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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 FY2024 budget requests \$2,540.4 million (i.e., about \$2.5 billion) in procurement funding for Ford-class ships, including \$624.6 million for CVN-79, \$1,115.3 million for CVN-80, and \$800.5 million for CVN-81.

CVN-78 (*Gerald R. Ford*) was procured in FY2008. The ship's procurement final cost was \$13,316.5 million (i.e., about \$13.3 billion) in then-year dollars. The ship was commissioned into service on July 22, 2017, and achieved initial operational capability in December 2021. The ship's first deployment was delayed by a need to complete work on the ship's weapons elevators and correct other technical problems aboard the ship. The first deployment—a two-month "service-retained deployment" in Atlantic waters that served as an operational stress test—reportedly began on October 4, 2022, more than five years after the ship was commissioned into service, and ended on November 26, 2022. The ship reportedly will make its first full-length deployment in 2023.

CVN-79 (*John F. Kennedy*) was procured in FY2013. The Navy's proposed FY2024 budget estimates the ship's procurement cost at \$12,700.0 million (i.e., \$12.7 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. CVN-79 is scheduled for delivery to the Navy in July 2025.

CVN-80 (*Enterprise*) was procured in FY2018. The Navy's proposed FY2024 budget estimates the ship's procurement cost at \$12,812.9 million (i.e., about \$12.8 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 FY2024 budget submission, like its FY2021-FY2023 submissions, shows CVN-81 as a ship that was procured in FY2020.) The Navy's FY2024 budget submission estimates the ship's procurement cost at \$12,929.1 million (i.e., about \$12.9 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 future aircraft carrier force level;
- the procurement of aircraft carriers after CVN-81;
- the delay in CVN-78's first deployment;
- the transfer of parts intended for CVN-79 to CVN-78;
- 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; and
- additional CVN-78 program issues that were raised in a January 2023 report from the Department of Defense's (DOD's) Director of Operational Test and Evaluation (DOT&E) and a June 2022 Government Accountability Office (GAO) report on DOD weapon systems.

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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 FY2024 budget requests \$2,540.4 million (i.e., about \$2.5 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.

Background

Current Navy Aircraft Carrier Force

The Navy's current aircraft carrier force consists of 11 CVNs,¹ 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, 2017.²

Statutory Requirements for 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.³ 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).⁴

¹ The Navy's last remaining conventionally powered carrier (CV), *Kitty Hawk* (CV-63), was decommissioned on January 31, 2009.

² 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.

³ 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.)

⁴ As mentioned in footnote 2, the carrier force dropped from 11 ships to 10 ships between December 1, 2012, 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 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.

Prohibition on Retiring Nuclear-Powered Aircraft Carriers Prior to Refueling

Section 1054 of the FY2021 National Defense Authorization Act (NDAA) (H.R. 6395/P.L. 116-283) amended 10 U.S.C. 8062 to create a new subsection (f) stating: “A nuclear powered aircraft carrier may not be retired before its first refueling.”

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.⁵

Navy’s Aircraft Carrier Force-Level Goal

Current Aircraft Carrier Force-Level Goal

In December 2016, the Navy released a force-level goal for achieving and maintaining a fleet of 355 ships, including 12 aircraft carriers⁶—one more than the minimum of 11 carriers required by 10 U.S.C. 8062(b).

Emerging Aircraft Carrier Force-Level Goal

The Navy and Department of Defense (DOD) have been working since 2019 to develop a new force-level goal to replace the 355-ship force-level goal of 2016. Studies of this emerging force-level goal that have been released by the Navy in summary form suggest that the new force-level goal could call for achieving and maintaining a Navy with a carrier force of 8 to 12 carriers, to be supplemented (in the case of the lower end of that range) by up to 6 light aircraft carriers (CVLs).⁷

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. Under the Navy’s FY2020 30-year shipbuilding plan, for example, carrier procurement would shift from five-year centers (i.e., one carrier procured each five years) to four-year centers

⁵ 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.

⁶ 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.

⁷ For the effort to develop a successor to the 355-ship goal of 2016, including the studies that the Navy has released in summary form, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O’Rourke.

after the procurement of CVN-82 in FY2028, and a 12-carrier force would be achieved on a sustained basis in the 2060s.⁸

Projected Number of Aircraft Carriers

The Navy's FY2023 30-year (FY2023-FY2052) shipbuilding plan, released on April 20, 2022, includes three alternative 30-year shipbuilding profiles for the period FY2028-FY2052. Based on the three profiles, the 30-year plan projects that the carrier force would increase to 12 ships in FY2024, decline back to 11 ships in FY2025 and remain there through the end of the 2030s (except for FY2027, when it would drop to 10), decline to 10 ships in FY2040 and remain at 9 or 10 ships in subsequent years, and finish the 30-year period at 10 ships in FY2052.⁹

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.¹⁰ Under incremental funding, some of the funding needed to fully fund a ship is provided in one or more years after the year in which the ship is procured.¹¹

⁸ 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 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.

⁹ For projected force levels each year from FY2023 to FY2052, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

¹⁰ The provisions providing authority for using incremental funding for procuring Ford-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 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.

¹¹ 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.

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.¹²

Gerald R. Ford (CVN-78) Class Program

Overview

The *Gerald R. Ford* (CVN-78) class carrier design (**Figure 1** and **Figure 2**) 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.

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



Source: Cropped version of U.S. Navy photograph 170408-N-WZ792-198, showing CVN-78 on April 8, 2017. Accessed March 17, 2021, at <https://www.navy.mil/Resources/Photo-Gallery/igphoto/2001728935/>.

¹² 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.

Figure 2. USS Gerald R. Ford (CVN-78)



Source: U.S. Navy photograph 200515-N-Q1093-1151, showing CVN-78 on May 15, 2020, with the oiler USNS *Patuxent* (T-AO 201) alongside. Accessed March 17, 2021, at <https://allhands.navy.mil/Media/Gallery/igphoto/2002340124/>.

CVN-78 (Gerald R. Ford)

CVN-78, which was named *Gerald R. Ford* in 2007,¹³ was procured in FY2008. The ship's final procurement cost was \$13,316.5 million (i.e., about \$13.3 billion) in then-year dollars. The ship was commissioned into service on July 22, 2017, and achieved initial operational capability (IOC) in December 2021.¹⁴ The ship's first deployment was delayed by a need to complete work on the ship's weapons elevators and correct other technical problems aboard the ship. The first deployment—a two-month “service-retained deployment” in Atlantic waters that served as an operational stress test—reportedly began on October 4, 2022, more than five years after the ship was commissioned into service, and ended on November 26, 2022. The ship reportedly will make its first full-length deployment in 2023.¹⁵

¹³ §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.

