in aggregate Navy capability that would result from the destruction of an individual Navy platform;
- give U.S. leaders the option of deploying USVs and UUVs in wartime to sea locations that would be tactically advantageous but too risky for manned ships; and
- increase the modularity and reconfigurability of the fleet for adapting to changing mission needs.

For more on China's maritime A2/AD capabilities, see CRS Report RL33153, *China Naval Modernization: Implications for U.S. Navy Capabilities—Background and Issues for Congress*, by Ronald O'Rourke.

[4] For additional discussion about shifting the Navy to a more distributed architecture, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

December 9, 2020, Document Presented Potential New Force-Level Goal

On December 9, 2020, the Trump Administration released a long-range Navy shipbuilding document that called for a Navy with a more distributed fleet architecture, including 382 to 446 manned ships and 143 to 242 large surface and underwater unmanned vehicles (UVs). Within the total of 382 to 446 manned ships is a requirement for 60 to 67 SSCs.[5]

June 17, 2021, Document Presents Potential New Force-Level Goal

On June 17, 2021, the Biden Administration released a long-range Navy shipbuilding document that can calls for a Navy with a more distributed fleet architecture, including 321 to 372 manned ships and 77 to 140 large surface and underwater (UVs). Within the total of 321 to 372 manned ships is a requirement for 40 to 45 SSCs.[6]

Comparison of Surface Combatant Force-Level Goals

Table 1 compares the current force-level goals for surface combatants (i.e., LSCs, SSCs, and large and medium unmanned surface vehicles [LUSVs] and [MUSVs]) within the 355-ship plan to the potential force-level goals for surface combatants in the June 17, 2021, and December 9, 2020, long-range Navy shipbuilding documents.[7]

Table 1. Current and Potential Surface Combatant Force-Level Goals

	Current force-level goal within 355-ship plan	December 9, 2020, shipbuilding document	June 17, 2021, shipbuilding document
Large surface combatants (LSCs—cruisers and destroyers)	**104**	**73 to 88**	**63 to 65**
Small surface combatants (SSCs—frigates and Littoral Combat Ships)	**52**	**60 to 67**	**40 to 45**
Subtotal: LSCs and SSCs	***156***	***133 to 155***	***103 to 110***
Large and Medium Unmanned Surface Vehicles (LUSVs and MUSVs)	0	119 to 166	59 to 89

Source: Table prepared by CRS based on U.S. Navy data.

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

[5] For more on the December 9, 2020, long-range Navy shipbuilding document, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

[6] For more on the June 17, 2021, long-range Navy shipbuilding, document, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

[7] For more on the Navy's LCS programs, see CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke, and CRS In Focus IF11679, *Navy DDG(X) Next-Generation Destroyer Program: Background and Issues for Congress*, by Ronald O'Rourke. For more on the LUSV and MUSV programs, see CRS Report R45757, *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress*, by Ronald O'Rourke.

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.[8]

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.[9]) 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.

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/.

[8] 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.

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

FFG-62 Class Program

Program Name

The FFG-62 program was previously known as the FFG(X) program.[10] On October 7, 2020, the Navy announced that FFG-62 would be named *Constellation*, in honor of the first U.S. Navy 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.

Ship Capabilities and Crewing

FFG-62s 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) area, 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.[11] The Navy plans to operate the first few FFG-62s, however, with single crews.[12]

Figure 2 and **Figure 3** show renderings of the FFG-62 design, which 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 the French navy.

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.

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[10] 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. 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.

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

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

Figure 2. Constellation (FFG-62) Class Frigate

Artist's rendering of F/MM design

Source: Cropped version of photograph accompanying PEO USC Public Affairs, "US Navy Awards Guided Missile Frigate (FFG(X)) Contract," *Navy News Service*, April 30, 2020.

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.

Annual Procurement Quantities

Table 2 compares projected annual procurement quantities for the FFG-62 program under the Navy's FY2020, FY2021, and FY2022 budget submissions and the Trump Administration's December 9, 2020, shipbuilding document.

Table 2. Annual FFG-62 Procurement Quantities

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

Source: Table prepared by CRS based on Navy's FY2020 and FY2021 budget submissions and Trump Administration December 9, 2020, shipbuilding document.

Note: N/a means not available.

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), and the second FFG-62 in FY2021 at a cost of $1,053.1 million (i.e., about $1.1 billion). The Navy's proposed FY2022 budget requests $1,087.9 million (i.e., about $1.1 billion) for the procurement of the third FFG-62. 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.)

