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Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress

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Summary

The aircraft carriers CVN-78, CVN-79, CVN-80, and CVN-81 are the first four ships in the Navy's new *Gerald R. Ford* (CVN-78) class of nuclear-powered aircraft carriers (CVNs). The Navy's proposed FY2021 budget requests $2,714.1 million (i.e., about $2.7 billion) in procurement funding for CVN-78 class ships, including $71.0 million for CVN-78, $997.5 million for CVN-80, and $1,645.6 million for CVN-81.

CVN-78 (*Gerald R. Ford*) was procured in FY2008. The Navy's proposed FY2021 budget estimates the ship's procurement cost at $13,316.5 million (i.e., about $13.3 billion) in then-year dollars. The ship was commissioned into service on July 22, 2017. The Navy is currently working to complete construction, testing, and certification of the ship's 11 weapons elevators and to correct other technical problems aboard the ship.

CVN-79 (*John F. Kennedy*) was procured in FY2013. The Navy's proposed FY2021 budget estimates the ship's procurement cost at $11,397.7 million (i.e., about $11.4 billion) in then-year dollars. The ship is being built with an improved process that incorporates lessons learned from the construction of CVN-78. CVN-79 is scheduled for delivery to the Navy in September 2024.

CVN-80 (*Enterprise*) was procured in FY2018. The Navy's proposed FY2021 budget estimates the ship's procurement cost at $12,321.3 million (i.e., about $12.3 billion) in then-year dollars. The ship is scheduled for delivery to the Navy in March 2028.

CVN-81 (*Doris Miller*) is treated in this report as a ship that was procured in FY2019, consistent with congressional action on the Navy's FY2019 budget. The Navy's FY2021 budget submission shows CVN-81 as a ship that was procured in FY2020. The Navy's FY2021 budget submission estimates the ship's procurement cost at $12,450.7 million (i.e., about $12.5 billion) in then-year dollars. The ship is scheduled for delivery to the Navy in February 2032.

CVN-80 and CVN-81 are being procured under a two-ship block buy contract that was authorized by Section 121(a)(2) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (H.R. 5515/P.L. 115-232 of August 13, 2018). The use of the two-ship block buy contract reduced the combined estimated procurement cost of the two ships.

Oversight issues for Congress for the CVN-78 program include the following:

- the potential impact of the COVID-19 (coronavirus) situation on the execution of U.S. military shipbuilding programs, including the CVN-78 program;
- a delay in CVN-78's first deployment due to the need to complete work on the ship's weapons elevators and correct other technical problems aboard the ship;
- whether the Navy in its FY2020 budget request has accurately priced the work on the CVN-78 program that it is proposing to fund in FY2021;
- cost growth in the CVN-78 program, Navy efforts to stem that growth, and Navy efforts to manage costs so as to stay within the program's cost caps;
- additional CVN-78 program issues that were raised in a December 2019 report from the Department of Defense's (DOD's) Director of Operational Test and Evaluation (DOT&E) and a May 2019 Government Accountability Office (GAO) report on DOD weapon systems;
- whether the aircraft carrier to be procured after CVN-81 should be a Ford-class carrier (i.e., a large-deck, nuclear-powered carrier) or a smaller and perhaps nonnuclear-powered aircraft carrier.

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Introduction

This report provides background information and potential oversight issues for Congress on the *Gerald R. Ford* (CVN-78) class nuclear-powered aircraft carrier (CVN) aircraft carrier program. The Navy's proposed FY2021 budget requests $2,714.2 million (i.e., about $2.7 billion) in procurement funding for the program. Congress's decisions on the CVN-78 program could substantially affect Navy capabilities and funding requirements and the shipbuilding industrial base.

For an overview of the strategic and budgetary context in which the CVN-78 class program and other Navy shipbuilding programs may be considered, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.[1]

Background

Current Navy Aircraft Carrier Force

The Navy's current aircraft carrier force consists of 11 CVNs,[2] including 10 Nimitz-class ships (CVNs 68 through 77) that entered service between 1975 and 2009, and one Gerald R. Ford (CVN-78) class ship that was commissioned into service on July 22, 2017.[3]

Statutory Requirements for Numbers of Carriers and Carrier Air Wings

Requirement to Maintain Not Less Than 11 Carriers

10 U.S.C. 8062(b) requires the Navy to maintain a force of not less than 11 operational aircraft carriers.[4] The requirement for the Navy to maintain not less than a certain number of operational aircraft carriers was established by Section 126 of the FY2006 National Defense Authorization Act (H.R. 1815/P.L. 109-163 of January 6, 2006), which set the number at 12 carriers. The requirement was changed from 12 carriers to 11 carriers by Section 1011(a) of the FY2007 John Warner National Defense Authorization Act (H.R. 5122/P.L. 109-364 of October 17, 2006).[5]

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[1] See also CRS Report R43838, *Renewed Great Power Competition: Implications for Defense—Issues for Congress*, by Ronald O'Rourke, and CRS Report R44891, *U.S. Role in the World: Background and Issues for Congress*, by Ronald O'Rourke and Michael Moodie.

[2] The Navy's last remaining conventionally powered carrier (CV), *Kitty Hawk* (CV-63), was decommissioned on January 31, 2009.

[3] The commissioning into service of CVN-78 on July 22, 2017, ended a period during which the carrier force had declined to 10 ships—a period that began on December 1, 2012, with the inactivation of the one-of-a-kind nuclear-powered aircraft carrier *Enterprise* (CVN-65), a ship that entered service in 1961.

[4] 10 U.S.C. 8062 was previously numbered as 10 U.S.C. 5062. It was renumbered as 10 U.S.C. 8062 by Section 807 of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (H.R. 5515/P.L. 115-232 of August 13, 2018), which directed a renumbering of sections and titles of Title 10 relating to the Navy and Marine Corps. (Sections 806 and 808 of P.L. 115-232 directed a similar renumbering of sections and titles relating to the Air Force and Army, respectively.)

[5] As mentioned in footnote 3, the carrier force dropped from 11 ships to 10 ships between December 1, 2017, when *Enterprise* (CVN-65) was inactivated, and July 22, 2017, when CVN-78 was commissioned into service. Anticipating the gap between the inactivation of CVN-65 and the commissioning of CVN-78, the Navy asked Congress for a

Requirement to Maintain a Minimum of Nine Carrier Air Wings

10 U.S.C. 8062(e), which was added by Section 1042 of the FY2017 National Defense Authorization Act (S. 2943/P.L. 114-328 of December 23, 2016), requires the Navy to maintain a minimum of nine carrier air wings.[6]

Navy Force-Level Goal of 12 Carriers

12-Carrier Goal Established December 2016

In December 2016, the Navy released a force-level goal for achieving and maintaining a fleet of 355 ships, including 12 aircraft carriers[7]—one more than the minimum of 11 carriers required by 10 U.S.C. 8062(b).

Planned and Potential Dates for Achieving 12-Carrier Force

Given the time needed to build a carrier and the projected retirement dates of existing carriers, increasing the carrier force from 11 ships to 12 ships on a sustained basis would take a number of years.[8] Under the Navy's FY2020 30-year shipbuilding plan, carrier procurement would shift from 5-year centers (i.e., one carrier procured each five years) to 4-year centers after the procurement of CVN-82 in FY2028, and a 12-carrier force would be achieved on a sustained basis in the 2060s.[9]

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temporary waiver of 10 U.S.C. 8062(b) to accommodate the period between the two events. Section 1023 of the FY2010 National Defense Authorization Act (H.R. 2647/P.L. 111-84 of October 28, 2009) authorized the waiver, permitting the Navy to have 10 operational carriers between the inactivation of CVN-65 and the commissioning of CVN-78.

[6] 10 U.S.C. 8062(e) states the following:

> The Secretary of the Navy shall ensure that-
>
> (1) the Navy maintains a minimum of 9 carrier air wings until the earlier of-
>
> (A) the date on which additional operationally deployable aircraft carriers can fully support a 10th carrier air wing; or
>
> (B) October 1, 2025;
>
> (2) after the earlier of the two dates referred to in subparagraphs (A) and (B) of paragraph (1), the Navy maintains a minimum of 10 carrier air wings; and
>
> (3) for each such carrier air wing, the Navy maintains a dedicated and fully staffed headquarters.

[7] For more on the 355-ship force-level goal, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

[8] Procuring carriers on 3-year centers would achieve a 12-carrier force on a sustained basis by about 2030, unless the service lives of one or more existing carriers were substantially extended. Procuring carriers on 3.5-year centers (i.e., a combination of 3- and 4-year centers) would achieve a 12-carrier force on a sustained basis no earlier than about 2034, unless the service lives of one or more existing carriers were substantially extended. Procuring carriers on 4-year centers would achieve a 12-carrier force on a sustained basis by about 2063—almost 30 years later than under 3.5-year centers—unless the service lives of one or more existing carriers were substantially extended. (Source for 2063 date in relation to four-year centers: Congressional Budget Office (CBO), in a telephone consultation with CRS on May 18, 2017.)

[9] The projected size of the carrier force in the Navy's FY2020 30-year (FY2020-FY2049) shipbuilding plan reflected the Navy's now-withdrawn FY2020 budget proposal to not fund the RCOH for the aircraft carrier CVN-75 (Harry S. Truman), and to instead retire the ship around FY2024. With the withdrawal of this budget proposal, the projected size of the carrier force became, for the period FY2022-FY2047, one ship higher than what is shown in the Navy's FY2020 budget submission. The newly adjusted force-level projection, reflecting the withdrawal of the proposal to retire CVN-75 around FY2024, were as follows: The force is projected to include 11 ships in FY2020-FY2021, 12 ships in

April 2020 Press Report of DOD Assessment on Revised Navy Force-Level Goal

An April 20, 2020, press report stated:

> An internal Office of the Secretary of Defense assessment calls for the Navy to cut two aircraft carriers from its fleet, freeze the large surface combatant fleet of destroyers and cruisers around current levels and add dozens of unmanned or lightly manned ships to the inventory, according to documents obtained by Defense News.
>
> The study calls for a fleet of nine carriers, down from the current fleet of 11, and for 65 unmanned or lightly manned surface vessels. The study calls for a surface force of between 80 and 90 large surface combatants, and an increase in the number of small surface combatants—between 55 and 70, which is substantially more than the Navy currently operates.
>
> The assessment is part of an ongoing DoD-wide review of Navy force structure and seem to echo what Defense Secretary Mark Esper has been saying for months: the Defense Department wants to begin de-emphasizing aircraft carriers as the centerpiece of the Navy's force projection and put more emphasis on unmanned technologies that can be more easily sacrificed in a conflict and can achieve their missions more affordably….
>
> There are about 90 cruisers and destroyers in the fleet: the study recommended retaining at least 80 but keeping about as many as the Navy currently operates at the high end.
>
> The Navy's small surface combatant program is essentially the 20 littoral combat ships in commission today, with another 15 under contract, as well as the 20 next-generation frigates, which would get to the minimum number in the assessment of 55 small combatants, with the additional 15 presumably being more frigates.[10]

Incremental Funding Authority for Aircraft Carriers

In recent years, Congress has authorized DOD to use incremental funding for procuring certain Navy ships, most notably aircraft carriers.[11] Under incremental funding, some of the funding

FY2022-FY2024, 11 ships in FY2025-FY2026, 10 ships in FY2027, 11 ships in FY2028-FY2039, 10 ships in FY2040, 11 ships in FY2041, 10 ships in FY2042-FY2044, 11 ships in FY2045, 10 ships in FY2046-FY2047, 9 ships in FY2048, and 10 ships in FY2049.

[10] David B. Larter, "Defense Department Study Calls for Cutting 2 of the US Navy's Aircraft Carriers," *Defense News*, April 20, 2020.

[11] The provisions providing authority for using incremental funding for procuring CVN-78 class carriers are as follows:

Section 121 of the FY2007 John Warner National Defense Authorization Act (H.R. 5122/P.L. 109-364 of October 17, 2006) granted the Navy the authority to use four-year incremental funding for CVNs 78, 79, and 80. Under this authority, the Navy could fully fund each of these ships over a four-year period that includes the ship's year of procurement and three subsequent years.

Section 124 of the FY2012 National Defense Authorization Act (H.R. 1540/P.L. 112-81 of December 31, 2011) amended Section 121 of P.L. 109-364 to grant the Navy the authority to use five-year incremental funding for CVNs 78, 79, and 80. Since CVN-78 was fully funded in FY2008-FY2011, the provision in practice originally applied to CVNs 79 and 80, although as discussed in the footnote to **Table 1**, the Navy made use of the authority in connection with an FY2020 reprogramming action that reprogrammed $86.0 million of funding into FY2012 for CVN-78.

Section 121 of the FY2013 National Defense Authorization Act (H.R. 4310/P.L. 112-239 of January 2, 2013) amended Section 121 of P.L. 109-364 to grant the Navy the authority to use six-year incremental funding for CVNs 78, 79, and 80. Since CVN-78 was fully funded in FY2008-FY2011, the provision in practice applies to CVNs 79 and 80.

Section 121(c) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (H.R. 5515/P.L. 115-232 of August 13, 2018) authorized incremental funding to be used for making payments under the two-ship block buy

needed to fully fund a ship is provided in one or more years after the year in which the ship is procured.[12]

Aircraft Carrier Construction Industrial Base

All U.S. aircraft carriers procured since FY1958 have been built by Huntington Ingalls Industries/Newport News Shipbuilding (HII/NNS), of Newport News, VA. HII/NNS is the only U.S. shipyard that can build large-deck, nuclear-powered aircraft carriers. The aircraft carrier construction industrial base also includes roughly 2,000 supplier firms in 46 states.[13]

Gerald R. Ford (CVN-78) Class Program

Overview

The *Gerald R. Ford* (CVN-78) class carrier design (**Figure 1**) is the successor to the *Nimitz*-class carrier design. The *Ford*-class design uses the basic *Nimitz*-class hull form but incorporates several improvements, including features permitting the ship to generate more aircraft sorties per day, more electrical power for supporting ship systems, and features permitting the ship to be operated by several hundred fewer sailors than a *Nimitz*-class ship, reducing 50-year life-cycle operating and support (O&S) costs for each ship by about $4 billion compared to the *Nimitz*-class design, the Navy estimates. Navy plans call for procuring at least four Ford-class carriers—CVN-78, CVN-79, CVN-80, and CVN-81.

CVN-78 (Gerald R. Ford)

CVN-78, which was named *Gerald R. Ford* in 2007,[14] was procured in FY2008. The Navy's proposed FY2021 budget estimates the ship's procurement cost at $13,316.5 million (i.e., about $13.3 billion) in then-year dollars. The ship was commissioned into service on July 22, 2017. The Navy is currently working to complete construction, testing, and certification of the ship's 11 weapons elevators and to correct other technical problems aboard the ship.

CVN-79 (John F. Kennedy)

CVN-79, which was named *John F. Kennedy* on May 29, 2011,[15] was procured in FY2013. The Navy's proposed FY2021 budget estimates the ship's procurement cost at $11,397.7 million (i.e.,

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contract for the construction of CVN-80 and CVN-81. This provision does not limit the total number of years across which incremental funding may be used to procure either ship.

[12] For more on full funding and incremental funding, see CRS Report RL31404, *Defense Procurement: Full Funding Policy—Background, Issues, and Options for Congress*, by Ronald O'Rourke and Stephen Daggett, and CRS Report RL32776, *Navy Ship Procurement: Alternative Funding Approaches—Background and Options for Congress*, by Ronald O'Rourke.

[13] Source for figures of 2,000 supplier firms in 46 states: Jennifer Boykin, president of HII/NNS, as quoted in Marcus Weisgerber, "US Navy Places First 2-Carrier Order in Three Decades," *Defense One*, January 31, 2019.

[14] §1012 of the FY2007 defense authorization act (H.R. 5122/P.L. 109-364 of October 17, 2006) expressed the sense of Congress that CVN-78 should be named for President Gerald R. Ford. On January 16, 2007, the Navy announced that CVN-78 would be so named. CVN-78 and other carriers built to the same design are consequently referred to as Ford (CVN-78) class carriers. For more on Navy ship names, see CRS Report RS22478, *Navy Ship Names: Background for Congress*, by Ronald O'Rourke.