¹⁴ See, for example, Marcus Weisgerber, “Surprise! The Navy Declared Its Newest Carrier Battle-Ready Last Year,” *Defense One*, April 5, 2022.

¹⁵ See, for example, Nick Wilson, “First-in-Class Ford Aircraft Carrier Completes Inaugural Deployment,” *Inside Defense*, November 29, 2022; Sam LaGrone, “Video: USS Gerald R. Ford Back in Norfolk After Two Months in the

Figure 3. USS Gerald R. Ford (CVN-78)



Source: Cropped version of photograph accompanying Megan Eckstein, “Navy Removes Ford Carrier Program Manager, Citing Performance Over Time,” *USNI News*, July 2, 2020. The caption credits the photograph to the U.S. Navy and states that it shows CVN-78 on June 4, 2020.

CVN-79 (John F. Kennedy)

CVN-79, which was named *John F. Kennedy* on May 29, 2011,¹⁶ was procured in FY2013. The Navy’s proposed FY2024 budget estimates the ship’s procurement cost at \$12,700.0 million (i.e.,

Atlantic,” *USNI News*, November 26 (updated November 27), 2022; Diana Stancy Correll, “USS Gerald R Ford Slated to Wrap Up First Deployment,” *Navy Times*, November 23, 2022; Mallory Shelbourne, “Inside Carrier USS Gerald R. Ford’s Two-Month Operational Stress Test,” *USNI News*, October 12 (updated October 13), 2022; USS Gerald R. Ford (CVN 78) Public Affairs, “Gerald R. Ford Carrier Strike Group Departs for First Deployment,” U.S. Navy, October 5, 2022; Luca Peruzzi, “USS Gerald R. Ford Departs For Its First Major Deployment,” *Naval News*, October 4, 2022; Caitlin M. Kenney, “Much-Delayed Carrier Won’t Go Far in Its First Deployment,” *Defense One*, September 29, 2022; Mallory Shelbourne, “Carrier USS Gerald R. Ford to Embark on Short Cruise Ahead of Full Deployment Next Year,” *USNI News*, September 29, 2022.

¹⁶ See “Navy Names Next Aircraft Carrier USS John F. Kennedy,” *Navy News Service*, May 29, 2011, accessed online

\$12.7 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. CVN-79 is scheduled for delivery to the Navy in July 2025.

CVN-80 (Enterprise)

CVN-80, which was named *Enterprise* on December 1, 2012,¹⁷ was procured in FY2018. The Navy's proposed FY2024 budget estimates the ship's procurement cost at \$12,812.9 million (i.e., about \$12.8 billion) in then-year dollars. The ship is scheduled for delivery to the Navy in March 2028.

CVN-81 (Doris Miller)

CVN-81, which was named *Doris Miller* on January 20, 2020,¹⁸ 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 FY2024 budget submission, like its FY2021-FY2023 submissions, shows CVN-81 as a ship that was procured in FY2020.) The Navy's FY2024 budget submission estimates the ship's procurement cost at \$12,929.1 million (i.e., about \$12.9 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 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. Prior to the awarding of the two-ship block buy contract, CVN-81 was scheduled to be procured in FY2023.

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

on June 1, 2011, at http://www.navy.mil/search/display.asp?story_id=60686. See also Peter Frost, "U.S. Navy's Next 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.

¹⁷ 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.

¹⁸ Doris Miller was an African American enlisted sailor who received the Navy Cross for his actions during the Japanese attack on Pearl Harbor on December 7, 1941. 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.

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

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 the **Appendix**.

Interest in Potential Two-Ship Block Buy Contract for CVN-82 and CVN-83

Some observers reportedly are interested in the option of using another two-ship block buy contract to procure two additional Ford-class carriers, which would be CVN-82 and CVN-83.²² The Navy's FY2023 30-year (FY2023-FY2052) shipbuilding plan shows the next two carriers after CVN-81 as scheduled for procurement in FY2028 and either FY2032 or FY2033.

Section 132 of the FY2023 NDAA (H.R. 7776/P.L. 117-263 of December 23, 2022) states:

SEC. 132. REPORT ON ADVANCE PROCUREMENT FOR CVN-82 AND CVN-83.

(a) REPORT.—Not later than March 1, 2023, the Secretary of the Navy shall submit to the congressional defense committees a report on the plan of the Navy for advance procurement for the aircraft carriers designated CVN-82 and CVN-83.

(b) ELEMENTS.—The report required by subsection

(a) shall include an assessment of—

(1) the value, cost, and feasibility of a two-year advance procurement period under a single-carrier acquisition strategy;

(2) the value, cost, and feasibility of a three-year advance procurement period under a single-carrier acquisition strategy;

(3) the value, cost, and feasibility of a two-year advance procurement period under a two-carrier acquisition strategy;

(4) the value, cost, and feasibility of a three-year advance procurement period under a two-carrier acquisition strategy; and

(5) the effect of a two-carrier acquisition strategy on force development and fleet capability.

(c) DEFINITIONS.—In this section:

(1) The term “single-carrier acquisition strategy” means a strategy for the procurement of the aircraft carriers designated CVN-82 and CVN-83 pursuant to which each aircraft carrier is procured separately under a different contract.

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 See, for example, Loren Thompson, “The Right Way To Buy The U.S. Navy’s New Generation Of Supercarriers,” *Forbes*, September 30, 2022; Mike Gooding, “Block-Buy for New Aircraft Carriers Will Save Taxpayers Billions of Dollars,” *13 News Now*, August 30 (updated August 31), 2022; Megan Eckstein, “Navy, HII Pitch Congress for Another Two-Carrier Contract,” *Defense News*, August 29, 2022; Sam LaGrone, “HII Argues for Aircraft Carrier Block Buy as New Enterprise Takes Shape,” *USNI News*, August 28, 2022; Justin Katz, “Ahead of Shipyard Ceremony, Navy and Industry Advocate for Another Aircraft Carrier ‘Block Buy,’” *Breaking Defense*, August 26, 2022.