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. The Navy has not, however, ruled out the option of building the ships at two or three shipyards at the same time. The annual procurement quantities of three and four ships per year that are shown in **Table 2** under the Trump Administration's December 9, 2020, shipbuilding document would be executed by two shipyards.[13]

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.[14] The parent-design approach has also been used in the past for other Navy

[13] 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.)

[14] 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[15] and the Coast Guard's new Fast Response Cutters (FRCs).[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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[15] The Navy's Osprey (MCM-51) class mine warfare ships are an enlarged version of the Italian Lerici-class mine warfare ships.

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

[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 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)

U.S. Content Requirements for Components

As part of its action on the Navy's FY2020 and FY2021 budgets, 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 8113(b) of the FY2020 DOD Appropriations Act (Division A of H.R. 1158/P.L. 116-93 of December 20, 2019) states

> SEC. 8113….
>
> (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.

Section 8113(b) of the FY2021 DOD Appropriations Act (Division C of H.R. 133/P.L. 116-260 of December 27, 2020), the Consolidated Appropriations Act, 2021) states:

> SEC. 8113….
>
> (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 incorporate 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.

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:

> … *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 after the lead ship (if none of the nine option ships are exercised), after the 10th ship (if all nine of the option ships are exercised), or somewhere in between (if some but not all of the nine option ships are exercised). As a means of reducing their procurement cost, the Navy might at some point convert the DD&C contract into a multiyear contract known as a block buy contract to procure the ships.[18]

Issues for Congress

Future SSC Force-Level Goal

One issue for Congress concerns the future SSC force-level goal. In connection with this issue, one potential oversight question for Congress concerns the difference between the emerging Navy force-level goals for SSCs and other surface combatants in the Biden Administration's June 17, 2021, long-range Navy shipbuilding document and the emerging force-level goals for SSCs and other surface combatants in the Trump Administration's December 9, 2020, long-range Navy shipbuilding document. Using the figures shown in **Table 1**, the Trump Administration's emerging force-levels goals for surface combatants include about 22%-35% more large surface combatants, about 49%-50% more small surface combatants, about 29%-41% more large and small surface combatants combined, and about 87%-102% more unmanned surface vehicles than the Biden Administration's emerging force-level goals for surface combatants. A potential oversight question is to what degree these differences between the two sets of emerging force-level goals for surface combatants are due to differences between the two Administrations regarding one or more of the following factors:

- U.S. national security strategy and U.S. national defense strategy;
- projections of future capabilities of potential adversaries such as China and Russia;

[18] 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.

- consequent requirements, from the two factors above, for day-to-day forward-deployed Navy capacity and capability and Navy warfighting capacity and capability;
- assumptions about the capabilities of future U.S. Navy manned and unmanned ships;
- Navy homeporting arrangements and operational cycles;
- projections about future Navy budgets, including future Navy shipbuilding budgets; and
- the degree of operational risk deemed acceptable regarding the ability of the Navy to successfully perform its various day-to-day and warfighting missions.

Accuracy of Navy's Estimated Unit Procurement Cost

Overview

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)[19] and the Government Accountability Office (GAO),[20] lead ships in Navy shipbuilding programs in many cases have turned out to be more expensive to build than the Navy had estimated.

14% Increase in Estimated Cost of Frigate to Be Procured in FY2022

In the Navy's FY2021 budget submission, the FFG-62 class ship to be procured in FY2022 (i.e., the third ship in the program) had an estimated procurement cost of $954.5 million. In the Navy's FY2022 budget submission, the ship has an estimated procurement cost of $1,087.9 million—an increase of $133.4 million, or 14.0%, over the figure in the Navy's FY2021 budget submission.

Of the $133.4 million increase, the Navy states that $85 million is for preparation and equipment procurement for a land-based engineering site (LBES) for testing and verifying the ship's propulsion train, and $11 million is for developing options for a second source strategy (i.e., a strategy for adding a second shipyard for building FFG-62s) using the Navy's FFG-62 technical data package.[21] Although the Navy decided to incorporate these costs into the estimated procurement cost of the third ship in the program, they are not specific to the cost of building that ship. Subtracting out these costs, the increase in the estimated procurement cost of the third ship in the program becomes $37.4 million, or 3.9%.