[15] See "Navy Names Next Aircraft Carrier USS John F. Kennedy," *Navy News Service*, May 29, 2011, accessed online on June 1, 2011, at http://www.navy.mil/search/display.asp?story_id=60686. See also Peter Frost, "U.S. Navy's Next

about $11.4 billion) in then-year dollars. The ship is being built with an improved shipyard fabrication and assembly process that incorporates lessons learned from the construction of CVN-78. The ship is scheduled for delivery to the Navy in September 2024.

Figure 1. USS *Gerald R. Ford* (CVN-78)

Source: Navy photograph dated April 8, 2017, accessed October 3, 2017, at http://www.navy.mil/view_image.asp?id=234835.

CVN-80 (Enterprise)

CVN-80, which was named *Enterprise* on December 1, 2012,[16] was procured in FY2018. The Navy's proposed FY2021 budget estimates the ship's procurement cost at $12,335.1 million (i.e., about $12.3 billion) in then-year dollars. The Navy's proposed FY2021 budget estimates the ship's procurement cost at $12,321.3 million (i.e., about $12.3 billion) in then-year dollars. The ship is scheduled for delivery to the Navy in March 2028.

Aircraft Carrier Will Be Named After The Late John F. Kennedy," *Newport News Daily Press*, May 30, 2011. CVN-79 is the second ship to be named for President John F. Kennedy. The first, CV-67, was the last conventionally powered carrier procured for the Navy. CV-67 was procured in FY1963, entered service in 1968, and was decommissioned in 2007.

[16] The Navy made the announcement of CVN-80's name on the same day that it deactivated the 51-year-old aircraft carrier CVN-65, also named *Enterprise*. ("Enterprise, Navy's First Nuclear-Powered Aircraft Carrier, Inactivated," *Navy News Service*, December 1, 2012; Hugh Lessig, "Navy Retires One Enterprise, Will Welcome Another," *Newport News Daily Press*, December 2, 2012.) CVN-65 was the eighth Navy ship named *Enterprise*; CVN-80 is to be the ninth.

CVN-81 (Doris Miller)

CVN-81 was named *Doris Miller* on January 20, 2020, for an African American enlisted sailor who received the Navy Cross for his actions during the Japanese attack on Pearl Harbor on December 7, 1941.[17] CVN-81 is treated in this report as a ship that was procured in FY2019, consistent with congressional action on the Navy's FY2019 budget. The Navy's FY2021 budget submission shows CVN-81 as a ship that was procured in FY2020.[18] Prior to the awarding of the two-ship block buy contract for CVN-80 and CVN-81 that is discussed in the next section, CVN-81 was scheduled to be procured in FY2023. The Navy's FY2021 budget submission estimates CVN-81's procurement cost at $12,450.7 million (i.e., about $12.5 billion) in then-year dollars. The ship is scheduled for delivery to the Navy in February 2032.

Two-Ship Block Buy Contract for CVN-80 and CVN-81

CVN-80 and CVN-81 are being procured under a two-ship block buy contract that was authorized by Section 121(a)(2) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (H.R. 5515/P.L. 115-232 of August 13, 2018). The provision permitted the Navy to add CVN-81 to the existing contract for building CVN-80 after the Department of Defense (DOD) made certain certifications to Congress. DOD made the certifications on December 31, 2018, and the Navy announced the award of the contract on January 31, 2019.

Compared to the estimated procurement costs for CVN-80 and CVN-81 in the Navy's FY2019 budget submission, the Navy estimated under its FY2020 budget submission that the two-ship block buy contract will reduce the cost of CVN-80 by $246.6 million and the cost of CVN-81 by $2,637.3 million, for a combined reduction of $2,883.9 million (i.e., about $2.9 billion).[19] (DOD characterized the combined reduction as "nearly $3 billion."[20]) Using higher estimated baseline costs for CVN-80 and CVN-81 taken from a December 2017 Navy business case analysis, the Navy estimated under its FY2020 budget submission that the two-ship contract will reduce the cost of CVN-80 by about $900 million and the cost of CVN-81 by about $3.1 billion, for a combined reduction of about $4.0 billion.[21] These figures are all expressed in then-year dollars, meaning dollars that are not adjusted for inflation. For additional background information on the two-ship block buy contract, see **Appendix A**.

Program Procurement Cost Cap

Congress has established and subsequently amended procurement cost caps for CVN-78 class aircraft carriers.[22]

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[17] For further discussion of the naming of CVN-81 for Doris Miller, see CRS Report RS22478, *Navy Ship Names: Background for Congress*, by Ronald O'Rourke.

[18] For additional discussion of CVN-81's year of procurement, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

[19] Source: CRS calculation based on costs for single-ship purchases as presented in Navy's FY2019 budget submission and costs for two-ship purchase as presented in the Navy's FY2020 budget submission.

[20] Source: Navy information paper on estimated cost savings of two-ship carrier buy provided to CRS by Navy Office of Legislative Affairs on June 20, 2019.

[21] Navy information paper provided to CRS by Navy Office of legislative Affairs on June 20, 2019.

[22] The provisions that established and later amended the cost caps are as follows:

Section 122 of the FY2007 John Warner National Defense Authorization Act (H.R. 5122/P.L. 109-364 of October 17, 2006) established a procurement cost cap for CVN-78 of $10.5 billion, plus adjustments for inflation and other factors, and a procurement cost cap for subsequent Ford-class carriers of $8.1 billion each, plus adjustments for inflation and

Program Procurement Funding

Table 1 shows procurement funding for CVNs 78, 79, 80, and 81 through FY2028, the final year of funding programmed for CVN-81. As shown in the table, the Navy's proposed FY2021 budget requests $2,714.1 million (i.e., about $2.7 billion) in procurement funding for CVN-78 class ships, including $71.0 million for CVN-78, $997.5 million for CVN-80, and $1,645.6 million for CVN-81.

other factors. The conference report (H.Rept. 109-702 of September 29, 2006) on P.L. 109-364 discusses Section 122 on pages 551-552.

Section 121 of the FY2014 National Defense Authorization Act (H.R. 3304/P.L. 113-66 of December 26, 2013) amended the procurement cost cap for the CVN-78 program to provide a revised cap of $12,887.0 million for CVN-78 and a revised cap of $11,498.0 million for each follow-on ship in the program, plus adjustments for inflation and other factors (including an additional factor not included in original cost cap).

Section 122 of the FY2016 National Defense Authorization Act (S. 1356/P.L. 114-92 of November 25, 2015) further amended the cost cap for the CVN-78 program to provide a revised cap of $11,398.0 million for each follow-on ship in the program, plus adjustment for inflation and other factors, and with a new provision stating that, if during construction of CVN-79, the Chief of Naval Operations determines that measures required to complete the ship within the revised cost cap shall result in an unacceptable reduction to the ship's operational capability, the Secretary of the Navy may increase the CVN-79 cost cap by up to $100 million (i.e., to $11.498 billion). If such an action is taken, the Navy is to adhere to the notification requirements specified in the cost cap legislation.

Section 121(a) of the FY2018 National Defense Authorization Act (H.R. 2810/P.L. 115-91 of December 12, 2017) further amended the cost cap for the CVN-78 program to provide a revised cap of $12,568.0 million for CVN-80 and subsequent ships in the program, plus adjustment for inflation and other factors. (The cap for CVN-79 was kept at $11,398.0 million, plus adjustment for inflation and other factors.) The provision also amended the basis for adjusting the caps for inflation, and excluded certain costs from being counted against the caps.

Section 121 of the FY2020 National Defense Authorization Act (S. 1790/P.L. 116-92 of December 20, 2020) further amended the cost cap for the CVN-78 program to provide revised caps of $13,224. Million for CVN-78, $11,398.0 million for CVN–79, $12,202. Million for CVN–80, and $12,451.0 million for CVN–81. The provision directs the Navy to exclude from these figures costs for CVN–78 class battle spares, interim spares, and increases attributable to economic inflation after December 1, 2018.

Table 1. Procurement Funding for CVNs 78, 79, 80, and 81 Through FY2028

(Millions of then-year dollars, rounded to nearest tenth)

FY	CVN-78	CVN-79	CVN-80	CVN-81	Total
FY01	21.7 (AP)	0	0	0	21.7
FY02	135.3 (AP)	0	0	0	135.3
FY03	395.5 (AP)	0	0	0	395.5
FY04	1,162.9 (AP)	0	0	0	1,162.9
FY05	623.1 (AP)	0	0	0	623.1
FY06	618.9 (AP)	0	0	0	618.9
FY07	735.8 (AP)	52.8 (AP)	0	0	788.6
FY08	2,685.0 (FF)	123.5 (AP)	0	0	2,808.5
FY09	2,687.0 (FF)	1,210.6 (AP)	0	0	3,895.2
FY10	851.3 (FF)	482.9 (AP)	0	0	1,334.2
FY11	1,848.1 (FF)	902.5 (AP)	0	0	2,677.7
FY12	86.0 (FF)**	554.8 (AP)	0	0	554.8
FY13	0	491.0 (FF)	0	0	491.0
FY14	588.1 (CC)	917.6 (FF)	0	0	1,505.7
FY15	663.0 (CC)	1,219.4 (FF)	0	0	1,882.4
FY16	123.8 (CC)	1,569.5 (FF)	862.4 (AP)	0	2,555.7
FY17	0	1,241.8 (FF)	1,370.8 (AP)	0	2,612.6
FY18	20.0 (CC)	2,557.4 (FF)	1,569.6 (FF)	0	4,147.0
FY19	0	0	930.2 (FF)	643.0 (FF)	1,573.2
FY20	0	0	1,062.0 (FF)	1,214.5 (FF)	2,276.5
FY21 (requested)	*71.0 (CC)*	*0*	*997.5 (FF)*	*1,645.6 (FF)*	*2,714.1*
FY22 (programmed)	*0*	*74.0 (CC)*	*1,014.1 (FF)*	*1,307.0 (FF)*	*2,395.1*
FY23 (programmed)	*0*	*0*	*1,166.1 (FF)*	*760.0 (FF)*	*1,926.1*
FY24 (programmed)	*0*	*0*	*1,047.9 (FF)*	*667.0 (FF)*	*1,714.9*
FY25 (programmed)	*0*	*0*	*2,300.6 (FF)*	*591.0 (FF)*	*2,891.6*
FY26 (projected)	*0*	*0*	*0*	*2,171.0 (FF)*	*2,171.0*
FY27 (projected)	*0*	*0*	*0*	*1,851.0 (FF)*	*1,851.0*
FY28 (projected)	*0*	*0*	*0*	*1,600.7 (FF)*	*1,600.7*
Total	**13,316.5**	**11,397.7**	**12,321.3**	**12,450.7**	**49,486.2**

Source: Table prepared by CRS based on Navy's FY2021 budget submission.

Notes: Figures may not add due to rounding. "AP" is advance procurement funding; "FF" is full funding; "CC" is cost-to-complete funding (i.e., funding to cover cost growth), which is sometimes abbreviated in Navy documents as CTC. The funding figures shown in the CVN-78 column reflect reprogramming under the FY2021 budget submission of $161.5 million of additional funding into FY2009, FY2011, and FY2012. Regarding the ** notation for the FY2012 funding figure for CVN-78, even though FY2012 is after FY2011 (CVN-78's original final year of full funding), the Navy characterizes the $86.0 million reprogrammed into FY2012 as full funding rather than cost-to-complete funding on the grounds that in the years since FY2011, as discussed earlier in this report (see footnote 11), the authority to use incremental funding for procuring aircraft carriers has been expanded by Congress to permit more than the four years of incremental funding that were permitted at the time that CVN-78 was initially funded.

Changes in Estimated Unit Procurement Costs Since FY2008 Budget

Table 2 shows changes in the estimated procurement costs of CVNs 78, 79, 80, and 81 since the budget submission for FY2008—the year of procurement for CVN-78.

Table 2. Changes in Estimated Procurement Costs of CVNs 78, 79, 80, and 81

(As shown in FY2008-FY2020 budgets, in millions of then-year dollars)

Budget	CVN-78		CVN-79		CVN-80		CVN-81	
	Est. proc. cost	Scheduled FY of proc.	Est. proc. cost	Scheduled FY of proc.	Est. proc. cost	Scheduled FY of proc.	Est. proc. cost	Scheduled FY of proc.
FY08	10,488.9	FY08	9,192.0	FY12	10,716.8	FY16	n/a	FY21
FY09	10,457.9	FY08	9,191.6	FY12	10,716.8	FY16	n/a	FY21
FY10	10,845.8	FY08	n/a	FY13	n/a	FY18	n/a	FY23
FY11	11,531.0	FY08	10,413.1	FY13	13,577.0	FY18	n/a	FY23
FY12	11,531.0	FY08	10,253.0	FY13	13,494.9	FY18	n/a	FY23
FY13	12,323.2	FY08	11,411.0	FY13	13,874.2	FY18	n/a	FY23
FY14	12,829.3	FY08	11,338.4	FY13	13,874.2	FY18	n/a	FY23
FY15	12,887.2	FY08	11,498.0	FY13	13,874.2	FY18	n/a	FY23
FY16	12,887.0	FY08	11,347.6	FY13	13,472.0	FY18	n/a	FY23
FY17	12,887.0	FY08	11,398.0	FY13	12,900.0	FY18	n/a	FY23
FY18	12,907.0	FY08	11,377.4	FY13	12,997.6	FY18	n/a	FY23
FY19	12,964.0	FY08	11,341.4	FY13	12,601.7	FY18	15,088.0	FY23
FY20	13,084.0	FY08	11,327.4	FY13	12,335.1	FY18	12,450.7	FY19
FY21	13,316.5	FY08	11,397.7	FY13	12,321.3	FY18	12,450.7	FY19
Annual % change								
FY08 to FY09	-0.3		0%		0%		n/a	
FY09 to FY10	+3.7		n/a		n/a		n/a	
FY10 to FY11	+6.3		n/a		n/a		n/a	
FY09 to FY11					+26.7%			
FY11 to FY12	0%		-1.5%		-0.1%		n/a	
FY12 to FY13	+6.9%		+11.3%		+2.8%		n/a	
FY13 to FY14	+4.1%		-0.6%		0%		n/a	
FY14 to FY15	+0.5%		+1.4%		0%		n/a	
FY15 to FY16	0%		-1.3%		-2.9%		n/a	
FY16 to FY17	0%		+0.4%		-4.2%		n/a	
FY17 to FY18	+0.2%		-0.2%		+0.7%		n/a	
FY18 to FY19	+0.4%		-0.3%		-3.0%		n/a	
FY19 to FY20	+0.9%		-0.1%		-2.1%		-17.5%	
FY20 to FY21	+1.8%		+0.6%		-0.1%		0%	
Cumulative % change through FY21								
Since FY08	+27.0%		+24.0%		+15.0%		n/a	
Since FY13	+8.1%		-0.1%		-11.2%		n/a	
Since FY18	+3.2%		+0.2%		-5.2%		n/a	
Since FY19	+2.7%		+0.5%		-2.2%		-17.5%	

Source: Table prepared by CRS based on FY2008-FY2020 Navy budget submissions. n/a means not available.

Notes: The FY2010 budget submission did not show estimated procurement costs or scheduled years of procurement for CVNs 79 and 80. The scheduled years of procurement for CVNs 79 and 80 shown here for the FY2010 budget submission are inferred from the shift to five-year intervals for procuring carriers that was announced by Secretary of Defense Gates in his April 6, 2009, news conference regarding recommendations for the FY2010 defense budget.

Issues for Congress for FY2021

Potential Impact of COVID-19 (Coronavirus) Situation

One issue for Congress concerns the potential impact of the COVID-19 (coronavirus) situation on the execution of U.S. military shipbuilding programs, including the CVN-78 program. For additional discussion of this issue, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

Delay in CVN-78's Deployment Due to Weapon Elevators and Other Problems

Overview

One oversight issue for Congress concerns a delay in CVN-78's first deployment due to the need to complete the construction, testing, and certification of the ship's weapons elevators and to correct other technical problems aboard the ship. Challenges in completing the construction, testing, and certification of CVN-78's weapon elevators were first reported in November 2018,[23] and the issue has been a matter of continuing oversight attention since then.