(2) The term “two-carrier acquisition strategy” means a strategy for the procurement of the aircraft carriers designated CVN-82 and CVN-83 pursuant to which both aircraft carriers are procured together under one contract.

Program Procurement Cost Cap

Congress established and subsequently amended procurement cost caps for Ford-class aircraft carriers.²³

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, under the Navy’s FY2024 budget submission. As shown in the table, the Navy’s proposed FY2024 budget requests \$2,540.4 million (i.e., about \$2.5 billion) in procurement funding for Ford-class ships, including \$624.6 million for CVN-79, \$1,115.3 million for CVN-80, and \$800.5 million for CVN-81.

²³ 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 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, 2019) further amended the cost cap for the CVN-78 program to provide revised caps of \$13,224.0 million for CVN-78, \$11,398.0 million for CVN-79, \$12,202.0 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	3,897.6
FY10	851.3 (FF)	482.9 (AP)	0	0	1,334.2
FY11	1,848.1 (FF)	902.5 (AP)	0	0	2,750.6
FY12	86.0 (FF)*	554.8 (AP)	0	0	640.8
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)	2,556.4 (FF)	1,569.6 (FF)	0	4,146.0
FY19	0	0	929.1 (FF)	643.0 (FF)	1,572.1
FY20	0	0	1,062.0 (FF)	1,214.5 (FF)	2,276.5
FY21	71.0 (CC)	0	958.9 (FF)	1,606.4 (FF)	2,636.3
FY22	0	291.0 (CC)	1,062.0 (FF)	1,287.7 (FF)	2,640.7
FY23	0	461.7 (CC)	1,465.9 (FF)	1,052.0 (FF)	2,995.2
FY24 (requested)	0	624.6 (CC)	1,115.3 (FF)	800.5 (FF)	2,540.4
FY25 (programmed)	0		2416.7 (FF)	666.0 (FF)	3,082.7
FY26 (programmed)	0			1,922.1 (FF)	1,922.1
FY27 (programmed)	0			2,011.8 (FF)	2,011.8
FY28 (programmed)	0			1,725.0 (FF)	1,725.0
Total	13,316.5	12,700.0	12,812.9	12,929.1	51,758.5

Source: Table prepared by CRS based on Navy’s FY2024 budget submission and prior-year submissions.

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. 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 10), 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-FY2024 budgets, in millions of then-year dollars)

Budget	CVN-78		CVN-79		CVN-80		CVN-81	
	Est. proc. cost	Scheduled/ actual FY of proc.	Est. proc. cost	Scheduled/ actual FY of proc.	Est. proc. cost	Scheduled/ actual FY of proc.	Est. proc. cost	Scheduled/ actual 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	FY19
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
FY22	13,316.5	FY08	11,929.7	FY13	12,405.5	FY18	12,483.6	FY19
FY23	13,316.5	FY08	12,700.0	FY13	12,832.9	FY18	12,930.0	FY19
FY24	13,316.5	FY08	12,700.0	FY13	12,812.9	FY19	12,929.1	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%	
FY21 to FY22	0%		+4.7%		+0.7%		+0.3%	
FY22 to FY23	0%		+6.5%		+3.4%		+3.6%	
FY23 to FY24	0%		0%		-0.156%		-0.007%	
Cumulative % change through FY24 from actual procurement dates of FY08, FY13, FY18, and FY19								
Since FY08	+27.0%		+38.2%		+19.6%		n/a	
Since FY13	+8.1%		+11.3%		-7.7%		n/a	
Since FY18	+3.2%		+11.6%		-1.4%		n/a	
Since FY19	+2.7%		+12.0%		+1.7%		-14.3%	

Source: Table prepared by CRS based on FY2008-FY2024 Navy budget submissions.

Notes: n/a means not available. 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 FY2024

Future Aircraft Carrier Force Level

One issue for Congress concerns the future aircraft carrier force level. Decisions on this issue could have implications for the service lives of existing aircraft carriers and/or plans for procuring new aircraft carriers. The future aircraft carrier force level has been a frequent matter of discussion over the years, and (correctly or not) is often the starting point or the center of broader discussions over the future size and composition of the Navy. Factors involved in discussions about the future aircraft carrier force level include but are not limited to the following:

- the capabilities and costs (including procurement costs and life-cycle operation and support [O&S] costs) of aircraft carriers and their embarked air wings, and how those capabilities and costs compare to those of other U.S. military forces;
- the prospective survivability of aircraft carriers in conflicts against adversaries (such as China) with highly capable anti-ship missiles;
- the numbers of carriers needed to support policymaker-desired levels of day-to-day aircraft carrier forward presence in various regions around the world; and
- the utility of carriers for purposes other than high-end combat, including deterrence of potential regional adversaries, reassurance of allies and partners, signaling U.S. commitment and resolve, and noncombat operations such as humanitarian assistance/disaster response (HA/DR) operations.

As discussed earlier, the Navy and DOD have been working since 2019 to develop a new force-level goal to replace the 355-ship force-level goal of 2016. Studies of this emerging force-level goal that have been released by the Navy in summary form suggest that the new force-level goal could call for achieving and maintaining a Navy with a carrier force of 8 to 12 carriers, to be supplemented (in the case of the lower end of that range) by up to 6 light aircraft carriers (CVLs).²⁴

An aircraft carrier force-level goal that includes fewer than 11 CVNs could lead to Navy proposals for one or more of the following:

- accelerated retirements for one or more Nimitz-class carriers that have already received their mid-life nuclear refueling overhauls (which are called Refueling Complex Overhauls, or RCOHs);
- a deferral or cancellation of the procurement of the next aircraft carrier after CVN-81, which under the Navy's FY2023 30-year shipbuilding plan is scheduled for FY2028; and/or
- the deferral or cancellation of the construction of CVN-81, which could require modifying the current two-ship construction contract for CVN-80 and CVN-81.

²⁴ For the effort to develop a successor to the 355-ship goal of 2016, including the studies that the Navy has released in summary form, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

Procurement of Aircraft Carriers After CVN-81

A related issue for Congress concerns the procurement of aircraft carriers after CVN-81. The question of whether the Navy should shift at some point from procuring CVNs like the Ford-class carriers to procuring smaller and perhaps nonnuclear-powered aircraft carriers has been a recurrent matter of discussion and Navy study over the years.