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

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

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

[21] Source: Navy FY2022 FFG-62 program briefing for CRS and CBO, July 15, 2021.

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-62a could cost 17% to 56% more than the estimate for those ships shown in the Navy's FY2021 budget submission.

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,[22] 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.[23]

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).[24]

Put another way, FFG-62s have

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

[23] 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.

[24] 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 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
- 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.[25]

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.[26] 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.

[25] 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.

[26] 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)

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.

• 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.[27]

Potential Oversight Questions

Potential oversight questions for Congress include the following:

- What caused the estimated cost of the FFG-62 class ship to be procured in FY2022 to increase 14% from the Navy's FY2021 budget submission to its FY2022 budget submission?
- 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

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

MYP contract.[28] 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 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?[29]
- 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?

Potential Impact of COVID-19 Situation

Another issue for Congress concerns the potential impact of the COVID-19 situation on the execution of U.S. military shipbuilding programs, including the FFG-62 program. A May 1, 2020, press report stated that James Geurts, then-Assistant Secretary of the Navy for Research Development, and Acquisition (i.e., the Navy's acquisition executive),

[28] 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.

[29] 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.

> said he does not expect the COVID-19 pandemic to affect the newly awarded FFG(X) frigate program to Fincantieri's Marinette Marine. "I don't expect it to slow down the program…knowing what I know about COVID and the impact. You know the first year or two of this will be in detail design, engineering level work. We've proven across all our shipyards an ability to keep a high percentage of design work going on schedule and high percentage of the workforce on track there." He said that unlike how the industrial operations are being affected in some shipyards this level of design work should not be sensitive to the pandemic. "I don't see that as a risk to this program because of the phasing that industrial operations and construction won't start for a little while, another two years down the road," he added.[30]

For additional discussion of the potential impact of the COVID-19 situation on the execution of U.S. military shipbuilding programs, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

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 or three shipyards. The Navy's FFG-7s, which were procured at annual rates of as high as eight ships per year, were built at three shipyards.

In considering whether to build FFG-62s at a single shipyard (the Navy's baseline plan), or at two or three 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 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).[31]

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.

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[30] Item entitled "FFG(X) COVID" within DDN Staff, "Defense Watch: COVID Delays, DDG-1002, SASC Hearings, OPC," *Defense Daily*, May 1, 2020.

[31] 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.

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.[32]

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,[33] 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,[34] and provide a hedge against the possibility that Navy plans to field VLS tubes on Large Unmanned Surface Vehicles (LUSVs)[35] 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 the Navy is moving ahead with its plan to deploy 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

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

[33] 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.

[34] 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.

[35] 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.

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.
>
> 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.[36]

Compared to an FFG-62 follow-on ship unit procurement cost of about $900 million, the above estimated increase of $16 million to $24 million would equate to an increase in unit procurement cost of about 1.8% to about 2.7%.

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,[37] 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.

[36] 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.

[37] 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.

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

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.
>
> **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.[38]

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

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

> 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.[39]

As discussed in another CRS report,[40] 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."[41]

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).

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.

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[39] 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.

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

[41] 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.

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.[42]

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 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.[43]

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

[42] 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.

[43] 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.

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.[44]

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.[45]

Legislative Activity for FY2022

Summary of Congressional Action on FY2022 Funding Request

Table 3 summarizes congressional action on the Navy's FY2022 funding request for the LCS program.

Table 3. Congressional Action on FY2022 Procurement Funding Request

Millions of dollars, rounded to nearest tenth.

		Authorization			Appropriation		
	Request	**HASC**	**SASC**	**Conf.**	**HAC**	**SAC**	**Conf.**
Procurement	1,087.9				1,087.9		
Advance procurement (AP)	69.1				69.1		
(Procurement quantity)	*(1)*				*(1)*		

Source: Table prepared by CRS based on FY2022 Navy budget submission, committee and conference reports, and explanatory statements on the FY2022 National Defense Authorization Act and the FY2022 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; **Conf.** is conference agreement.

[44] 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.

[45] 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.

FY2022 DOD Appropriations Bill (H.R. 4432)

House

The House Appropriations Committee, in its report (H.Rept. 117-88 of July 15, 2021) on H.R. 4432, recommended the funding level shown in the HAC column of **Table 3**.

Section 8103(b) of H.R. 4432 as reported by the committee 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.

Author Information

Ronald O'Rourke
Specialist in Naval Affairs

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