The ship's 11 weapons elevators—referred to as Advanced Weapons Elevators (AWEs)—move missiles and bombs from the ship's weapon magazines up to the ship's flight deck, so that they can be loaded onto aircraft that are getting ready to take off from the ship. A lack of working weapons elevators can substantially limit an aircraft carrier's ability to conduct combat operations. The Navy has struggled since November 2018 to meet promises it has repeatedly made to the defense oversight committees to get the elevators completed, tested, and certified. For much of 2019, the Navy continued to report that 2 of the 11 weapon elevators were completed, tested, and certified.[24] On October 23, 2019, the Navy reported that the figure had

[23] See Anthony Capaccio, "U.S. Navy's Costliest Carrier Was Delivered Without Elevators to Lift Bombs," *Bloomberg*, November 2, 2018.

[24] Sam LaGrone, "Carrier Ford Will Only Have Two Weapon Elevators Ready When it Leaves Shipyard," *USNI News*, October 9, 2019. See also Anthony Capaccio, "On Costliest U.S. Warship Ever, Navy Can't Get Munitions on Deck," *Bloomberg*, July 30, 2019. (The article was also published by *Bloomberg* with the title "Flawed Elevators on $13 Billion Carrier Miss Another Deadline.") Ben Werner, "Navy Says More Experts Coming to Work Ford Carrier Elevator Delays," *USNI News*, July 5, 2019; Navy Research, Development and Acquisition Public Affairs Office, "Navy Full Court Press on USS Gerald R. Ford Weapons Elevators," *Navy News Service*, July 1, 2019; Mark D. Faram, "The Navy's New Plan to Fix Ford's Elevators Failures," *Navy Times*, July 1, 2019; Paul McLeary, "Navy Calls In Outsiders To Fix Troubled Ford Carrier," *Breaking Defense*, July 1, 2019; Ben Werner and Sam LaGrone, "USS Gerald R. Ford Weapons Elevator Certifications Will Extend Pat October," USNI News, May 29, 2019. See also Paul McLeary, "Will Trump Fire SecNav? Super Carrier USS Ford Suffers New Setback," *Breaking Defense*, May 29, 2019; Rich Abott, "Ford Elevator Work Prioritized And Extending Past October," *Defense Daily*, June 3, 2019; Megan Eckstein, "Navy Building a Land-Based Test Site for Ford-Class Weapons Elevators, But Timing Won't Help CVN-78," *USNI News*, May 31, 2019.

For earlier press reports, see Anthony Capaccio, "U.S. Navy's Costliest Carrier Was Delivered Without Elevators to Lift Bombs," *Bloomberg*, November 2, 2018; Anthony Capaccio, "Flawed Bomb Elevators Leave Inhofe Leery of Buying Two Carriers," *Bloomberg*, December 5, 2019; Megan Eckstein, "SECNAV to Trump: Ford Carrier Weapons Elevators Will Be Fixed by Summer, or 'Fire Me,'" *USNI News*, January 8, 2019; USS Gerald R. Ford Public Affairs, "USS Gerald R. Ford Accepts First Advanced Weapons Elevator," *Navy News Service*, January 16, 2019; Christopher Woody, "The Navy's Newest Aircraft Carrier Got a Long-Missing Piece of Gear in December, Helping to Solve a Problem the Navy Secretary Has Bet His Job on Fixing," *Business Insider*, January 20, 2019; Richard Sisk, "Navy Finally Has One Weapons Elevator Working on Its Newest Carrier," *Military.com*, January 22, 2019; Mark D. Faram,

increased to 4 of 11.[25] On April 22, 2020, the Navy announced that the fifth elevator had been certified, that the sixth is scheduled to be certified in the fourth quarter of FY2020, and that the remaining five are scheduled to be certified by the time that the ship undergoes Full Ship Shock Trials (FSSTs) in the third quarter of FY2021.[26] The Navy states that lessons learned in building, testing, and certifying CVN-78's AWEs will be applied to the AWEs of subsequent CVN-78 class carriers.[27]

In addition to challenges in building, testing, and certifying the ship's weapon elevators, the Navy reportedly has been working to address problems with other systems on the ship, including its propulsion and electrical systems. Technical issues regarding the weapon elevators and other ship systems have delayed the ship's first deployment to 2022 at the earliest, which would be about five years after the ship was commissioned into service.[28] The delay in the ship's first deployment is lengthening a period during which the Navy is attempting to maintain policymaker-desired levels of carrier forward deployments with its 10 other carriers—a situation that can lead to operational strains on those 10 carriers and their crews.

In a December 6, 2019, memorandum, then-Acting Secretary of the Navy Thomas Modly stated that one of his five immediate objectives would be to "put all hands on deck to make [CVN-78] ready as a warship as soon as practically possible."[29] In a December 20, 2019, memorandum, Modly elaborated on this effort, stating that "With the successful completion of CVN 78's Post Shakedown Availability and subsequent Independent Steaming Events, finishing work [on the ship] and delivering this capability to the fleet as quickly and effectively as possible is one of my highest priorities." The memorandum established a series of specific tasks to be completed by certain dates, stated that "The Program Executive Office (PEO) Aircraft Carriers, RADM [Rear Admiral] Jim Downey, will be accountable for this Vector as supported activity," and stated that

"Once Beleaguered by Critics, the Ford Gets a Lift," *Navy Times*, January 23, 2019; USS Gerald R. Ford (CVN 78) Public Affairs, "USS Gerald R. Ford Accepts Second Advanced Weapons Elevator," *Navy News Service*, March 6, 2019; Mark D. Faram, "Why the Once-Maligned Flattop Ford Is Finally Getting a Lift (or 11)," *Navy Times*, March 7, 2019; Rich Abott, "Carrier Elevator Test Site Will Procure New Elevator, Ford Accepts Second Elevator," *Defense Daily*, March 7, 2019; Rich Abott, "Navy To Build Land-Based Carrier Elevator Test Site," *Defense Daily*, February 21, 2019.

[25] Wesley Morgan, "Navy Secretary Accuses Congressional Critics of 'Disinformation' on Ford Carrier," *Politico Pro*, October 23, 2019. See also Sam LaGrone, "Carrier Ford May Not Deploy Until 2024, 3rd Weapons Elevator Certified," *USNI News*, October 22, 2019; Anthony Capaccio, "Trump Lets Navy's Chief Off the Hook Over an Offer to 'Fire Me,'" *Bloomberg*, November 2, 2019.

[26] Program Executive Office Aircraft Carriers Public Affairs, "Fifth Advanced Weapons Elevator certified aboard USS Gerald R. Ford (CVN 78)," *Navy News Service*, April 22, 2020. See also Megan Eckstein, "Ford's 5th Weapons Elevator Done With Testing; All 11 Should Be Done By Next Summer's Shock Trials," *USNI News*, April 16, 2020.

On January 16, 2020, a Navy official reportedly stated that work on all 11 elevators will be completed by May 2021, although the official acknowledged that there is some risk in that schedule. (Mallary Shelbourne, "Navy Confident CVN-78 Will Have All Weapons Elevators by May 2021," *Inside Defense*, January 16, 2020.)

[27] See, for example, Ben Werner, "Navy Applying USS Gerald Ford Advanced Weapons Elevators Lessons to Rest of Carrier Class," *USNI News*, April 22, 2020.

[28] An October 25, 2019, press report stated that Navy officials "are taking a hard look at what's next and if there's enough time for Ford to meet remaining milestones and necessary to deploy sometime in 2022—which as of now is still the target…." (Mark D. Faram, "Carrier Ford Underway For Tests as Navy Mulls Future Schedule," *Defense & Aerospace Report*, October 25, 2019.)

[29] Thomas B. Modly, memorandum for distribution, subject "SecNav [Secretary of the Navy] Vector 1," December 6, 2019, p. 1.

"Our first 'Make Ford Ready' summit will occur on January 9, 2020, with every stakeholder in government and industry present."[30] On February 27, 2020, Navy leaders testified that

> With the successful completion of CVN 78's Post Shakedown Availability and subsequent Independent Steaming Events, finishing our work and delivering this capability to the fleet as quickly and effectively as possible is one of DON's [the Department of the Navy's] highest priorities. The Navy has learned with each test and is consistently bringing each of the innovative systems online. FORD is currently undergoing final air compatibility testing, bringing the entire carrier air wing onboard and progressing towards her maiden deployment.[31]

Potential Oversight Questions

Potential oversight questions for Congress include the following:

- Why did the Navy accept delivery of CVN-78 from the shipbuilder and commission the ship into service if most or all of its weapon elevators were not completed, tested, and certified?
- What steps has the Navy taken since CVN-78 was delivered to the Navy on May 31, 2017, to keep Congress informed of challenges regarding the ship's weapon elevators and other ship systems?
- Why is it taking so long to complete, test, and certify the weapon elevators?
- How much is it costing to complete, test, and certify the weapon elevators, and will the Navy include all of this cost in the ship's total reported procurement cost?
- When will the ship start its first deployment, and how much of a delay will that represent compared to the ship's original schedule for starting its first deployment?
- How much additional operational stress is the delay in CVN-78's first deployment placing on the Navy's 10 other aircraft carriers?
- What steps is the Navy taking to ensure that a similar situation does not arise regarding the construction and initial deployments of CVN-79, CVN-80, and CVN-81?

Recent Press Reports

An October 22, 2019, press report states:

> USS Gerald R. Ford (CVN-78) may not be ready to deploy until 2024, further complicating the Navy's persistent problems of generating deployable carriers from the East Coast.
>
> Ford's originally planned deployment date was 2018, but that timeline has continued to slip due largely to developmental delays in the new technologies that were included aboard the first-in-class nuclear aircraft carrier. The delays are also in part due to the Department of Defense's decision for Ford to undergo full-ship shock trials before its first deployment.

[30] Thomas B. Modly, memorandum for distribution, subject "SecNav [Secretary of the Navy] Vector 3," December 20, 2019.

[31] Statement of the Honorable Thomas B. Modly, Acting Secretary of the Navy, Admiral Michael M. Gilday, Chief of Naval Operations, [and] General David H. Berger, Commandant of the U.S. Marine Corps, on [the] Fiscal Year 2021 Department of the Navy Budget before the House Armed Services Committee, February 27, 2020, p. 29.

> The news of the later deployment date came during a Tuesday House Armed Services readiness subcommittee hearing in an exchange between Naval Sea Systems Command head Vice Adm. Tom Moore and Rep. Elaine Luria (D-Va.).
>
> "The original deployment was 2018 and best estimates we're looking at 2024?" Luria asked Moore during the hearing.
>
> "I think we'll beat that," Moore said. "We're going to pull back as far to the left [i.e., earlier] as we can, but I think we're going to beat that."
>
> The initial estimated deployment date is still under review, pending a decision by Chief of Naval Operations Adm. Mike Gilday in consultation with Moore and James Geurts, assistant secretary of the Navy for research, development and acquisition, Geurts told reporters following the hearing.
>
> "I want to make sure the new CNO has got an opportunity to review that plan and make sure he and I are both comfortable with it," Geurts told USNI News after the hearing.[32]

An October 23, 2019, press report states:

> Navy Secretary Richard Spencer defended the long-delayed USS Gerald R. Ford aircraft carrier Wednesday [October 23] and shot back at critics, suggesting that pointed remarks on Capitol Hill Tuesday amounted to "disinformation."
>
> "The ship will be ready to serve and do what it's going to do in the time that the CNO thinks is appropriate, and it's going to be sooner than 2024," Spencer told an audience at the Brookings Institution, referring to Chief of Naval Operations Adm. Michael Gilday. That's the latest estimate for when the Ford will deploy for the first time.
>
> The carrier was originally scheduled to be able to deploy in 2018. Former Navy officer Rep. Elaine Luria (D-Va.) offered a blistering criticism of the delays Tuesday [October 22], calling the vessel a "$13 billion nuclear-powered floating berthing barge" during a hearing with Vice Adm. Thomas Moore of Naval Sea Systems Command and Assistant Secretary of the Navy for Research, Development, and Acquisition James Geurts.
>
> "I look at her and other leadership on the Hill who continually disparage the Ford as a program and I get a little angry," Spencer said, noting that the 2024 date refers to when the carrier's air wing will be aboard and certified for operations, not when the warship itself will be ready. The carrier will be "sent to the fleet much earlier than that," he said.
>
> "You could not ask for a better disinformation program for our competitors" than criticism from congressional critics that underplays the Ford's potential, he added.
>
> "We're going to work this out," Spencer continued, calling the carrier an "efficiency game-changer" and emphasized that of its 11 weapons elevators, long a sticking point for the ship, "this morning we signed elevator No. 4 over" and "elevators 5 and 6 are moving in the ship." Moore and Geurts said Tuesday [October 22] that three of the elevators have been certified for use.[33]

An October 24, 2019, press report stated:

> The plight of the very expensive and very late Gerald R. Ford aircraft carrier ignited a war of words between U.S. lawmakers and Navy leaders this week….

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[32] Sam LaGrone, "Carrier Ford May Not Deploy Until 2024, 3rd Weapons Elevator Certified," *USNI News*, October 22, 2019.

[33] Wesley Morgan, "Navy Secretary Accuses Congressional Critics of 'Disinformation' on Ford Carrier," *Politico Pro*, October 23, 2019. See also Ben Werner, "SECNAV Spencer Rebuts Congressional Criticism of Ford Carrier Program," *USNI News*, October 23, 2019; Paul McCleary, "Navy Secretary Rips Hill, Says Shipbuilder HI Has 'No Idea,'" *Breaking Defense*, October 23, 2019.

> At an event Wednesday [October 23], Navy Secretary Richard Spencer bristled at Luria's criticism of the "massively complex systems" on Ford.
>
> Speaking at a Brookings Institution think tank event, he said such complaints left him feeling that he "could not ask for a better disinformation program for our competitors."
>
> "The way we went to the moon was because the country was behind this, to get us to the moon with new technology," Spencer said. "We're going to work this out."
>
> Ford's innovative high-tech catapults have not only bedeviled engineers trying to perfect them but have also irked President Donald Trump, who said in 2017 that the carrier's electromagnetic systems should return to "goddamned steam."
>
> Spencer blamed Congress Wednesday for ever putting a price cap on the carrier, which he likened to making a deal to get your house painted for $100 and then offering the painter only $75.
>
> "I would love to know that Congress understands what a price cap does," Spencer added.
>
> Spencer also laid into [Representative Elaine] Luria for not offering to help.
>
> "I consider that disparaging," he said.
>
> Luria's Capitol Hill team responded that, during Tuesday's hearing, she offered to do just that.
>
> "We want to be here for readiness to provide you the tools to get the carriers out to deploy on time," she told Moore and Assistant Navy Secretary for Research, Development and Acquisition James Geurts. "What else do you need to do that?"
>
> On Wednesday, Spencer also denounced how lawmakers—who he refers to as his "board of directors"—only blame the Navy for the Ford's failures.
>
> "I love the fact that…Congress turns around and says, 'Navy, this is your fault,'" he said. "I have an extra seat up there when I testify, and I have not seen Huntington Ingalls-Newport News called up on the Hill to testify on the outrage my board of directors sees on the Ford."
>
> In a statement released Wednesday night, Luria said she was disappointed that Spencer "finds Congressional oversight disparaging."
>
> "Here are the facts: The USS FORD will be six years delayed in its initial deployment, which causes incredible strain on the carrier fleet," she said.[34]

An October 27, 2019, press report stated:

> The Navy was kept in the dark by Huntington Ingalls' leadership about the severity of engineering issues with Advanced Weapons Elevators on the aircraft carrier Gerald R. Ford according to Navy's top civilian official speaking with reporters Sunday [October 27] at Naval Station Norfolk.
>
> Secretary of the Navy Richard Spencer minced no words after being questioned about the Ford's struggles and recent lawmaker comments about the ship shortly after arriving back ashore from a several hour visit to the ship, which is undergoing trials off the Virginia Coast….

[34] Geoff Ziezulewicz, "SECNAV, Lawmaker Trade Barbs on Ford Flattop Woes," Navy Times, October 24, 2019. See also Justin Katz, "Spencer Unloads on Congress, HII Following Navy Testimony on Ship Maintenance," *Inside Defense*, October 23, 2019.