As mentioned earlier, the Navy's FY2023 30-year shipbuilding plans shows the next aircraft carrier after CVN-81 being procured in FY2028. The Navy has not stated that this ship would be something other than CVN-82 (i.e., a fifth Ford-class carrier).

As also mentioned earlier, studies of the emerging new force-level goal that have been released by the Navy in summary form suggest that the new force-level goal could call for achieving and maintaining a Navy with a carrier force of 8 to 12 carriers, to be supplemented (in the case of the lower end of that range) by up to 6 light aircraft carriers (CVLs). The Navy does not currently operate CVLs. The Navy in recent years has experimented with the concept of using an LHA-type amphibious assault ship with an embarked group of F-35B Joint Strike Fighters as a CVL.²⁵ A February 1, 2021, press report, for example, states

The Navy's engineering community has already started conducting light carrier design and engineering studies, even as the Navy and the joint force still consider whether they'd even want to invest in a CVL to supplement supercarriers to bring more distributed capability to the fleet for less cost.

The idea of a light carrier resurfaced last summer as a Pentagon-led Future Naval Force Study was nearing its completion. The idea hadn't appeared in Navy and Marine Corps plans, but then-Defense Secretary Mark Esper had a growing interest in the topic as he sought ways to keep future shipbuilding and sustainment costs down and as he worried about the Navy's ability to conduct maintenance on its nuclear-powered aircraft carriers at Navy-run public shipyards.

The FNFS and the plan it produced, *Battle Force 2045*, ultimately recommended between zero and six light carriers and noted much more study would need to be done.

That work is already happening at Naval Sea Systems Command within the engineering and logistics directorate (SEA 05).

Rear Adm. Jason Lloyd, the SEA 05 commander and deputy commander for ship design, integration and engineering, said last week that his Cost Engineering and Industrial Analysis team has been studying different options to understand what operational utility the Navy would get out of each design and for what cost compared to the Ford-class carrier, "and then let the operators really, and the Navy, decide, hey, do we want that capability for that cost?"

"We have looked at an America-class possibility,²⁶ we have looked at a Ford-class-light,²⁷ we've looked at various different options and done cost studies on all those options. There

²⁵ See CRS Report R43543, *Navy LPD-17 Flight II and LHA Amphibious Ship Programs: Background and Issues for Congress*, by Ronald O'Rourke.

²⁶ This is a reference to a CVL whose design is based on that of the America (LHA-6) class amphibious assault ship.

²⁷ This is a reference to a carrier whose design is similar to that of the CVN-78 design, but with some of the CVN-78 design's features reduced or removed, resulting in a ship whose procurement cost and capability are less than that of the CVN-78 design.

are also capabilities studies on all those options,” Lloyd said last week while speaking at a virtual event hosted by the American Society of Naval Engineers.²⁸

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 Ford-class carrier, 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 the Ford-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.²⁹ 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).

Delay in CVN-78’s First Deployment Due to Weapon Elevators and Other Challenges

Overview

Another oversight issue for Congress concerns the delay in CVN-78’s first deployment that was caused by a need to complete work on the ship’s weapons elevators and correct other technical problems aboard the ship. As noted earlier, the ship’s first deployment occurred in October and November 2022, more than five years after it was commissioned into service. The delay in the ship’s first deployment lengthened a period during which the Navy attempted to maintain policymaker-desired levels of carrier forward deployments with its 10 other carriers—a situation that may have added to operational strains on those 10 carriers and their crews.

Weapons Elevators

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

²⁸ Megan Eckstein, “Light Carrier Studies Already Underway As Navy Considers Role for CVLs in Future Fleet,” *USNI News*, February 1, 2021. See also Joseph Trevithick, “Navy Looking At America And Ford Class Derivatives In New Light Aircraft Carrier Studies,” *The Drive*, February 2, 2021.

²⁹ Bradley Martin and Michael McMahon, *Future Aircraft Carrier Options*, Santa Monica, CA, RAND Corporation, 2017, 87 pp.

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. Challenges in completing the construction, testing, and certification of the ship's AWEs were first reported in November 2018,³⁰ and the issue became a matter of continuing congressional oversight. Navy officials stated that the 11th and final weapon elevator was completed, tested, and certified on December 22, 2021.

Following the initial press report about the ship's AWEs in November 2018, the Navy struggled to meet promises it repeatedly made to the defense oversight committees to get the AWEs completed, tested, and certified. Reported developments included the following:

- For much of 2019, the Navy continued to report that two of the 11 AWEs were completed, tested, and certified.³¹
- On October 23, 2019, the Navy reported that the figure had increased to four of 11.³²
- On April 22, 2020, the Navy announced that the fifth AWE had been certified, that the sixth was scheduled to be certified in the fourth quarter of FY2020, and that the remaining five were scheduled to be certified by the time that the ship

³⁰ See Anthony Capaccio, "U.S. Navy's Costliest Carrier Was Delivered Without Elevators to Lift Bombs," *Bloomberg*, November 2, 2018.

³¹ 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 Past 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, "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.

³² 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.

underwent Full Ship Shock Trials (FSSTs), which was then scheduled for the third quarter of FY2021.³³

- On July 23, 2020, the Navy announced that the sixth AWE had been certified.³⁴
- In November 2020, it was reported that the seventh AWE was scheduled to be certified before the end of calendar year 2020, and that the remaining four would be completed by the end of April 2021.³⁵
- On March 16, 2021, it was reported that seventh AWE had been delivered in early March, that the eighth elevator was in testing and was scheduled to be delivered in April, that work on all the AWE considered together was 93% or 94% complete, and that the remaining three AWEs would be completed during 2021.³⁶
- On March 23, 2021, Navy Admiral John Aquilino testified that nine of the 11 AWEs had been “repaired.”³⁷
- On May 13, 2021—about four years after the ship was delivered to the Navy—it was reported that four of the 11 AWEs would not be certified until later in 2021.³⁸
- On July 21, 2021, the Chief of Naval Operations (CNO), Admiral Michael Gilday, reportedly stated: “We’ll deliver two more [of the AWEs] in early fall [2021] and then the remaining two by the end of 2021, so the elevators will be complete. And that’s going very, very well.”³⁹
- The Navy stated that the 11th and final AWE was completed, tested, and certified on December 22, 2021.⁴⁰

³³ 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. (Mallory Shelbourne, “Navy Confident CVN-78 Will Have All Weapons Elevators by May 2021,” *Inside Defense*, January 16, 2020.)

³⁴ Gina Harkins, “Supercarrier Ford Could Soon Have More Than Half of Its Weapons Elevators Working,” *Military.com*, June 19, 2020.

³⁵ Mallory Shelbourne, “USS Gerald R. Ford Making Steady Progress Ahead of Deployment,” *USNI News*, November 24, 2020.

³⁶ Michael Fabey, “US Navy Reports Progress on Key Carrier Ford Systems,” *Jane’s Navy International*, March 16, 2021; Megan Eckstein, “As USS Gerald R. Ford Nears Shock Trials, Carrier Remains Busy With Testing, Fleet Support,” *USNI News*, March 12, 2021. See also Kara Dixon, “USS Gerald R. Ford Moving Toward Completion of Post-Delivery Tests and Trials,” *WAVY.com*, March 10, 2021.

³⁷ See Rich Abott, “Aquilino Says Nine Of 11 Ford Elevators Finished,” *Defense Daily*, March 23, 2021; Aidan Quigley, “Aquilino: Ford ‘Through’ Technological Challenges, All but Two Elevators Finished,” *Inside Defense*, March 23, 2021.

³⁸ Aidan Quigley, “Ford Missed Elevator Certification Timeline Goal but Moves into Shock Trials on Time,” *Inside Defense*, May 10, 2021. See also Craig Hooper, “Despite Promises, USS Ford Heads to Shock Trials with 4 Broken Elevators,” *Forbes*, May 13, 2021; Peter Suci, “The Navy’s New, Powerful Aircraft Carrier Is Heading to ‘Shock Trials,’” *Business Insider*, May 24, 2021.

³⁹ As quoted in Rich Abott, “CNO Says Final Ford Elevators Delivered By End Of Year, Identifies Lessons Learned,” *Defense Daily*, July 21, 2021. See also Aidan Quigley, “Navy Says Final Four Ford Elevators to be Complete by End of Year,” *Inside Defense*, August 3, 2021; Konstantin Toropin, “All of Aircraft Carrier Ford’s Weapons Elevators Will Be Ready by End of Year Despite Long Delay, Navy Says,” *Military.com*, August 10, 2021.

⁴⁰ See, for example, Megan Eckstein, “US Navy Completes Final Weapons Elevator on Aircraft Carrier Gerald R. Ford,” *Defense News*, December 23, 2021; Sam LaGrone, “HII Delivers Final Advanced Weapons Elevator Aboard USS Gerald R. Ford,” *USNI News*, December 23, 2021; Craig Hooper, “The Navy Gets A Christmas Present: All 11

The Navy stated in 2020 that lessons learned in building, testing, and certifying CVN-78's AWEs will be applied to the AWEs of subsequent Ford-class carriers.⁴¹

Other Technical Challenges

In addition to challenges in building, testing, and certifying the ship's weapon elevators, the Navy reportedly worked to address problems with other systems on the ship. A January 21, 2022, press report stated

Four years after the U.S. Navy's costliest warship was hobbled by a flaw in its propulsion system, prime contractor Huntington Ingalls Industries Inc. and subcontractor General Electric Co. are still haggling over who will pay for fixing the defect.

The \$13 billion USS Gerald R. Ford was forced to return to port during post-delivery sea trials in early 2018 after the failure of a main thrust bearing, a key propulsion system component that's made by GE.

Huntington Ingalls has repaired the faulty gear, and the Navy advanced funds for the work. The "actual root cause" of the defective part was "machining errors" by GE workers, according to Navy documents. The bearing, one of four that transfers thrust from the ship's four propeller shafts, overheated but "after securing the equipment to prevent damage, the ship safely returned to port," the Navy said in a March 2018 memo to Congress.

The Ford returned to sea for additional trials after the damage was contained....

Vice Admiral Thomas Moore, then head of the Naval Sea Systems Command, told reporters in 2019 that the Navy was paying for the repairs until GE and Huntington "figure out who has the liability for it. At some point you've got to pay them to get the work done." The Navy has declined to say how much it paid Huntington, although in 2018 it asked Congress to shift \$30 million from other accounts to start work.

The companies are still hashing things out.

"We are continuing to work on a final agreement with GE to resolve this claim," Danny Hernandez, a spokesman for Newport News, Virginia-based Huntington Ingalls, said in a statement. Sean Smith, a spokesman for Boston-based GE, said "we continue working with the U.S. Navy and Huntington Ingalls to resolve this issue." GE hasn't commented publicly on the Navy's contention that its workers were at fault.⁴²

An April 28, 2021, press report stated

The Advanced Arresting Gear (AAG) and Electromagnetic Aircraft Launch System (EMALS) achieved 8,000 aircraft recoveries and launches aboard USS Gerald R. Ford (CVN 78) on April 19, during the final independent steaming event of her 18-month Post Delivery Test & Trials (PDT&T) period, the Naval Air Systems Command said in an April 26 release.

Capt. Kenneth Sterbenz, Aircraft Launch and Recovery Equipment (ALRE) program manager (PMA-251) for EMALS and AAG, said ALRE finished PDT&T strong, and they

USS Ford Weapons Elevators Delivered," *Forbes*, December 24, 2021; Anthony Capaccio, "Navy's Costly Carrier Finally Has Its Bomb-Lifting Elevators," *Bloomberg*, December 30, 2021.

⁴¹ See, for example, David B. Larter, "US Navy Makes Progress on Aircraft Carrier Ford's Bedeviled Weapons Elevators," *Defense News*, July 23, 2020; Mallory Shelbourne, "Navy Verifies USS Gerald R. Ford's Sixth Advanced Weapons Elevator," *USNI News*, July 23, 2020; Rich Abott, "Navy Certifies Second [Lower-Stage] Ford Magazine Elevator," *Defense Daily*, July 23, 2020; Gina Harkins, "Navy Carrier Ford Now Has 6 Working Weapons Elevators," *Military.com*, July 24, 2020.

⁴² Anthony Capaccio, "Priciest U.S. Warship Spurs Haggling on Who Pays for Crucial Fix," *Bloomberg*, January 21, 2022.

are ready for the next step, as Ford prepares for Full Ship Shock Trials, which is scheduled to begin summer 2021.

“ALRE’s support of EMALS and AAG was admirable throughout the rigorous testing of PDT&T operations,” said Sterbenz. “On the way to reaching 8,000 launches and recoveries, we saw many Ford crew trained, learned a great deal about the systems, and laid invaluable groundwork for future Ford-class ships.”