Spencer lauded the work being done on the ship by what he described as an "energized" and "seamless" team of sailors and civilian yard workers working together "to knock down these problems."

His ire, he said, is with leadership at Huntington Ingalls and the shipyard for not communicating the problem up front.

"My issue is with senior management, the board of directors," Spencer said. "I do not believe that we did have an understanding of their understanding of the issue, as translated to us all through the fall [of calendar year 2018)."

The company originally promised the ship' post-shakedown availability would end this past July 15, Spencer said, telling the Navy they were "fairly confident they're going to get all the elevators done."

That forecast changed in March, Spencer said, when "all of a sudden" the shipyard informed the Navy the elevators wouldn't be completed until sometime in 2021 or 2022.

"That was a bit of a gut blow, which questioned in my mind, do they really know what the problem is?" Spencer said and adding "Navy came in and did what we should have done earlier" and "took control of the situation completely as it pertains to the elevator program" and "we got the issues knocked down."

Huntington Ingalls didn't comment directly on Spencer's words, saying instead that the Ford, as a "first-in-class ship" has had "many unique challenges" according to Beci Brenton, spokeswoman for for the company. While "most things have gone very well," she said, "Some of the newer technologies have been more challenging than anticipated.

She echoed Spencers comments saying the company and the Navy have been "working closely" to resolve issues as they arise and praised the efforts of the shipbuilders finding fixes.

"With respect to the advanced weapon elevators, we have four certified elevators turned over to the Navy, and we are on a path to complete the remaining seven in the coming months," she said. "We will continue to support our Navy partner in their preparations for the ship's deployment."

Spencer said he believes the ship and the program have turned a corner in recent months and the worst is behind….

To date, he said, the ship has "seven moving elevators, of which four are certified" and handed over to the ship with "three others that are under various forms of testing."

When asked how long now before the ship is combat-ready, Spencer said "I'll let you know" saying the ship can't become combat ready until she is "given to the Navy" and put through a full work-up cycle.

That's because of necessary milestones in the ship's immediate future, such as "Post Delivery Tests and Trials, Full Ship Shock Trials", and a "Planned Incremental [Maintenance] Availability," which all must happen before the ship can begin working up for deployment, officials told Defense & Aerospace Report this week.

But that work-up and deployment, Spencer said, is "going to be way before 2024, I guarantee you that."…

"The issues with the elevators that we're slaving away with, when we find a fix here is being immediately walked over to the Kennedy [CVN-79]," he said. "I think what you're going to see is learning put into action with Kennedy, and you'll see it out quicker."[35]

[35] Mark D. Faram, "SECNAV: Huntington Ingalls Leadership Misled Navy on Ford Elevator Issues," *Defense & Aerospace Report,* October 27, 2019.

An October 28, 2019, press report stated:

> The US Navy's top acquisition official was upbeat as he met with media Monday [October 28] in his Pentagon office. He was just back after a quick trip to the long-troubled aircraft carrier Gerald R Ford (CVN 78), now underway off the Virginia coast on sea trials after 15 months in a shipyard….
>
> [Assistant Secretary of the Navy for Research, Development and Acquisition James Geurts] added that the four operationally-certified elevators are the three upper-stage elevators plus a utility elevator also used for medical evacuations. Seven more lower-stage elevators continue to receive attention, with three of those nearing certification, he said. But it will still be about a year and a half before all 11 elevators are certified and in full operation, he cautioned.
>
> Of the ship's other systems, the Dual Band Radar (DBR), a unique feature on the Ford, "has been up and operating while at sea, tracking targets. Feeling pretty good about that," he said.
>
> Geurts also said he was pleased with progress on the Electromagnetic Aircraft Launch System (EMALS) and Advanced Arresting Gear (AAG), two more key new technologies on the carrier. New elements have been put in place on the arresting gear, he said, and land-based testing of the systems continues at an ever-growing pace. Flight operations on the Ford, he said, should resume shortly after the turn of the year, adding the goal is to work the system hard.
>
> The ship's propulsion system already is being checked out, Geurts noted.
>
> "We've been at full power, we've tested the [main shaft] bearings, we've tested the throttles, everything looks solid," he said, knocking a wooden table while adding the main turbine generators and the propulsion plant also look good.
>
> Geurts expressed confidence that a dispute between HII and General Electric about responsibilities with problems in the ship's propulsion plant will be worked out between the companies, with no additional costs to the Navy….
>
> Asked for examples of where the cost cap might have prevented needed work from being done in a timely fashion, Geurts pointed to "some of the prototyping, some of the risk reduction.
>
> "With a cost cap you can actually cause a behavior that suppresses information," he said. "People don't want to bring bad news to the boss. I'm much more for transparency so you can make decisions.
>
> "I just worry sometimes the intended behavior might not be the resultant behavior," he added. "Cost cap as a management mechanism may not be the best way to drive that."
>
> During the Ford's post-shakedown availability—a planned post-delivery shipyard period where Navy ships return to the yard to correct deficiencies discovered in their initial, shakedown, period and receive additional work—Newport News shipbuilders essentially defined a new shipyard trade of specialists working on the advanced elevators, which will be installed on the Kennedy, Enterprise and all future carriers in addition to the Ford.
>
> "The shipyard has created a kind of trade school for elevators now," Geurts said. "I am pretty optimistic that HII is setting up almost a specific trade, with specific training and a specific focus on this. That work force can now move from ship to ship and kind of be the AWE super geniuses as opposed to having to retrain tradesmen in this rather unique skill."
>
> A full, land-based test site is also being built by the Navy in Philadelphia to further test the technology.

> "I think that's where we missed it," Geurts said of the AWE problems on the Ford. "The technology itself is not that exotic. The construction and getting the construction sequence right and having that planned very, very specifically, is what we really learned on 78.
>
> "The other challenge is there isn't a huge degree of commonality between the eleven elevators, so you don't really get as much learning between elevators on the single ship, you get learning on the elevators across a class of ships."[36]

An October 29, 2019, press report stated that

> The Navy's top acquisition official said all the of the delayed advanced weapons elevators (AWEs) on the USS Gerald R. Ford (CVN-78) will be finished and operational by the time an 18-month post-deliver test and trials (PDT&T) period finishes.
>
> Assistant Secretary of the Navy for Research, Development and Acquisition James Geurts told media during a roundtable Oct. 28 that as of Oct. 27, when he and Secretary of the Navy Richard Spencer visited the Ford, it was about 50 percent through its sea trials and is expected back to the naval base by the mid-week.
>
> The carrier first went back to sea for sea trials after finishing its post-shakedown availability (PSA) repair and maintenance period on Oct. 25….
>
> After finishing these trials, it will undergo a nominal 18-month PDT&T period where the crew and air wing will get certified and get the ship ready for carrier strike group workups. Flight operations will start on CVN-78 in the next calendar year to recertify the flight deck, fuel systems and overall prepare for flight operations.
>
> Geurts admitted there is carryover work on the long-delayed elevators, but he was sure they will be finished before the ship is deployed and the Navy-industry team have a better handle on them going forward.
>
> "We do have a little carryover work and so we did work our way through elevators," with four turned over to the crew and seven left to finish installation and certification.
>
> Geurts said the Navy has cycled the finished elevators over 200 times since the Ford started these trials. They are "operating fine at sea and all that but we'll continue to shake those systems out."
>
> He noted shipbuilder and AWE builder Huntington Ingalls Industries [HII' has personnel on board during the trials to work on the seven remaining elevators "proving exactly how to do that while at sea & how to pre-stage equipment the right way."
>
> Geurts said three of the lower elevators are in varying states of final construction and when he visited HII was testing one.
>
> "So we're taking advantage of that and working as an integrated team out there."
>
> Geurts underscored the Navy-HII team's output over the last 90-100 days "has been on a much better path than we were previously and that's why I am cautiously optimistic on both progress to get the rest of the Ford ones done and then be able to accelerate through 79 through 81."
>
> Last week, Spencer said the Navy started making more progress on the AWEs once a service team took over the project but also strongly criticized HII management….
>
> Geurts said the Navy and HII have had to work together "to get the right team focused on elevators. The Navy put a dedicated team down there, HII has recognized we've got to get

[36] Christopher P. Cavas, "Heady Days for US Navy's Carrier Program," *Defense & Aerospace Report*, October 28, 2019.

> both build, grow and sustain a dedicated workforce to get after those and be a little bit bolder in our action."…
>
> Geurts explained several risk reduction measures the Navy and HII have undertaken to speed up the elevator work.
>
> Some changes are "design tweaks for producibility." Previously, the AWE door hinges were welded on every time so when you reset the door they had to unweld them and then reposition them.
>
> "It actually was one of the submarine experts came over from HII and looked at it and now kind of moving to movable fittings so you can kind of get the fitting right and then do the welds so you can adjust it easier."
>
> The Navy has also built a full digital twin of the AWE software. "That's already up and running, so we can run the software and get the software stable and test it. And then longer term we're building a land-based test site up in Philly."[37]

An October 30, 2019, press report stated:

> The Secretary of the Navy today said the cost cap on the first Ford-class aircraft carrier helped lead to problems resulting in delays to the advanced weapons elevators (AWEs) and explained the government's issues and changing strategy with the shipbuilder.
>
> Secretary of the Navy Richard Spencer said on Wednesday at a Heritage Foundation press roundtable that the Navy and shipbuilder/AWE builder Huntington Ingalls Industries [HII] planned to build a test elevator site, similar to the electromagnetic advanced landing system (EMALS) located in Lakehurst, N.J.
>
> The Navy has used Joint Base McGuire-Dix-Lakehurst to test the General Atomics advanced arresting gear (AAG) and EMALS [electromagnetic aircraft launch system] hundreds of times before testing them on the first new carrier, the USS Gerald R. Ford (CVN-78).
>
> "Then we had the cost cap come in. And as [HII president and CEO] Mike Petters can say, you know fine, the cost cap comes in and no one builds the land site [weapon] elevator. We had to cut costs somewhere. Sometimes we're our own worst enemy," Spencer said….
>
> Spencer said he thinks about it and wonders if anyone was expecting there to be second and third order effects of a cost cap.
>
> "You don't get anything for free and you're not going to drive quality by cost cap. We have to start thinking differently when we go to cost control."…
>
> On Monday [October 28], Assistant Secretary of the Navy for Research, Development and Acquisition James Geurts said the Navy-HII team's output on the elevators has been much better in the last few months and he was cautiously optimistic on progress of the Ford elevators….
>
> Spencer said in fall 2018 the Navy was finalizing the HII elevator plan. The company gave him a chart that said all 11 AWEs would be tested and certified by the end of the planned post-shakedown availability (PSA), which was then planned for July 15.
>
> He said HII management reported high confidence of this timeline while Naval Reactors told him due to throttle and bearing issues the PSA would likely be pushed into September or October, "so I had more margin there. Did I feel confident? Completely confident."

[37] Rich Abott, "Geurts: Ford Elevators Done By 18-Month Post-Delivery Trial End, New Team Working," *Defense Daily*, October 29, 2019. See also Ben Werner, "Navy Rethinking Need For Dual-Phase Carrier Delivery," *USNI News*, October 29, 2019.

> Then, in January, Spencer said he made a bet with President Trump that the AWEs would be finished with the PSA or he could be fired….
>
> Spencer explained this was meant to rally the shipbuilders.
>
> "What we weren't seeing down there was the spring in the step of the people on the waterfront, to be very frank with you. It was business as usual. So we said ok, here's a rally point, we're going to commit to this."
>
> However, in May 2019 he said HII management "goes oops, here we are, elevators aren't going to be ready until the end of 2020, possibly 2021. And that's when I went, do they really know what they're doing?"
>
> Spencer called that a moment of inflection and called Thomas Fargo, chairman of the board of HII, asking if the board knew what was going on with management "because out trust and confidence on this specific project of the elevators has eroded significantly."
>
> While Spencer said Fargo said yes, there were continued frustrations on the government side.
>
> "That's when Hondo [Geurts] and I said let's get a tiger team down there and let's take this over as the general contractor and HII can sub[contract] to us [i.e., the Navy]. And that's basically what's happened this last 3 months."
>
> Spencer said he went to the president and, after explaining the situation, was told "it's a complex system, keep knocking down the dragons."[38]

Another October 30, 2019, press report stated that at the press roundtable, Spencer noted that CVN-78 is the first ship in its class:

> "It's first of class…. First of class is tough. If I look at what we're doing to [the second-in-class ship, the future John F. Kennedy (CVN-79)], we're down 3.2 million man-hours for where Ford was[, an] 18 percent decrease. You look at what we're doing on the elevators, what we're picking up on—here's a fine example to the way to look at it: on the elevators, one of the problems was we have to get a two-pound pressure differential in each deck on three-ton doors. Well, the way they designed it is you actually have to weld and cut the hinge to adjust it. Well, now we're doing a hanging hinge on Kennedy. So we're taking learning [from CVN-78] to the ship [CVN-79]. I'd be remiss if I'd say that's the last (funding request), to be very frank; I'd rather have the option to say we're going to come for more than to say we're capped off now. I feel good on what we're finally learning on the end of this."[39]

Another October 30, 2019, press report resulting from the press roundtable stated:

> Refusing to backtrack from previous criticisms and admitting anew he has questioned if executives at Huntington "really know what they're doing," Spencer did signal a new detente with a congresswoman [Representative Elaine Luria] he sparred with recently about the Ford class, however….
>
> In a thaw in the relationship however, on Tuesday Luria and Navy acquisition boss James Geurts met in her Capitol Hill office to go over the Navy's plans to fix seven of the ship's 11 electromagnetic weapons elevators. Luria spokesman Chris Carroll told me it was "a positive meeting," adding his boss "still has strong concerns about progress on the Ford."

[38] Rich Abott, "SECNAV: Ford Issues Due To Cost Cap, Explains Timeline," *Defense Daily*, October 30, 2019. See also Megan Eckstein, "SECNAV Spencer: Carrier Ford Challenges Tied to Costs Caps, Requirements Process," *USNI News*, October 30, 2019; Paul McCleary, "SecNav Again Blasts Huntington Ingalls On Ford Carriers," *Breaking Defense*, October 30, 2019.

[39] Megan Eckstein, "SECNAV Spencer: Carrier Ford Challenges Tied to Costs Caps, Requirements Process," *USNI News*, October 30, 2019. Ellipsis as in original.

> Geurts' spokesman Capt. Danny Hernandez said the Navy would keep conversations with members of Congress private.
>
> Speaking at a breakfast event at the Heritage Foundation today, Spencer sought to play down the feud, telling reporters the back-and-forth was the result of "frustration on both sides" over problems on the Ford, adding he shares her frustration over the ship's problematic technologies and delayed schedule.

Reporting on the status of various systems on the ship, another October 20, 2019, press report stated:

> The skipper of the world's most technologically advanced aircraft carrier [Capt. John J. "Yank" Cummings] says the ship has "absolutely" turned the corner and is now ready to work towards full operational status.
>
> After a 15-month stint back in the shipyard where the ship was built, most of its plethora of new technology is now up and running. The ship is now ready to begin advanced trials as the crew and the Navy will now learn how to take Ford's high-tech gear to the next level and earn a spot in the deployment rotation….
>
> Cummings talked to media on board the ship today, moments after their five-day at sea period ended as the ship tied up at Naval Station Norfolk's Pier 11. While underway… nearly all of her ship systems were put to the test, he said, and passed….
>
> The past few days, according to to the Naval Sea Systems Command's Rear Adm. Jim Downey, the man in charge of overseeing the building and maintenance of the Navy's flattop fleet, have proven the ship has finally worked out most of the kinks that have plagued the ship since even before it was commissioned in July of 2017.
>
> "The ship got underway right on schedule on Friday—conducted over 100 events over the the last few days and was very successful overall."
>
> Up and running, he said, is the ship's propulsion system that was put through the full range of testing both forward and backwards and even high-speed turns. There was no sign of the thrust bearing issues that led to breakdowns before the latest overhaul started.
>
> "Throttle control…performed very well, overall," Downey said "All four [main turbine generators] were online all of those fixes were demonstrated at sea."
>
> The navigation system got a workout and combat systems, which features the ship's dual-band radar worked fine through its initial runs where it "tracked multiple targets."
>
> And though all the Advanced Weapons Elevators aren't fully operational, yet, Downey said that all eleven will be operating by the end of the "post delivery testing and trials phase" which is expected to wrap up in the next 18 months.
>
> While at sea, he said, the four elevators now fully operational got a workout while at sea. In addition, a fifth elevator, considered close close to certification was also run constantly and though it's not fully certified, Downey said it "met all its requirements."[40]

A January 30, 2020, press report stated:

> Over the past several months, the US Navy has been on a full-court press to show the world that its newest $14 billion super carrier isn't a dud.
>
> Once sarcastically referred to as "Building 78," senior leaders are stressing that the ship is well on its way to becoming a game-changing warship.