As CVN 78 moved through PDT&T, ALRE had the opportunity to directly support the fleet, as 351 Naval aviators were qualified using EMALS and AAG throughout 2020 and 2021. Time and training also enabled a great increase in the efficiency of flight operations. More than 7,000 of Ford’s total launches and recoveries were completed in the last 18 months.⁴³

An April 27, 2021, press report stated

The efforts of USS Gerald R. Ford sailors during the carrier’s 18 months of post-delivery tests and trials look set to cut the time before the Navy’s newest carrier is ready to deploy—possibly by a year or more.

Rear Adm. Craig Clapperton, commander of the Ford’s carrier strike group, said the group’s latest exercises show the Ford would be ready to deploy 12 to 18 months earlier than its current—a schedule that was in its turn roughly two years later than the Navy had hoped when it started working on the carrier nearly two decades ago.

After a set of live-fire exercises over the past several weeks at sea, the Ford has certified the missiles and cannons that are its last line of a defense.

The Ford and the ships and air wing in its strike group also completed a long distance maritime strike exercise, a critical war-gaming test in which it had to escape from another task force seeking to disable it and then attack in its turn.

“We have accelerated the timeline for Gerald R. Ford,” Clapperton said....

During the Ford’s latest at-sea exercise, its 18th since starting post delivery tests and trials, its electromagnetic catapult, for launching planes, and arresting gear, for keeping them from plunging into the sea when landing, hit the 8,000 launch-and-recovery cycle mark, said Capt. Joshua Sager, air wing commander.

That’s a key measure, since that is roughly the number of sorties an air-wing will fly during the several months of a deployment overseas.

Sager said the new electromagnetic technology means the air-wing can get into the air—and return to the battle after rearming and refueling—faster than with the traditional steam-and-hydraulics systems that have been the mainstay for decades.

“Now we’ve gone past the point of showing the Ford can do what Nimitz class can do.... Now we’re at the point of taking it to the next level,” he said, referring the class of 10 nuclear carriers now in service.⁴⁴

⁴³ Seapower Staff, “EMALS, AAG Hit 8,000 Aircraft Recoveries, Launches on Ford,” *Seapower*, April 28, 2021. See also Rich Abott, “Ford Finishes Combat Systems Ship Trials, Reaches 8,000 Aircraft Launches/Recoveries,” *Defense Daily*, April 26, 2021; Rich Abott, “Navy Completes Ford Carrier Post-Delivery Trials, Touts Success and Outlines Next Steps,” *Defense Daily*, May 5, 2021; Aidan Quigley, “Ford Missed Elevator Certification Timeline Goal but Moves into Shock Trials on Time,” *Inside Defense*, May 10, 2021.

⁴⁴ Dave Ress, “Ford Crew’s Efforts Set to Shorten Time Until the Carrier Is Ready to Deploy, Strike Group CO Says,” *Newport News Daily Press*, April 27, 2021.

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 did the Navy take following the delivery of CVN-78 to the Navy on May 31, 2017, to keep Congress informed of challenges regarding the ship's weapon elevators and other ship systems?
- Why did it take so long, and how much did it cost, to complete, test, and certify the weapon elevators?
- How much additional operational stress did the delay in CVN-78's first deployment place 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?

Transfer of Parts Intended for CVN-79 to CVN-78

Regarding the construction of CVN-79, a January 26, 2022, press report states

The Navy is confident in its supply chain and the availability of spare parts to build and sustain its aircraft carriers, as the lead ship in the Gerald R. Ford class gears up for its first deployment, two service officials said last week.

After taking parts from the future USS John F. Kennedy (CVN-79), the Navy is beginning to receive orders to replace those parts. The parts from JFK—which is currently under construction at Huntington Ingalls Industries' Newport News Shipbuilding—were placed on USS Gerald R. Ford (CVN-78) so the lead ship is ready to deploy this year.

“The backfill of the parts that were taken from JFK—those are starting to come in. So we don't see that it's going to have any future impacts on [the construction of] JFK,” Jay Stefany, who is currently performing the duties of the assistant secretary of the Navy for research, development and acquisition, told reporters on Friday [January 21].

The sustainment parts for Ford—which is set to deploy this fall—are on the carrier, Rear Adm. James Downey, the program executive officer for carriers, said last week....

As it prepares for the lead ship in the class to deploy for the first time later this year, the Navy is continuing to work with both industry and its field activities to ensure the carrier has the parts it needs, according to Downey.⁴⁵

A November 15, 2021, press report states

The Navy is taking parts from an aircraft carrier currently under construction and placing them on USS Gerald R. Ford (CVN-78) so the lead ship is ready to deploy next year, USNI News has learned.

The parts are coming from the future USS John F. Kennedy (CVN-79), the second ship in the Ford class of aircraft carriers that is currently under construction at Huntington Ingalls Industries' Newport News Shipbuilding in Newport News, Va.

⁴⁵ Mallory Shelbourne, “Navy Says Aircraft Carrier Supply Chain Improving; USS Gerald R. Ford to Deploy by Fall,” *USNI News*, January 26, 2022. See also Megan Eckstein, “Spare Parts Now Flowing, as Carrier Ford Prepares for Maiden Deployment This Year,” *Defense News*, January 25, 2022.

Capt. Clay Doss, the Navy's acquisition spokesman, told USNI News the parts taken from Kennedy for Ford range from pumps to limit switches.

"Examples of parts include HMI screens for stores elevators as well as motor controllers, power supplies, small pumps, limit switches and valve actuators for various systems throughout the ship," Doss said. "This is not unusual early in a program and will occur less often as supply support matures."

Doss described the decision to take parts from Kennedy for Ford as a "project management tool" the service uses across programs.

"It occurred only after confirming the parts or materials were not available in the supply system and/or that alternate sources were not available," Doss told USNI News. "A replacement plan was also required in each case. None of the parts transferred to CVN 78 are projected to impact the CVN 79 construction schedule."

In a separate statement, Naval Sea Systems Command said the procedures were in line with Navy maintenance rules.

"In accordance with the Navy's Joint Fleet Maintenance Manual, cannibalizations are being used as part of the process to augment readiness of CVN 78, and are only initiated after non-availability of materials has been established in the supply system or verification that alternate sources are not available," Naval Sea Systems Command spokesman Alan Baribeau told USNI News in a statement....