[40] Mark D. Faram, "Carrier Ford Turns the Corner, Officials Say," *Defense & Aerospace Report*, October 30, 2019.

> Earlier this week, Navy acquisition chief Hondo Geurts accompanied a small group of reporters to the ship, the latest batch of journalists to be given free access to the ship's leadership and crew.
>
> Geurts, Ford's commanding officer, Capt. JJ "Yank" Cummings, and his officers and sailors clearly telegraphed that the ship has indeed turned a corner thanks to a lot of hard work.
>
> Cumming's first-class leadership has inspired the Ford team and imbued it with a can-do spirit to distance the ship's troubled past and focus on its bright future.
>
> Geurts has focused on setting the conditions for long-term success by working with and incentivizing major contractors whether shipbuilder Huntington Ingalls Industries to catapult and arresting gear maker General Atomics to radar maker Raytheon and thousands of others to bend to the task.
>
> It is welcome news given delays getting the ship into the fleet has had a cascading effect, raising concerns whether the aging Nimitz and Eisenhower will have to remain in service longer.
>
> It is equally welcome that the Navy is finally realized the benefits of talking openly about its challenges and progress. The former lockdown on information only fueled rumor, speculation and lawmaker and journalists' ire. Worse, it gave the appearance that the Navy was doing nothing to solve the Ford's problems, only engaging fully a few months ago.
>
> Yes, Ford is expensive, late and over budget. She is also coming into service at a time when there is a robust debate about whether carriers constitute a critical capability or vulnerable liability. [Then-]Acting Navy Secretary Tom Modly has been candid about his concerns about the vulnerability of the current carrier fleet—arguing that a new design may be necessary after the fourth of the class, the Doris Miller is delivered.
>
> That said, Modly has also made clear it's vital the Navy get the Ford-class right. He's right. For the foreseeable future, big-deck aircraft carriers will be critical national capability and capital asset around which the US Navy will be organized until the service determine what new kind of smaller ship would be knitted into a more distributed architecture….
>
> Ford has made dramatic progress over the past months because of a prolonged post-shakedown availability that tackled engine, catapult, arresting gear and radar challenges. Sailors working closely with contractors and their Naval Sea Systems Command teammates were instrumental by applying their experience, innovative spirit and good old fashioned hard work. (Of 2,700 aboard Ford, 2,200 are crew and the remaining 500 are Navy personnel and contractors, 100 from HII alone.)
>
> It's this approach that is systemically resolving the ship's elevator problems. Sailors identified design and production problems, realigning guides, relocating and recalibrating limit switches to get three certified so far and another four by year's end.[41]

Pricing of Proposed FY2021 Work on CVN-78 Program

Another issue for Congress is whether the Navy has accurately priced the work it is proposing to do on the CVN-78 program in FY2021, particularly with regard to completing work on CVN-78 and implementing the two-carrier contract for CVN-80 and CVN-81.

[41] Vago Muradian, "Learning Ford's Lessons—Fast," *Defense & Aerospace Report*, January 30, 2020. See also David B. Larter, "The Carrier Ford Is Trying to Shake Years of Controversy and Find Its Groove," *Defense News*, January 30, 2020.

Cost Growth and Managing Costs within Program Cost Caps

Overview

Another issue for Congress concerns cost growth in the CVN-78 program, Navy efforts to stem that growth, and Navy efforts to manage costs so as to stay within the program's cost caps. The issue has been a continuing oversight issue for Congress several years. Congress in recent years has passed legislation on the issue that is in addition to the earlier-mentioned legislation that established and amended cost caps for the ships.[42]

As shown in **Table 2**, the estimated procurement costs of CVN-78, CVN-79, and CVN-80 have grown 27.0%, 24.0%, and 15.0%, respectively, since the submission of the FY2008 budget. As shown in **Table 1**, cost growth on CVN-78 required the Navy to program $1,394.9 million in cost-to-complete (CC) procurement funding for the ship in FY2014-FY2016 and FY2018,[43] to request another $71.0 million in CC funding for CVN-78 for FY2021, and to program another $74 million in CC funding for CVN-79 for FY2022.

As also shown in **Table 2**, however, cost growth on CVN-78, CVN-79, and CVN-80 has slowed since FY2013 and FY2014:

- while the estimated cost of CVN-78 grew considerably between the FY2008 budget (the budget in which CVN-78 was procured) and the FY2014 budget, since the FY2014 budget, it has grown by only a small amount (3.8%);
- while the estimated cost of CVN-79 grew considerably between the FY2008 budget and the FY2013 budget (in part because the procurement date for the ship was deferred by one year in the FY2010 budget),[44] since the FY2013 budget it has declined by a small amount (0.11%); and
- while the estimated cost of CVN-80 grew considerably between the FY2008 budget and the FY2013 budget (in part because the procurement date for the ship

[42] This additional legislation includes:

Section 128 of the FY2016 National Defense Authorization Act (S. 1356/P.L. 114-92 of November 25, 2015), which established a limitation on availability of funds for CVN–79 until certain conditions were met;

Section 126 of the FY2017 National Defense Authorization Act (S. 2943/P.L. 114-328 of December 23, 2016), which established a limitation on availability of funds for procurement of CVN–80 until certain conditions were met;

Section 121(b) of the FY2018 National Defense Authorization Act (H.R. 2810/P.L. 115-91 of December 12, 2017), which provided for a waiver on the limitation of availability of funds for CVN–79; and

Section 122 of the FY2020 National Defense Authorization Act (S. 1790/P.L. 116-92 of December 20, 2020), which modified the above-listed Section 126 of P.L. 114-328 regarding an annual report on cost targets for CVN-78 class carriers.

[43] The Navy's FY2021 budget submission reflects the reprogramming of $161.5 million of additional funding for CVN-78 into FY2009, FY2011, and FY2012, including $86.0 million reprogrammed into FY2012. As discussed earlier in the note to **Table 1**, even though FY2012 is after FY2011 (CVN-78's original final year of full funding), the Navy characterizes the $86.0 million reprogrammed into FY2012 as full funding rather than cost-to-complete funding on the grounds that in the years since FY2011, as discussed earlier in this report (see footnote 11), the authority to use incremental funding for procuring aircraft carriers has been expanded by Congress to permit more than the four years of incremental funding that were permitted at the time that CVN-78 was initially funded.

[44] Deferring the ship's procurement from FY2012 to FY2013 put another year of inflation into the ship's estimated cost in then-year dollars (which are the type of dollars shown in **Table 2**), and may have reduced production learning curve benefits in shifting from production of CVN-78 to production of CVN-79.

was deferred by two years in the FY2010 budget),[45] since the FY2013 budget it has declined by 11.2%.

CVN-78

Past Sources of Cost Growth

A primary source of past cost growth on CVN-78 appears to have been an unrealistically low original cost estimate for the ship in the FY2008 budget submission, which might have reflected an underestimate of the intrinsic challenges of building the then-new Ford-class design compared to those of building the previous and well understood Nimitz-class design.[46]

In addition to this general cause of past cost growth, additional and more-specific past risks of cost growth for CVN-78 included certain new systems to be installed on the ship whose development, if delayed, could delay the ship's completion. These included a new type of aircraft catapult called the Electromagnetic Launch System (EMALS), a new aircraft arresting system called the Advanced Arresting Gear (AAG), and the ship's primary radar, called the Dual Band Radar (DBR). Congress followed these and other sources of risk of cost growth on CVN-78 for years.

Recent Press Reports

An October 25, 2019, press report stated:

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[45] Deferring the ship's procurement from FY2016 to FY2018 put additional years of inflation into the ship's estimated cost in then-year dollars (which are the type of dollars shown in **Table 2**), and may have reduced production learning curve benefits in shifting from production of CVN-79 to production of CVN-80.

[46] The Congressional Budget office (CBO) in 2008 and GAO in 2007 questioned the accuracy of the Navy's cost estimate for CVN-78. CBO reported in June 2008 that it estimated that CVN-78 would cost $11.2 billion in constant FY2009 dollars, or about $900 million more than the Navy's estimate of $10.3 billion in constant FY2009 dollars, and that if "CVN-78 experienced cost growth similar to that of other lead ships that the Navy has purchased in the past 10 years, costs could be much higher still." CBO also reported that, although the Navy publicly expressed confidence in its cost estimate for CVN-78, the Navy had assigned a confidence level of less than 50% to its estimate, meaning that the Navy believed there was more than a 50% chance that the estimate would be exceeded. (Congressional Budget Office, Resource Implications of the Navy's Fiscal Year 2009 Shipbuilding Plan, June 9, 2008, p. 20.) GAO reported in August 2007 that

> Costs for CVN 78 will likely exceed the budget for several reasons. First, the Navy's cost estimate, which underpins the budget, is optimistic. For example, the Navy assumes that CVN 78 will be built with fewer labor hours than were needed for the previous two carriers. Second, the Navy's target cost for ship construction may not be achievable. The shipbuilder's initial cost estimate for construction was 22 percent higher than the Navy's cost target, which was based on the budget. Although the Navy and the shipbuilder are working on ways to reduce costs, the actual costs to build the ship will likely increase above the Navy's target. Third, the Navy's ability to manage issues that affect cost suffers from insufficient cost surveillance. Without effective cost surveillance, the Navy will not be able to identify early signs of cost growth and take necessary corrective action.
>
> (Government Accountability Office, *Defense Acquisitions[:] Navy Faces Challenges Constructing the Aircraft Carrier Gerald R. Ford within Budget*, GAO-07-866, August 2007, summary page. See also Government Accountability Office, *Defense Acquisitions[:] Realistic Business Cases Needed to Execute Navy Shipbuilding Programs*, Statement of Paul L. Francis, Director, Acquisition and Sourcing Management Team, Testimony Before the Subcommittee on Seapower and Expeditionary Forces, Committee on Armed Services, House of Representatives, July 24, 2007 (GAO-07-943T), p. 15.)

> The Navy's most expensive vessel is getting even costlier, as the service says it needs to add as much as $197 million more to correct deficiencies with the USS Gerald R. Ford aircraft carrier.
>
> That includes completing the installation and certification of 11 elevators to lift munitions and other equipment from below decks that were supposed to be ready more than two years ago.
>
> The previously undisclosed notification to Congress is on top of an extra $120 million identified in May 2018 to correct earlier deficiencies. The move last year caused the carrier to breach a $12.9 billion cost cap set by Congress in an effort to stop spiraling cost increases. The new request takes the carrier's estimated cost to $13.22 billion.
>
> The latest funding is needed "to correct deficiencies identified during testing to ensure the safety of the ship and personnel and to deliver an operational ship to the fleet," Captain Danny Hernandez, a Navy spokesman, said in a statement….
>
> More money also is needed to pay for "additional labor to address and correct technical issues, completing deferred work," and "there are also time charges associated with a longer repair period," the Pentagon comptroller said in an Oct. 7 document to Congress requesting permission for the Navy to shift $40 million from prior-year programs. The remaining $157 million would come from funds this fiscal year and 2021, Hernandez said.[47]

An October 28, 2019, press report stated:

> A congressionally-imposed cost cap remains in place on the Ford, however, and the Navy in late September received permission to add $197 million to the ship's acquisition cost, for a new total of $13.224 billion. The new monies were needed, the Navy said in a statement, "in order to correct deficiencies identified during testing, to ensure the safety of the ship and personnel, and to deliver an operational ship to the fleet."
>
> The additional money also includes more for work on the elevators. The new money will come from the current 2019 budget and the future fiscal 2020 and 2021 budgets.[48]

An October 30, 2019, press report stated that Secretary of the Navy Richard Spencer, at a press roundtable on that date,

> said he has "medium confidence" that a recent $197 million reprogramming request to Congress to fund more Ford fixes will be enough, simply because "first of classes is tough."
>
> "I'd be remiss if I said that was the last, to be very frank. I'd rather have the option to say we're going to come for more than saying no we're capped off now. I feel good on what we're finally learning on the end of this birthing process," Spencer said.[49]

[47] Anthony Capaccio, "Navy's $13 Billion Carrier Needs Another $197 Million in Fixes," *Bloomberg*, October 25, 2019.

[48] Christopher P. Cavas, "Heady Days for US Navy's Carrier Program," *Defense & Aerospace Report*, October 28, 2019.

[49] Rich Abott, "SECNAV: Ford Issues Due To Cost Cap, Explains Timeline," *Defense Daily*, October 30, 2019. See also Megan Eckstein, "SECNAV Spencer: Carrier Ford Challenges Tied to Costs Caps, Requirements Process," *USNI News*, October 30, 2019; Paul McCleary, "SecNav Again Blasts Huntington Ingalls On Ford Carriers," *Breaking Defense*, October 30, 2019.

CVNs 79, 80, and 81

Confidence Levels

The Navy states that it is working to control cost growth on CVNs 79, 80, and 81. Even so, the Navy states that its confidence levels for its estimated procurement costs (not including costs for class-wide spare parts) for CVNs 79, 80, and 81 were 36%, 22%, and 20% as of June 2019, respectively, meaning that the Navy as of June 2019 estimated that the risk of future cost growth on CVNs 79, 80, and 81 were 74%, 78%, and 80%, respectively.[50]

October 2019 CBO Report

An October 2019 CBO report on the potential cost of the Navy's 30-year shipbuilding plan states the following regarding the CVN-78 program:

> The Navy's current estimate of the total cost of the USS Gerald R. Ford, the lead ship of the CVN-78 class, is $13.1 billion in nominal dollars appropriated over the period from 2001 to 2018. CBO used the Navy's inflation index for naval shipbuilding to convert that figure to $16.2 billion in 2019 dollars, or 25 percent more than the corresponding estimate when the ship was first authorized in 2008. Neither the Navy's nor CBO's estimate includes the $5 billion in research and development costs that apply to the entire class.
>
> Because construction of the lead ship is finished, CBO used the Navy's estimate for that ship to estimate the cost of successive ships in the class. But not all of the cost risk has been eliminated; in particular, the ship's power systems, advanced arresting gear (the system used to recover fixed-wing aircraft landing on the ship), and weapons elevators are not yet working properly. It is not clear how much those problems will cost to fix, but current Navy estimates suggest that it will be several tens of millions of dollars or more. CBO does not have enough information to independently estimate those final repair costs.
>
> The next carrier after the CVN-78 is the CVN-79, the John F. Kennedy, which is expected to be completed in 2024 and deployed in 2026. Funding for the ship began in 2007, the Congress officially authorized its construction in 2013, and the planned appropriations for it were completed in 2018. The Navy estimates that the ship will cost $11.3 billion in nominal dollars (or $11.9 billion in 2019 dollars). The Navy's 2014 selected acquisition report on the CVN-79 states that "the Navy and shipbuilder have made fundamental changes in the manner in which the CVN 79 will be built to incorporate lessons learned from CVN 78 and eliminate the key contributors to cost performance challenges realized in the construction of CVN 78." Nevertheless, the Navy informed CBO that there is a greater than 60 percent chance that the ship's final cost will be more than the current estimate. Although CBO expects the Navy to achieve a considerable cost reduction in the CVN-79 compared with the CVN-78, as is typical with the second ship of a class, CBO's estimate is higher than the Navy's. Specifically, CBO estimates that the ship will cost $12.4 billion in nominal dollars (or $12.9 billion in 2019 dollars), about 9 percent more than the Navy's estimate.
>
> In 2018, the Congress authorized the third carrier of the class, the Enterprise (CVN-80). Appropriations for that ship began in 2016 and are expected to be complete by 2025. In 2019, the Congress authorized the Navy to purchase materials jointly for the CVN-80 and the next ship, the CVN-81, to save money by buying in greater quantity. It also authorized the Navy to change the sequencing involved in building the ships to gain greater efficiencies in their construction. Although that legislative action is known as a "two-carrier buy," the Navy would not be building both ships at exactly the same time. Purchasing the two ships together would accelerate the CVN-81's construction by only one

[50] Source: Navy information paper provided to CRS by Navy Office of legislative Affairs on June 20, 2019.

year compared with buying the ships individually as envisioned in the 2019 shipbuilding plan.

In the 2020 budget, the Navy estimated that the CVN-80 would cost $12.3 billion in nominal dollars (or $11.4 billion in 2019 dollars). That represents a savings of $300 million compared with the Navy's estimate in the 2019 budget. In contrast, CBO estimates that the CVN-80 would cost $13.6 billion in nominal dollars (or $12.4 billion in 2019 dollars), about 9 percent more than the Navy's estimate. In information provided to CBO as part of the 2019 budget presentation, the Navy indicated that there was a greater than 60 percent chance that the ship's final cost will be more than it estimated; in contrast, with the 2020 budget, the Navy puts that figure at 78 percent. Thus, it is not clear whether the service's 2020 estimates incorporate savings stemming from a two-carrier buy or simply an acceptance of increased risk of future cost growth.

With respect to the CVN-81, the pattern is similar. In the 2019 budget, the Navy estimated the CVN-81 at $15.1 billion in nominal dollars. In the 2020 budget with the two-carrier buy, the Navy estimated the cost of the ship at $12.6 billion in nominal dollars (or $10.5 billion in 2019 dollars), for a savings of $2.5 billion. However, the Navy also told CBO that there is an 80 percent chance that the final cost will be higher than the current estimate, compared with the roughly 40 percent chance indicated in the 2019 budget. CBO estimates that the CVN-81 would cost $14.4 billion in nominal dollars (or $11.9 billion in 2019 dollars), or 14 percent more than the Navy's estimate.

Overall, the Navy estimates an average cost of $12.7 billion (in 2019 dollars) for the 7 carriers (CVN-81 through CVN-87) in the 2020 shipbuilding plan. CBO's estimate is $13.0 billion per ship….[51]

CVN-79

Navy officials have stated that they are working to control the cost of CVN-79 by equipping the ship with a less expensive primary radar,[52] by turning down opportunities to add features to the ship that would have made the ship more capable than CVN-78 but would also have increased CVN-79's cost, and by using a build strategy for the ship that incorporates improvements over the build strategy that was used for CVN-78. These build-strategy improvements, Navy officials have said, include the following items, among others:

- achieving a higher percentage of outfitting of ship modules before modules are stacked together to form the ship;
- achieving "learning inside the ship," which means producing similar-looking ship modules in an assembly line-like series, so as to achieve improved production learning curve benefits in the production of these modules; and
- more economical ordering of parts and materials including greater use of batch ordering of parts and materials, as opposed to ordering parts and materials on an individual basis as each is needed.

A November 7, 2019, press report states:

[51] Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2020 Shipbuilding Plan*, October 2019, pp. 17-19.

[52] See, for example, Megan Eckstein, "PEO Carriers: CVN-79 Will Have a New Radar, Save $180M Compared to [CVN-78's] Dual Band Radar," *USNI News*, March 17, 2015; Christopher P. Cavas, "Dual Band Radar Swapped Out In New Carriers," *Defense News*, March 17, 2015; Christopher P. Cavas, "New US Carrier Radar Enters the Picture," *Defense News*, March 23, 2015.

It was a joyous day for Mike Butler and his enormous crew of shipyard workers who have labored for the past four years to build America's next super carrier.

The program director for CVN-79, the future aircraft carrier John F. Kennedy, donned a hardhat and briefed assembled members of the press on Oct. 29, eager to tout the progress he and his colleagues made.

"Today we're going to flood the dock, it's the first time the ship will be in the water since we started construction, since we started in August 2015," Butler said. "It will take about 10 hours. Dock holds about 160 million gallons of water, so it will take some time to get in here. … And we're flooding the dock about three months ahead of schedule, so that's a great accomplishment for our folks."

Kennedy is about 1,300 tons heavier than the aircraft carrier Gerald R. Ford was at the same point in its life span, and Butler said that's an indication of Kennedy's solid progress.

"There was a significant amount of change and improvements in how we built this ship that are helping us build this ship cheaper than we have on CVN-78," he said, referring to the Ford.

For Butler and his workforce at Huntington Ingalls Industries' Newport News, Virginia, shipyard, the Kennedy is a chance to right the ship and demonstrate the yard can learn from its challenges with Ford, even as the first-in-class aircraft carrier has become embroiled in yet another controversy over delays.…

"The main thing we did was shift more work earlier in the process," Butler said. "We moved a lot of work traditionally done on the ship to our final assembly platen, and that moved it to an area more conducive to better efficiency and better cost. We got a lot of that work done earlier than we had done before.

"That allows us to build larger super-lifts and put more outfitting in before we erected them on the ship."

The new approach at Newport News has been empowered by digital renderings that allow workers to build out spaces with a greater level of detail before piecing together the ship.

"The main difference is with the product model, early on with the 3D-designed product model—without that we could not have moved so much work earlier. For example, with Nimitz class, we had a lot of hole cuts in bulkheads for piping and electrical to pass through. On Nimitz class, most of that was cut on the ship. Here, we cut virtually all those holes in the shop. We mounted a lot of equipment in the shop. We could have never done that without the product model.

"And without the product model, we would have never been able to do the digital work packages and things that we are able to do electronically."

One of the major issues facing Newport News has been its relatively inexperienced labor force. Many of the older, most skilled workers are retiring. That, coupled with a reduction in the Navy's overall shipbuilding needs in past decades, has put pressure on the remaining pool of skilled labor from which shipyards like Newport News can draw.

That's prompted hiring of new workers and training of a new generation of skilled workers in places such as Connecticut's General Dynamics Electric Boat and in Hampton Roads, Virginia. However, the delays associated with training new workers who perform tasks more slowly than a more experienced workforce can impact the final cost of a ship, either sticking the Navy with a higher bill or taking a bite out of company profits, depending on how a contract is structured.

"Big picture is that it's not really a challenge [having a green workforce]," Butler said. "We've hired about 8,000 people in the last couple of years. Of course, that means we have

to bring them in and train them to be shipbuilders, which takes some time, but there is an advantage to having a new and younger workforce.

"Especially as we move to more digital, electronic work packages. The younger workforce is much more adept at that, and it's working very well."[53]

Issues Raised in December 2019 DOT&E and June 2020 GAO Reports

Another oversight issue for Congress concerns CVN-78 program issues raised in a December 2019 report from DOD's Director, Operational Test and Evaluation (DOT&E)—DOT&E's annual report for FY2019—and the 2020 edition of the Government Accountability Office's (GAO's) annual report surveying selected DOD weapon acquisition programs, which was published in June 2020.

December 2019 DOT&E Report

Regarding the CVN-78 program, the December 2019 DOT&E report stated the following in part:

Assessment

• As noted in previous annual reports, the test schedule has been aggressive. This year, the planned schedule slipped over a year. The recent extension in Planned Ship Availability delayed both phases of initial operational testing until FY22, and pushed the ship's first deployment to FY23.

Reliability

• Four of CVN 78's new systems stand out as being critical to flight operations: EMALS, AAG, DBR, and AWE. Overall, the poor reliability demonstrated by AAG and EMALS and the uncertain reliability of DBR and AWE could further delay CVN 78 IOT&E. Reliability estimates derived from test data for EMALS and AAG are discussed in following subsections. Since CVN 78 spent FY19 in the shipyard for PSA, the Navy has not conducted additional aircraft launches or recoveries from the ship. For DBR and AWE, only engineering reliability estimates have been provided.

EMALS

• Through the first 747 shipboard launches, EMALS suffered 10 critical failures. This is well below the requirement for Mean Cycles Between Critical Failures, where a cycle represents the launch of one aircraft. The Navy identified 9 unique Incident Reports (IRs) that resulted in the 10 critical failures for EMALS. Of the nine IRs, one fix was installed during PSA and is in place to support flight operations during CVN 78's Post Delivery Test and Trials (PDT&T). Four IRs will be corrected commencing in late FY20. The four remaining IRs occurred only once during pre-PSA operations, are deemed low priority, and will be monitored during future flight operations.

• The reliability concerns are exacerbated by the fact that the crew cannot readily electrically isolate EMALS components during flight operations due to the shared nature of the Energy Storage Groups and Power Conversion Subsystem inverters on board CVN 78. The process for electrically isolating equipment is time-consuming; spinning down the EMALS motor/generators takes 1.5 hours by itself. The inability to readily electrically isolate equipment precludes EMALS maintenance during flight operations.

[53] David B. Larter, "Amid the Latest Ford Controversy, a Green Workforce Is Making Rapid Progress on Its Sister Ship," *Defense News*, November 7, 2019.

AAG

• The Program Office redesigned major components that did not meet system specifications during land-based testing. Through the first 747 attempted shipboard landings, AAG suffered 10 operational mission failures, including one incident to the engine that supports the barricade. The Navy identified 7 unique IRs that caused the 10 operational mission failures for AAG. Of the seven, six fixes have been installed and will be in place to support flight operations during CVN 78's PDT&T. The one remaining IR occurred once, is deemed low priority, and will be monitored during future flight operations.

• This reliability estimate falls well below the re-baselined reliability growth curve and well below the requirement for Mean Cycles Between Operational Mission Failures, where a cycle represents the recovery of one aircraft.

• The reliability concerns are magnified by the current AAG design that does not allow electrical isolation of the Power Conditioning Subsystem equipment from high power buses, limiting corrective maintenance on below-deck equipment during flight operations.

Combat System

• The CVN 78 SDTS events revealed good performance of the SSDS Mark 2 command decision system due to its ability to manage the combat system tracks, manage and apply the ship's engagement doctrine, and schedule intercepts and launch missiles against incoming subsonic anti-ship cruise missile (ASCM) surrogates.

• In the most recent CVN 78 SDTS developmental test event, the MFR and CEC failed to maintain detections and tracks for one of the threat surrogates in the multi-target raid; however, that raid presented a scenario that was more challenging to the combat system than originally planned.

• In developmental testing on SDTS, the SLQ-32(V)6 electronic surveillance system demonstrated poor performance that prompted the Navy to delay additional operational tests until those problems could be corrected. Similar problems were previously reported in DOT&E's September 2016 SLQ-32(V)6 SEWIP Block 2 IOT&E Report.

• The Navy continues to address known deficiencies with the DBR Air Traffic Control (ATC), but the resolution of those problems will not be known until CVN 78 returns to sea. In at-sea testing before the PSA, DBR was plagued by extraneous false and close-in dual tracks adversely affecting ATC performance, and Navy analysis noted that DBR performance needs to be improved to support carrier ATC center certification.

SGR

• CVN 78 is unlikely to achieve its SGR requirement. The target threshold is based on unrealistic assumptions including fair weather and unlimited visibility, and that aircraft emergencies, failures of shipboard equipment, ship maneuvers, and manning shortfalls will not affect flight operations. During the 2013 operational assessment, DOT&E conducted an analysis of past aircraft carrier operations in major conflicts. The analysis concludes that the CVN 78 SGR requirement is well above historical levels.

• DOT&E plans to assess CVN 78 performance during IOT&E by comparing it to the SGR requirement, as well as to the demonstrated performance of the Nimitz-class carriers.

• Poor reliability of key systems that support sortie generation on CVN 78 could cause a cascading series of delays during flight operations that would affect CVN 78's ability to generate sorties. The poor or unknown reliability of these critical subsystems represents the most risk to the successful completion of CVN 78 IOT&E.

Manning

• Based on current expected manning, the berthing capacity for officers and enlisted will be exceeded by approximately 100 personnel with some variability in the estimates. This

also leaves no room for extra personnel during inspections, exercises, or routine face-to-face turnovers.

• Planned ship manning requires filling 100 percent of the billets. This is not the Navy's standard practice on other ships, and the personnel and training systems may not be able to support 100 percent manning. Additionally, workload estimates for the many new technologies, such as catapults, arresting gear, radar, and weapons and aircraft elevators are not yet well understood.

Electromagnetic Compatibility

• Developmental testing identified significant electromagnetic radiation hazard and interference problems. The Navy continues to characterize and develop mitigation plans for the problems, but some operational limitations and restrictions are expected to persist into IOT&E and deployment. The Navy will need to develop capability assessments at differing levels of system utilization in order for commanders to make informed decisions on system employment.

Live Fire Test & Evaluation

• The potential vulnerability of CVN 78's new critical systems to underwater threat-induced shock has not yet been fully characterized. The program continued shock testing on EMALS, AAG, and the AWE components during CY19 but because of a scarcity of systems, alternatives to component shock testing of DBR components are being pursued and shock testing will likely not be completed before the FSST. The Vulnerability Assessment Reports delivered to date provide an assessment of the ship's survivability to air-delivered threat engagements. The classified findings in the report identify the specific equipment that most frequently would lead to mission capability loss. In FY20, the Navy is scheduled to deliver additional report volumes that will assess vulnerability to underwater threats and compliance with Operational Requirements Document survivability criteria.

Recommendations

The Navy should:

1. Continue to characterize the electromagnetic environment on board CVN 78 and develop operating procedures to maximize system effectiveness and maintain safety. As applicable, the Navy should utilize the lessons learned from CVN 78 to inform design modifications for CVN 79 and future carriers.

2. Fund all remaining SDTS events and explore the possibility of leaving the MFR on the SDTS past 2QFY20 to allow for completion of the CVN 78 self-defense test program.

3. Fund the CVN 78 lead ship combat system operational testing and the M&S required to support assessment of the CVN 78 PRA requirement.

4. Implement the required software updates to multiple combat system elements to allow cueing from external sources necessary to conduct one of the SDTS test events.[54]

June 2020 GAO Report

The June 2020 GAO report, which covers some issues previously discussed in this CRS report, stated the following:

Technology Maturity, Design Stability, and Production Readiness

[54] Department of Defense, Director, Operational Test & Evaluation, *FY2019 Annual Report*, December 20, 2019, pp. 125-126.

This year the Navy reported that all 12 of the Ford Class's critical technologies were fully mature, an increase from the nine technologies that were mature at delivery. However, while the Navy assessed the advanced weapons elevators as mature, it ended the first post-delivery maintenance period in October 2019 with only four of the 11 elevators certified to operate. Further, none of the elevators that operate between the main deck and the lower decks are currently operational, which means the elevators are still not capable of bringing munitions to the flight deck. The Navy is working with the shipbuilder to complete all elevator work by Spring 2021—an 18-month delay from the schedule we reported last year. The Navy also constructed a land-based site to test the performance and reliability of the elevators, which is expected to be ready in early 2021.

Despite maturing its critical technologies, the Navy is still struggling to demonstrate the reliability of key systems, including the electromagnetic aircraft launch system (EMALS); Advanced Arresting Gear (AAG); and dual band radar (DBR). The Navy is continuing shipboard testing for these systems but has delayed operational testing by 18 months while it revises the test schedule to coordinate test schedules and complete deployment preparations. Although the Navy is testing EMALS and AAG on the ship with aircraft, the reliability of those systems remains a concern. If these systems cannot function safely by the time operational testing begins, CVN 78 will not be able to demonstrate it can rapidly deploy aircraft—a key requirement for these carriers.

Challenges in maturing CVN 78's critical technologies has led to their redesign or replacement on later ships in some cases. CVN 79 repeats the CVN 78 design with some modifications and replaces DBR with the Enterprise Air Surveillance Radar (EASR), which is in development. The Navy plans to procure two EASR units for CVNs 79 and 80 and install the CVN 79 unit during that ship's second phase of delivery. CVNs 80 and 81 will repeat the design of CVN 79.