A spokesperson for HII said the shipbuilder and the Navy are creating a supply network for the carrier class so the ships have access to spare parts.

"A common shipbuilding practice for the first ship in class is to share parts between ships in order to maximize readiness until a class-wide supply system is established," Duane Bourne told USNI News. "A relatively small volume of materials from the aircraft carrier John F. Kennedy (CVN 79) has been used on first-of-class U.S.S. Gerald R. Ford (CVN 78) without impacting schedules. We are working with our Navy customer to build a supply system to include spare parts for the Ford class."⁴⁶

Cost Growth

Overview

Another issue for Congress concerns cost growth in the CVN-78 program, which the Navy has worked for years to control. Navy efforts to stem cost growth and manage costs in the CVN-78 program so as to stay within the program's cost caps have been a continuing oversight issue for Congress. Congress has passed legislation on the issue that is in addition to the earlier-mentioned legislation that established and amended cost caps for the ships.⁴⁷

⁴⁶ Mallory Shelbourne, "USS Gerald R. Ford Needs Parts from Carrier Kennedy for Repairs; Navy Says 'Cannibalization' Won't Delay JFK Schedule," *USNI News*, November 15, 2021. See also Ryan Pickrell, "US Navy Pulls Parts off an Under-Construction Aircraft Carrier to Get USS Gerald R. Ford Ready to Deploy," *Business Insider*, November 16, 2021; Rich Abott, "CVN-78 Taking Parts From CVN-79, Navy Says No Delays To Construction," *Defense Daily*, November 18, 2021; Geoff Ziezulewicz and Diana Stancy Correll, "Kennedy Carrier Cannibalized to Ensure USS Gerald R. Ford Is Ready to Go Next Year," *Navy Times*, November 19, 2021.

⁴⁷ This additional legislation includes the following:

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

As shown in **Table 2**, the estimated procurement costs of CVN-78, CVN-79, and CVN-80 have grown 27.0%, 38.2%, and 19.6%, respectively, since the submission of the FY2008 budget. As shown in **Table 1**, cost growth on CVN-78 and CVN-79 has required the Navy to request \$2,843.2 million (i.e., about \$2.8 billion) in cost-to-complete (CC) procurement funding to cover cost growth on the two ships, including \$1,465.9 million for CVN-78 and \$1,377.3 million for CVN-79.

CVN-78

A primary source of past cost growth for 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.⁴⁸

In addition to this general cause of past cost growth, secondary and more-specific past risks of cost growth for CVN-78 included certain new systems to be installed on the ship. 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.

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 Ford-class carriers.

⁴⁸ 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.)

CVNs 79, 80, and 81

Impact of Original CVN-78 Cost Estimate

An unrealistically low cost estimate for CVN-78 may have led to similarly unrealistically low cost estimates for CVN-79 and CVN-80 in the FY2008 budget submission, since the cost estimates for CVN-79 and CVN-80 would have been derived from the estimate for CVN-78.

Confidence Levels

The Navy stated in June 2019 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%, respectively, meaning that the Navy as of June 2019 estimated that the risk of future cost growth on CVNs 79, 80, and 81 were 64%, 78%, and 80%, respectively.⁴⁹

November 2022 CBO Report

A November 2022 Congressional Budget Office (CBO) report on the potential cost of the Navy's FY2023 30-year shipbuilding plan states the following regarding the Ford-class program:

The first ship of the class, the USS Gerald R. Ford (CVN-78), cost \$13.3 billion in nominal dollars appropriated between 2001 and 2018. CBO used the Navy's inflation index for naval shipbuilding to convert that amount to \$17.3 billion (in 2022 dollars)—which is 25 percent more than the Navy's corresponding estimate when the ship was first authorized in 2008.... Because construction of the lead ship is finished, CBO used the end cost for that ship to estimate the cost of successive ships in the class.

The Navy estimates that [CVN-79] will cost \$13.9 billion (in 2022 dollars, or \$12.7 billion in nominal dollars). The cost overruns that have arisen over the past three years have now pushed the Navy's estimate slightly beyond what CBO's cost model predicts, which is \$13.8 billion (in 2022 dollars). (In its report on the fiscal year 2020 shipbuilding plan, CBO's estimate was 9 percent higher than the Navy's.)...

In the 2023 budget, the Navy estimated that the CVN-80 will cost \$12.3 billion (in 2022 dollars, or \$12.6 billion in nominal dollars). In contrast, CBO estimates that the CVN-80 will cost \$13.0 billion (in 2022 dollars), about 6 percent more than the Navy's estimate. In information provided to CBO when the Navy implemented the two-ship buy strategy, the Navy indicated that there is about an 80 percent chance that the final cost will be more than it estimated. On the basis of the history of cost growth in the carrier program thus far, the savings that the Navy estimated would result from the two-carrier approach appears more likely to increase the risk of future cost growth than to yield budgetary savings. (In fact, in its December 2021 Selected Acquisition Report on the CVN-78 program, the Navy reports that procurement costs have grown by \$1.3 billion since the December 2019 report was completed. Almost all of that increase is attributable to the CVN-79, CVN-80, and CVN-81.)

Estimates for the CVN-81 show a similar pattern. In the 2023 budget, the Navy estimated that the ship will cost \$11.8 billion (in 2022 dollars, or \$12.9 billion in nominal dollars) using the two-carrier buy strategy but also indicated that there is a 60 percent chance that the final cost will be higher than that estimate. CBO estimates that the CVN-81 will cost \$12.5 billion (in 2022 dollars), which is 6 percent more than the Navy's estimate. (In its

⁴⁹ Source: Navy information paper provided to CRS by Navy Office of legislative Affairs on June 20, 2019.

report on the fiscal year 2020 shipbuilding plan, CBO's estimate was 14 percent more than the Navy's estimate, which has increased since then.)⁵⁰

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,⁵¹ 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 March 7, 2022, press report stated

Aircraft carrier manufacturer Newport News Shipbuilding is revamping its processes to become more efficient as it builds the Gerald R. Ford class of carriers, a company official said.

Brian Fields, the vice president of aircraft carrier construction for CVN-80 and CVN-81, told reporters Feb. 18 the company had a plan going into construction on the Gerald R. Ford, but lessons learned are driving down cost and schedule as the company works through the John F. Kennedy and now the Enterprise.