Software and Cybersecurity

Software development for CVN 78's critical technologies is managed through separate program offices. For example, a separate program office manages AAG and EMALS, which rely on a mix of commercial and custom software. According to program officials, the Navy assessed these systems for cybersecurity vulnerabilities in August and October 2019. According to CVN 78 program officials, other ship systems have also undergone, or are scheduled to undergo, cybersecurity penetration or adversarial testing. The program is scheduled to complete an evaluation for potential cybersecurity vulnerabilities connected with section 1647 of the National Defense Authorization Act for Fiscal Year 2016 in May 2022.

Other Program Issues

In September 2019, the Navy increased the CVN 78 cost cap by $197 million to $13.2 billion in part to correct deficiencies in the advanced weapons elevators. This is the Navy's third adjustment to the cost cap since 2017. CVN 78's procurement costs increased by over $2.7 billion from its initial cost cap. Continuing technical deficiencies mean the Navy may still require more funding to complete this ship.

Further, the Navy is unlikely to obtain planned cost savings and construction efficiencies on the next three ships in the Ford class. We previously reported on the optimistic cost and labor assumptions for CVN 79, based on a projected 18 percent labor hour reduction compared to hours to construct CVN 78. In 2019 the shipbuilder increased the estimated cost at completion due to using more labor hours for CVN 79 than expected. In addition, the Navy awarded a contract to buy two carriers simultaneously—CVNs 80 and 81—based on the assumption that this strategy will save the Navy over $4 billion. However, the Navy's cost analysis showed that CVN 80 and 81 have a high likelihood of experiencing cost overruns, and it is uncertain whether the Navy can achieve the expected savings. The

Navy assumed a further reduction in labor hours compared to CVN 79—about 25 percent fewer labor hours than CVN 78—will contribute to cost savings for these ships.

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. The program office stated that CVN 78 is in an 18-month post-delivery testing phase; completed over 2,000 aircraft launches and recoveries since delivery in May 2017; and completed numerous test events and certifications. According to the program office, the Navy certified four elevators and plans to certify two more in April and September of 2020, and five remaining elevators are on track for certification in fiscal year 2021. The program stated that the Navy launched CVN 79 2 months ahead of schedule in December 2019, and construction is 70 percent complete. It also said Navy leadership approved a change for CVN 79 from a two-phase acquisition to a single phase delivery strategy and released a request for proposals for this new approach in January 2020. Additionally, the program stated that the Navy awarded the CVNs 80 and 81 detail design and construction contract in January 2019 and projected savings of over $4 billion compared to a single ship contract; CVN 80 construction is 3 percent complete and scheduled for delivery in 2028; and CVN 81 has begun material procurement and is scheduled for delivery in 2032.[55]

Design of Aircraft Carrier to Be Procured after CVN-81

Overview

Another oversight issue for Congress is whether the aircraft carrier to be procured after CVN-81 should be a Ford-class carrier (i.e., a CVN) or a smaller and perhaps nonnuclear-powered aircraft carrier. The Navy's FY2020 30-year shipbuilding plan calls for procuring the next carrier in FY2028, and for that carrier to be a CVN. The question of whether the Navy should shift at some point from procuring CVNs like the CVN-78 class to procuring smaller and perhaps nonnuclear-powered aircraft carriers has been a recurrent matter of discussion and Navy study over the years, and is currently an active discussion in the Navy.

Advocates of smaller carriers traditionally have argued that they are individually less expensive to procure, that the Navy might be able to employ competition between shipyards in their procurement (something that the Navy cannot do with large-deck, nuclear-powered carriers like the CVN-78 class, because only one U.S. shipyard, HII/NNS, can build aircraft carriers of that size), and that today's aircraft carriers concentrate much of the Navy's striking power into a relatively small number of expensive platforms that adversaries could focus on attacking in time of war.

Supporters of CVNs traditionally have argued that smaller carriers, though individually less expensive to procure, are less cost-effective in terms of dollars spent per aircraft embarked or aircraft sorties that can be generated, that it might be possible to use competition in procuring certain materials and components for large-deck, nuclear-powered aircraft carriers, and that smaller carriers, though perhaps affordable in larger numbers, would be individually less survivable in time of war than CVNs.

Section 128(d) of the FY2016 National Defense Authorization Act (S. 1356/P.L. 114-92 of November 25, 2015) required the Navy to submit a report on potential requirements, capabilities, and alternatives for the future development of aircraft carriers that would replace or supplement

[55] Government Accountability Office, *Defense Acquisitions Annual Assessment[:] Drive to Deliver Capabilities Faster Increases Importance of Program Knowledge and Consistent Data for Oversight*, GAO-20-439, June 2020, p. 120.

the CVN–78 class aircraft carrier. The report, which was conducted for the Navy by the RAND Corporation, was delivered to the congressional defense committees in classified form in July 2016. An unclassified version of the report was then prepared and issued in 2017 as a publicly released RAND report.[56] The question of whether to shift to smaller aircraft carriers was also addressed in three studies on future fleet architecture that were required by Section 1067 of the FY2016 National Defense Authorization Act (S. 1356/P.L. 114-92 of November 25, 2015).

Current Discussion

Statements from Navy officials reported in the press beginning in February 2019 suggested that the Navy is currently considering moving to a new aircraft carrier/naval aviation force architecture that might supplement today's CVNs with smaller and perhaps nonnuclear-powered aircraft carriers.[57] According to these press reports, one option for a smaller carrier is the so-called Lighting Carrier, a term referring to an LHA-type amphibious assault ship equipped with an air wing consisting largely of F-35B Joint Strike Fighter (JSFs). (The alternate name for the F-35 is the Lighting II. The B variant of the F-35, which is currently being procured for the Marine Corps, is short takeoff, vertical landing [STOVL] variant that can be operated off of ships with flight decks that are shorter than the flight decks of CVNs.) The Navy and Marine Corps have conducted experiments with the Lightning Carrier concept.[58] Another option for a smaller carrier is one whose air wing would consist mostly or entirely of unmanned aerial vehicles (UAVs). The Navy in recent years has periodically studied the potential of UAV carriers.

The current discussion both inside and outside the Navy over the aircraft carrier to be procured after CVN-81 appears to reflect several considerations, including the following:

- concerns over China's improving capabilities for detecting surface ships and attacking them with anti-ship ballistic missiles (ASBMs) and advanced anti-ship cruise missiles (ASCMs);
- the procurement and operating and support (O&S) costs of CVNs and their air wings, particularly in a context of constraints on Navy funding and funding demands from other competing Navy programs; and
- the potential capabilities of smaller carriers operating air wings consisting of unmanned aerial vehicles (UAVs) and/or F-35B Joint Strike Fighters (i.e., the short-takeoff, vertical landing [STOVL] version of the F-35 now being procured for the Marine Corps).

[56] Bradley Martin and Michael McMahon, *Future Aircraft Carrier Options*, Santa Monica, CA, RAND Corporation, 2017, 87 pp.

[57] See Rich Abott, "Navy Starts Looking At Carriers After CVN-81," *Defense Daily*, February 15, 2019; Richard R. Burges, "Secretary: Navy Discussing Next-Gen Carrier Concepts, Including 'Lightning Carrier,'" *Seapower*, October 24, 2019; Wesley Morgan, "Navy Secretary Accuses Congressional Critics of 'Disinformation' on Ford Carrier," *Politico Pro*, October 23, 2019; Otto Kreisher, "Spencer Lauds Tight Integration of Navy, Marine Forces in 'Great Power Competition,'" *Seapower*, October 27, 2019; Sam LaGrone, "Navy Still Mulling Post-F-35C Aviation Combatant; Could be Mix of Manned, Unmanned Aircraft," *USNI News*, December 5, 2019; Gina Hawkins, "Acting SecNav Hints at Fewer Aircraft Carriers in Next Ship-Count Plan," *Military.com*, January 29, 2020; Sam LaGrone, "Future of U.S. Carrier Fleet Key Issue as New Force Structure Moves Through Pentagon," *USNI News*, January 29, 2020; Rich Abott, "Modly: Future Carrier Force Unclear, All Options On The Table," *Defense Daily*, January 30, 2020.

[58] See, for example, Megan Eckstein, "Marines Test 'Lightning Carrier' Concept, Control 13 F-35Bs from Multiple Amphibs," *USNI News*, October 23, 2019.

Future Carrier 2030 Task Force (Reportedly Canceled)

A March 9, 2020, Navy news release stated:

> [Then-]Acting Secretary of the Navy Thomas B. Modly announced today he is commissioning a Blue-Ribbon Future Carrier 2030 (FC-2030) Task Force to conduct a six-month study to reimagine the future of the aircraft carrier and carrier-based naval aviation (manned and unmanned) for 2030 and beyond.
>
> FC-2030 will be complementary to, and informed by a broad review of national shipbuilding requirements being conducted by Deputy Secretary of Defense David L. Norquist. Navy and Marine Corps uniformed and civilian leadership will be engaged in both efforts. FC-2030 will attract current and former leaders from Congress, leaders from the U.S. shipbuilding and supporting technology industries, current and former Department of Defense leaders, as well as thought leaders at War Colleges, think-tanks, and futurists from around the nation.
>
> "The long-term challenges facing our nation and the world demand clear-eyed assessments and hard choices," said Modly. "Because we have four new Ford carriers under contract, we have some time to reimagine what comes next. Any assessment we do must consider cost, survivability, and the critical national requirement to sustain an industrial base that can produce the ships we need—ships that will contribute to a superior, integrated naval force for the 2030s and far beyond.
>
> "Aircraft carrier construction sustains nearly 60,000 skilled jobs in over 46 states," Modly added. "It can't be simply turned on and off like a faucet. We must be thoughtful in how we approach changes as they will have lasting impacts on our national industrial competitiveness and employment."
>
> The task force will be led by an Executive Director chosen from within the Department of the Navy's Secretariat staff, and assisted on a collateral-duty basis by representatives from the Office of Naval Research and the Deputy Chief of Naval Operations for Warfighting Development.
>
> Along with an executive director, the FC-2030 Senior Executive Panel will consist of thought leaders with historical records of leading and contributing to large change in maritime defense strategies and programs. Former Senator John Warner of Virginia has agreed to serve as the Honorary Chairman of the Executive Panel. Former Secretary of the Navy John Lehman, former acting Deputy Secretary of Defense Christine Fox, former Deputy Undersecretary of the Navy Seth Cropsey, and former Congressman Randy Forbes have agreed to serve as Executive members of the panel.
>
> "Our future strength will be determined as much by the gray matter we apply to our challenges as the gray hulls we build," said Modly. "We need the best minds from both inside and outside of government focused on this issue."
>
> The study will be conducted with the assistance of the Naval University System (U.S. Naval Academy, Naval War College, Marine Corps University, and Naval Postgraduate School) as well as eligible Federally Funded Research and Development Centers (FFRDCs) and Naval Warfare Centers.
>
> The goal at the end of the study is to provide a report to the secretary of the Navy detailing a vision of the competitive global security environment and the role of carrier-based naval aviation in that future context. Considerations will include expected principles of deterrence, global presence missions, protection of American economic security, as well as potential combat with possible adversaries.
>
> The study will also define likely constraints of means in terms of future defense budgets, as well as avenue to contemplate future possible technologies not yet invented that could change the stakes of carrier-based naval aviation in all phases of global competition.

> Finally, the report will provide options for the Department of the Navy in requirements for different various future aircraft (manned and unmanned, nuclear and/or conventional) carriers, to be used in future months and years in developing guidance to industry. The study will also examine how best to utilize and evolve the existing carrier fleet, including the more flexible and adaptable Ford Class, to meet the challenges of advanced long-range weapons that will extend and expand contested areas in the future.[59]

A May 12, 2020, press report, however, stated that

> Acting Navy Secretary James McPherson has scuttled a major initiative of his ousted predecessor, canceling a planned 6-month study on the future of the aircraft carrier, relying instead on a DoD-led effort to determine the size and structure of the future fleet.
>
> The acting SecNav, who has kept the ship steady since taking over from Thomas Modly last month, "recently determined the Department of the Navy will not, for the time being, move forward with the Future Carrier 2030 effort," Cmdr. Sarah Higgins told me in an email. Instead, the Navy "will fully support the Department of Defense's internal study on future force structure requirements, which will include a carrier review."
>
> The carrier review was the brainchild of Modly, who resigned in March amid the chaos of his firing of the captain of the COVID-19 stricken carrier USS Theodore Roosevelt.
>
> The deep dive into the future of the carrier was problematic from the start. It was scheduled to wrap up in September, two months after the Pentagon planned to release its version of the Navy's new force structure plan.
>
> That schedule would have made the carrier study dead on arrival, since Defense Secretary Mark Esper's views on the shape of the fleet would outrank the Navy study, and would have been briefed to the Hill weeks before.
>
> Asked specifically about Modly's carrier review in written answers submitted to the Senate Armed Services Committee last week before his nomination hearing to become the next Navy Secretary, Kenneth Braithwaite declined to support the effort.
>
> "It is my understanding that a 2016 study completed by the RAND corporation, which examined notional aircraft carrier variants that could replace or supplement the FORD class CVN, confirmed the design attributes of the FORD Class CVN in a near-peer conflict," he wrote. "It is further my understanding that the capabilities of survivability, maintainability, and power projection have been designed into our FORD-class CVNs to support the high-end fight."
>
> That position didn't give the carrier study much top cover, and signaled it might not have long to live if Braithwaite was confirmed.[60]

[59] Secretary of the Navy Public Affairs, "Acting SECNAV to Commission Future Carrier 2030 Task Force," *Navy News Service*, March 9, 2030. See also Paul McCleary, "Beyond The Ford: Navy Studies Next-Gen Carriers EXCLUSIVE," *Breaking Defense*, March 5, 2020.; Megan Eckstein, "Navy Kicks Off Study of Next-Generation Carriers, Naval Aviation," *USNI News*, March 9, 2020; Mallory Shelbourne, "Modly launches 2030 Carrier Task Force," *Inside Defense*, March 10, 2030; Megan Eckstein, "Modly: Parallel Fleet Studies Could Reshape Future of Aircraft Carriers," *USNI News*, March 12, 2030.

[60] Paul McLeary, "Navy Scraps Big Carrier Study, Clears Deck For OSD Effort," *Breaking Defense*, May 12, 2020. See also Megan Eckstein, "Acting SECNAV McPherson Ends Navy Future Carrier Study; Nominee Braithwaite Gives Full Support to Ford Program," *USNI News*, May 12, 2020.

Shock Trial

An earlier oversight issue for Congress for the CVN-78 program was whether to conduct the shock trial for the CVN-78 class in the near term, on the lead ship in the class, or years later, on the second ship in the class. For background information on that issue, see **Appendix B**.

Legislative Activity for FY2021

Summary of Congressional Action on FY2021 Funding Request

Table 3 summarizes congressional action on the FY2021 procurement funding request for the CVN-78 program.

Table 3. Congressional Action on FY2021 Procurement Funding Request

Millions of dollars, rounded to nearest tenth.

		Authorization			Appropriation		
	Request	HASC	SASC	Conf.	HAC	SAC	Conf.
CVN-78	71.0						
CVN-79	0						
CVN-80	997.5						
CVN-81	1,645.6						
Total above	2,714.1						

Source: Table prepared by CRS based on Navy's FY2021 budget submission, committee and conference reports, and explanatory statements on FY2021 National Defense Authorization Act and FY2020 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.

Appendix A. Background Information on Two-Ship Block Buy for CVN-80 and CVN-81

This appendix presents additional background information on the two-ship block buy contract for CVN-80 and CVN-81.

The option for procuring two CVN-78 class carriers under a two-ship block buy contract had been discussed in this CRS report since April 2012.[61] In earlier years, the discussion focused on the option of using a block buy contract for procuring CVN-79 and CVN-80. In more recent years, interest among policymakers focused on the option of using a block buy contract for procuring CVN-80 and CVN-81.

On March 19, 2018, the Navy released a request for proposal (RFP) to Huntington Ingalls Industries/Newport News Shipbuilding (HII/NNS) regarding a two-ship buy of some kind for CVN-80 and CVN-81. A March 20, 2018, Navy News Service report stated the following:

> The Navy released a CVN 80/81 two-ship buy Request for Proposal (RFP) to Huntington Ingalls Industries—Newport News Shipbuilding (HII-NNS) March 19 to further define the cost savings achievable with a two-ship buy.
>
> With lethality and affordability a top priority, the Navy has been working with HII-NNS over the last several months to estimate the total savings associated with procuring CVN 80 and CVN 81 as a two-ship buy.
>
> "In keeping with the National Defense Strategy, the Navy developed an acquisition strategy to combine the CVN 80 and CVN 81 procurements to better achieve the Department's objectives of building a more lethal force with greater performance and affordability," said James F. Geurts, Assistant Secretary of the Navy, Research Development and Acquisition. "This opportunity for a two-ship contract is dependent on significant savings that the shipbuilding industry and government must demonstrate. The Navy is requesting a proposal from HII-NNS in order to evaluate whether we can achieve significant savings."
>
> The two-ship buy is a contracting strategy the Navy has effectively used in the 1980s to procure Nimitz-class aircraft carriers and achieved significant acquisition cost savings compared to contracting for the ships individually. While the CVN 80/81 two-ship buy negotiations transpire, the Navy is pursuing contracting actions necessary to continue CVN 80 fabrication in fiscal year (FY) 2018 and preserve the current schedule. The Navy plans to award the CVN 80 construction contract in early FY 2019 as a two-ship buy pending Congressional approval and achieving significant savings.[62]

Section 121(a)(2) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (H.R. 5515/P.L. 115-232 of August 13, 2018) permitted the Navy, after the Department of Defense (DOD) made certain certifications to Congress, to add CVN-81 to the existing contract for building CVN-80. DOD provided the required certification on December 31, 2018. On

[61] See the section entitled "Potential Two-Ship Block Buy on CVN-79 and CVN-80" in the April 4, 2012, version of CRS Report RS20643, *Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress*, by Ronald O'Rourke. In more recent years, this section was modified to discuss the option in connection with CVN-80 and CVN-81.

[62] Naval Sea Systems Command Public Affairs, "Navy Seeks Savings, Releases Two-Carrier RFP," *Navy News*, March 20, 2018. See also Megan Eckstein, "UPDATED: Navy, Newport News Taking Steps Towards Two-Carrier Buy," *USNI News*, March 19, 2018.

January 31, 2019, the Navy announced that it had awarded a two-ship fixed-price incentive (firm target) (FPIF) contract for CVN-80 and CVN-81 to HII/NNS.[63]

The two-ship contract for CVN-80 and CVN-81 can be viewed as a block buy contract because the two ships are being procured in different fiscal years (CVN-80 was procured in FY2018 and CVN-81 is shown in the Navy's FY2020 budget submission as a ship procured in FY2020).[64] The Navy's previous two-ship aircraft carrier procurements occurred in FY1983 (for CVN-72 and CVN-73) and FY1988 (for CVN-74 and CVN-75). In each of those two earlier cases, however, the two ships were fully funded within a single fiscal year, making each of these cases a simple two-ship purchase (akin, for example, to procuring two Virginia-class attack submarines or two DDG-51 class destroyers in a given fiscal year) rather than a two-ship block buy (i.e., a contract spanning the procurement of end items procured across more than one fiscal year).

Compared to DOD's estimate that the two-ship block buy contract for CVN-80 and CVN-81 would produce savings of $3.9 billion (as measured from estimated costs for the two ships in the December 2017 Navy business case analysis), DOD states that "the Department of Defense's Office of Cost Assessment and Program Evaluation (CAPE) developed an Independent Estimate of Savings for the two-ship procurement and forecast savings of $3.1 billion ([in] Then-Year [dollars]), or approximately 11 percent.... The primary differences between [the] CAPE and Navy estimates of savings are in Government Furnished Equipment[65] and production change orders."[66] Within the total estimated combined reduction in cost, HII/NNS reportedly expects to save up to $1.6 billion in contractor-furnished equipment.[67]

A November 2018 DOD report to Congress that was submitted as an attachment to DOD's December 31, 2018, certification stated the following regarding the sources of cost reduction for the two-ship contract:

> The CVN 80 and CVN 81 two-ship buy expands and improves upon the affordability initiatives identified in the Annual Report on Cost Reduction Efforts for JOHN F. KENNEDY (CVN 79) and ENTERPRISE (CVN 80) as required by section 126(c) of the National Defense Authorization Act for Fiscal Year 2017 (P.L. 114-328). Production saving initiatives for single-ship buys included use of unit families in construction, pre-outfitting and complex assemblies which move work to a more efficient workspace environment, reduction in the number of superlifts,[68] and facility investments which improve the shipbuilder trade effectiveness. A two-ship buy assumes four years between

[63] See Office of the Navy Chief of Information, "Navy Awards Contract for Construction of Two Carriers," Navy News Service, January 31, 2019; Megan Eckstein, "UPDATED: Navy Awards 2-Carrier Contract to Newport News Shipbuilding," *USNI News*, January 31, 2019; Marcus Weisgerber, "US Navy Places First 2-Carrier Order in Three Decades," *Defense One*, January 31, 2019; David B. Larter, "US Navy Signs Mammoth Contract with Huntington Ingalls for Two Aircraft Carriers," *Defense News*, January 31, 2019; Rich Abott, "Navy Awards HII $15 Billion In Two Carrier Buy," *Defense Daily*, February 1, 2019.

[64] 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.

[65] Government-furnished equipment (GFE) is equipment that the government purchases from supplier firms and then provides to the shipbuilder for incorporation into the ships.

[66] Department of Defense, FORD Class Aircraft Carrier Certification, CVN 80 and CVN 81 Two Ship Procurement Authority, as Required by Section 121(b) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (P.L. 115-232), November 2018, pp. 8-9.

[67] Rich Abott, "Navy Awards HII $15 Billion In Two Carrier Buy," *Defense Daily*, February 1, 2019. Contractor-furnished equipment (CFE) is equipment that the contractor (in this case, HII/NNS) purchases from supplier firms for incorporation into the ships.

[68] A superlift is the use of a crane to move a very large section of the ship from the land into its final position on the ship.

ship deliveries which allows more schedule overlap, and therefore more shop-level and assembly-level production efficiencies than two single-ship buys.

Procuring two ships to a single technical baseline reduces the requirement for engineering labor hours when compared to single-ship estimates. The ability to rollover production support engineering and planning products maximizes savings while recognizing the minimum amount of engineering labor necessary to address obsolescence and regulatory changes on CVN 81. The two-ship agreement with the shipbuilder achieves a 55 percent reduction in construction support engineering hours on CVN 81 and greater than 18 percent reduction in production support and planning hours compared to single ship procurements.

The two-ship procurement strategy allows for serial production opportunities that promote tangible learning and reduced shop and machine set-up times. It allows for efficient use of production facilities, re-use of production jigs and fixtures, and level loading of key trades. The continuity of work allows for reductions in supervision, services and support costs. The result of these efficiencies is a production man-hours step down that is equivalent to an 82 percent learning curve since CVN 79.

Key to achieving these production efficiencies is Integrated Digital Shipbuilding (iDS). The Navy's Research, Development, Test, and Evaluation (RDT&E) and the shipbuilder's investment in iDS, totaling $631 million, will reduce the amount of production effort required to build FORD Class carriers. The two-ship buy will accelerate the benefits of this approach. The ability to immediately use the capability on CVN 81 would lead to a further reduction in touch labor and services in affected value streams. The two-ship agreement with the shipbuilder represents a production man-hours reduction of over seven percent based on iDS efficiencies. Contractual authority for two ships allows the shipbuilder to maximize economic order quantity material procurement. This allows more efficient ordering and scheduling of material deliveries and will promote efficiencies through earlier ordering, single negotiations, vendor quotes, and cross program purchase orders. These efficiencies are expected to reduce material costs by about six percent more when compared to single-ship estimates. Improved material management and flexibility will prevent costly production delays. Furthermore, this provides stability within the nuclear industrial base, de-risking the COLUMBIA and VIRGINIA Class programs. The two-ship buy would provide economic stability to approximately 130,000 workers across 46 States within the industrial base.

Change order requirements are likewise reduced as Government Furnished Equipment (GFE) providers will employ planning and procurement strategies based on the common technical baseline that minimize configuration changes that must be incorporated on the follow ship. Change order budget allocations have been reduced over 25 percent based on two-ship strategies.

In addition to the discrete savings achieved with the shipbuilder, the two-ship procurement authority provides our partner GFE providers a similar opportunity to negotiate economic order quantity savings and achieve cross program savings when compared to single-ship estimates.[69]

An April 16, 2018, press report stated the following:

> If the Navy decides to buy aircraft carriers CVN-80 and 81 together, Newport News Shipbuilding will be able to maintain a steady workload that supports between 23,000 and 25,000 workers at the Virginia yard for the next decade or so, the shipyard president told reporters last week.

[69] Department of Defense, FORD Class Aircraft Carrier Certification, CVN 80 and CVN 81 Two Ship Procurement Authority, as Required by Section 121(b) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (P.L. 115-232), November 2018, pp. 6-7.

> Part of the appeal of buying the two carriers together is that the Navy would also buy them a bit closer together: the ships would be centered about three-and-a-half or four years apart, instead of the five-year centers for recent carrier acquisition, Newport News Shipbuilding President Jennifer Boykin told reporters.
>
> Boykin said the closer ship construction centers would allow her to avoid a "labor valley" where the workforce levels would dip down after one ship and then have to come back up, which is disruptive for employees and costly for the company.
>
> If this two-carrier buy goes through, the company would avoid the labor valley altogether and ensure stability in its workforce, Boykin said in a company media briefing at the Navy League's Sea Air Space 2018 symposium. That workforce stability contributes to an expected $1.6 billion in savings on the two-carrier buy from Newport News Shipbuilding's portion of the work alone, not including government-furnished equipment....
>
> Boykin said four main things contribute to the expected $1.6 billion in savings from the two-carrier buy. First, "if you don't have the workforce valley, there's a labor efficiency that represents savings."
>
> Second, "if you buy two at once, my engineering team doesn't have to produce two technical baselines, two sets of technical products; they only have to produce one, and the applicability is to both, so there's savings there. When we come through the planning, the build plan of how we plan to build the ship, the planning organization only has to put out one plan and the applicability is to both, so there's savings there."
>
> The third savings is a value of money over time issue, she said, and fourth is economic order quantity savings throughout the entire supply chain.[70]

Discussions of the option of using a block buy contract for procuring carriers have focused on using it to procure two carriers in part because carriers have been procured on five-year centers, meaning that two carriers could be included in a block-buy contract spanning six years—the same number of years originally planned for the two block buy contracts that were used to procure mnay of the Navy's Littoral Combat Ships.[71]

It can be noted, however, that there is no statutory limit on the number of years that a block buy contract can cover, and that the LCS block buy contracts were subsequently amended to cover LCSs procured in a seventh year. This, and the possibility of procuring carriers on 3- or 3.5-year centers, raises the possibility of using a block buy contract to procure three aircraft carriers: For example, if procurement of aircraft carriers were shifted to 3- or 3.5-year centers, a block buy contract for procuring CVN-80, CVN-81, and CVN-82 could span seven years (with the first ship procured in FY2018, and the third ship procured in FY2024) or eight years (with the first ship procured in FY2018 and the third ship procured in FY2025).

The percentage cost reduction possible under a three-ship block buy contract could be greater than that possible under a two-ship block buy contract, but the offsetting issue of reducing congressional flexibility for changing aircraft carrier procurement plans in coming years in response to changing strategic or budgetary circumstances could also be greater.

[70] Megan Eckstein, "Newport News Would Save $1.6 Billion, Maintain Stable Workforce of 25,000 Under 2 Proposed Carrier Buy," *USNI News*, April 16, 2018. See also Rich Abott, "HII Sees Two Carrier Buy Saving $1.6 Billion Before GFE," *Defense Daily*, April 11, 2018: 10-11.

[71] For more on the LCS block buy contracts, see CRS Report RL33741, *Navy Littoral Combat Ship (LCS) Program: Background and Issues for Congress*, by Ronald O'Rourke.

Appendix B. Shock Trial

An earlier oversight issue for Congress for the CVN-78 program was whether to conduct the shock trial for the CVN-78 class in the near term, on the lead ship in the class, or years later, on the second ship in the class. This appendix presents background information on that issue.

A shock trial, known formally as a full ship shock trial (FSST) and sometimes called a shock test, is a test of the combat survivability of the design of a new class of ships. A shock trial involves setting off one or more controlled underwater charges near the ship being tested, and then measuring the ship's response to the underwater shock caused by the explosions. The test is intended to verify the ability of the ship's structure and internal systems to withstand shocks caused by enemy weapons, and to reveal any changes that need to be made to the design of the ship's structure or its internal systems to meet the ship's intended survivability standard. Shock trials are nominally to be performed on the lead ship in a new class of ships, but there have also been cases where the shock trial for a new class was done on one of the subsequent ships in the class.

The question of whether to conduct the shock trial for the CVN-78 class in the near term, on the lead ship in the class, or years later, on the second ship in the class, has been a matter of disagreement at times between the Navy and the office of the Secretary of Defense (OSD). The Navy has wanted to perform the shock trial on the second ship in the class, because performing it on the lead ship in the class, the Navy has argued, will cause a significant delay in the first deployment of the lead ship, effectively delaying the return of the carrier force to an 11-ship force level and increasing the operational strain on the other 10 carriers. The Navy has argued that the risks of delaying the shock trial on the CVN-78 to the second ship in the class are acceptable, because the CVN-78 class hull design is based on the Nimitz (CVN-68) class aircraft carrier hull design, whose survivability against shocks is understood, because systems incorporated into the CVN-78 design have been shock tested at the individual component level, and because computer modeling can simulate how the CVN-78 design as a whole will respond to shocks.

OSD has argued that the risks of delaying the CVN-78 class shock trial to the second ship in the class are not acceptable, because the CVN-78 design is the first new U.S. aircraft carrier design in four decades; because the CVN-78 design has many internal design differences compared to the CVN-68 design, including new systems not present in the CVN-68 class design; and because computer modeling can only do so much to confirm how a complex new platform, such as an aircraft carrier and all its internal systems, will respond to shocks. The risk of delaying the shock trial, OSD has argued, outweighs the desire to avoid a delay in the first deployment of the lead ship in the class. OSD in 2015 directed the Navy to plan for conducting a shock trial on the lead ship. The Navy complied with this direction but has also sought to revisit the issue with OSD.

The issue of the shock trial for the CVN-78 class has been a matter of legislative activity—see, for example, Section 121(b) of the FY2018 National Defense Authorization Act (H.R. 2810/P.L. 115-91 of December 12, 2017).

An April 5, 2018, press report states the following:

> The Pentagon's No. 2 civilian has said the Navy should perform shock-testing soon to determine how well its new $12.9 billion aircraft carrier—the costliest warship ever—could withstand an attack, affirming the service's recent decision to back down from a plan for delay.
>
> "We agree with your view that a test in normal sequence is more prudent and pragmatic," Deputy Defense Secretary Patrick Shanahan said in a newly released March 26 letter to Senate Armed Services Committee Chairman John McCain. The Arizona Republican and

Senator Jack Reed, the panel's top Democrat, pressed for the shock-testing to go ahead as originally planned.

James Guerts, the Navy's chiefs weapons buyer, told reporters last month that the Navy was acquiescing to the testing after initially asking Defense Secretary James Mattis to delay it for at least six years. In its push to maintain an 11-carrier fleet, the Navy wanted to wait and perform the test on a second carrier in the class rather than on the USS Gerald Ford.[72]

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Disclaimer

[72] Anthony Capaccio, "Pentagon Endorses Shock-Testing Carrier After Navy Backs Down," *Bloomberg*, April 5, 2018. See also Craig Hooper, "The Navy Obfuscates On Shock Testing The $13 Billion USS Ford," *Forbes*, October 23, 2019; Jason Sherman and Lee Hudson, "Navy to Conduct Full Ship Shock Trials of CVN-78 in '19 or '20," *Inside the Navy*, March 26, 2018; Anthony Capaccio, "Navy Presses Mattis to Delay 'Shock Testing' Costliest Carrier," *Bloomberg*, February 7, 2018; Jason Sherman, "Lawmakers Rraise Ford-Class Carrier Cost Cap, Grant Navy Wiggle Room to Avoid Shock Testing," *Inside the Navy*, November 13, 2017.