One lesson relates to crane lifts of large modules or supermodules. Given the immense size of aircraft carriers, the workforce builds the steel framing for segments of the ship, which can then be outfitted with pipes and cables. These modules are then lifted by crane and put into place on the hull.

Fields said the company has learned to use even larger supermodules, therefore needing fewer crane lifts to put the pieces into place.

“Some of our super lifts [on Enterprise] have incorporated what on [Ford and Kennedy] were in some cases 10, 15 erections with a crane—building one large supermodule,” he said. “We’re seeing a lot more opportunity to outfit earlier in the build process, which provides a lot of efficiencies just based on where the work is being performed.”

Fields said the company is also trying to group steel structures into “unit families,” where the pieces aren’t identical but similar enough that lessons can still be applied from one piece to the next. The sequencing on Ford and Kennedy had been based on what steel pieces were needed in what order to form modules that could be stacked in the right order. The new changes on Enterprise mean some steel pieces are built early to need—but Fields

⁵⁰ Congressional Budget Office, *An Analysis of the Navy’s Fiscal Year 2023 Shipbuilding Plan*, November 2022, pp. 20-21.

⁵¹ 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.

said “localized learning” could happen when similar pieces were built consecutively in a “batch manufacturing process.”

Fields said the company is seeing similar learning happening at its 2,500 suppliers around the country....

Fields also noted the Ford class was designed in a digital 3D environment, rather than using traditional blueprint drawings. The associated step-by-step digital work instructions weren’t ready for the first two ships, so Ford and Kennedy were built by craftspeople using paper drawings derived from the digital plans—though Kennedy was used to experiment with early digital work instructions and get employee feedback.

Starting with Enterprise, workers at the shipyard used laptops with digital work instructions for each step, with 3D images that can be enlarged and rotated.

“It provides the mechanics a lot clearer picture of what they’re expected to be doing. It helps with first-time quality. It helps the younger craftspeople, who sometimes, we find it takes as much time to learn to read drawings as it does to develop the craft skills,” Fields said.

Enterprise and Doris Miller will be fully built with these digital work instructions, in a first for the Navy.

Fields said the Navy invested significantly in getting the 3D product model and the digital work instructions right, as they will be the basis of not only construction of carriers and submarines at Newport News but also for lifecycle maintenance work at the Navy’s four public shipyards.

Fields said Newport News Shipbuilding made a “generational investment” in buying laptops for all hourly workers so they could access the digital work instructions. But, he said, the investment is yielding other benefits, giving workers immediate access to resources like procedures, troubleshooting manuals and more, as well as better access to their supervisors.⁵²

Issues Raised in DOT&E and GAO Reports

Another oversight issue for Congress concerns CVN-78 program issues raised in a January 2023 report from DOD’s Director, Operational Test and Evaluation (DOT&E)—DOT&E’s annual report for FY2022—and in the 2022 edition of the Government Accountability Office’s (GAO’s) annual report surveying selected DOD weapon acquisition programs, which was published in June 2022.

January 2023 DOT&E Report

Regarding the CVN-78 program, the January 2023 DOT&E report stated the following in part:

TEST ADEQUACY

The Navy began CVN 78 IOT&E [Initial Operational Test and Evaluation] in September 2022. The Navy is conducting IOT&E in accordance with TEMP [Test and Evaluation master Plan] Revision E and the IOT&E Test Plan, which involves 10 underway periods (including integrated test), extensive modeling, and spans 2 years.

The first of three land-based cyber survivability tests was completed on the Electromagnetic Aircraft Launch System (EMALS) and Advanced Arresting Gear (AAG) in June 2022. This test was executed in accordance with a DOT&E-approved test plan and

⁵² Megan Eckstein, “Navy Says Digital Work Instructions, Lessons Learned Are Improving Construction of Third Ford-Class Carrier,” *Defense News*, March 7, 2022.

DOT&E observed the test. The planned test was limited in scope due to the Navy's lack of robust cyber testing capability on industrial control systems that are common on modern ships. The Navy Surface Warfare Center Philadelphia Division's Strategic Cyber-Physical Initiative is attempting to address this limitation. Land-based cyber testing will continue in FY23, and a shipboard test is scheduled for FY24.

The Navy conducted self-defense testing against unmanned aerial vehicles and unmanned small boats in July 2022, in accordance with a DOT&E-approved test plan that was executed during Combat Systems Operational Rehearsal Event Phase 2. DOT&E observed the testing, and the results are still undergoing analysis.

Additionally, CVN 78 conducted sea trials after its PIA [Planned Incremental Availability (PIA, a 6-month maintenance period)] and six underway periods that included fixed-wing flight operations, two of which were in accordance with a DOT&E-approved test plan and one was observed by DOT&E. Four of these underway periods involved training squadrons and two involved a portion of its carrier air wing. To date, CVN 78 has conducted 10,826 catapult launches (2,699 of which were in FY22) and 10,826 arrested landings (2,699 of which were in FY22). During these underway periods, the crew also performed two ammunition onloads and a RAM [Rolling Airframe Missile] live fire. One of the ammunition onloads was part of a DOT&E-approved test plan, and the live fire was part of a Carrier Strike Group 12 self-defense exercise. DOT&E observed one ammunition onload and the RAM live fire. Although not part of the IOT&E test plan, the data from the RAM live fire will be adjudicated for score and is planned to contribute to the PRA [Probability of Raid Annihilation] model.

In April 2022, DOT&E submitted a classified report to Congress detailing system performance during planned test events against the Self Defense Test Ship (SDTS) configured to represent CVN 78's capability. This report covers testing between December 2018 and December 2020, during which the Navy completed three of the four planned test events against the SDTS [self-defense test ship], including the employment of RAMs and/or ESSMs [Evolved Sea Sparrow Missiles].

There may not be enough data to determine the operational effectiveness and suitability of the self-defense capability of CVN 78 against anti-ship cruise missiles (ASCMs) due to test data that will not be available for reasons discussed in the Ship Self-Defense System article of this Annual Report. The self-defense tests planned in the Revision E TEMP will provide the only remaining live fire self-defense data points in IOT&E, and will not inform performance against some types of ASCM threats. It is vital that the Navy successfully verify, validate, and accredit the high-fidelity PRA model being developed by the Program Executive Office for Integrated Warfare Systems in order to gain adequate understanding of the Anti-Air Warfare mission capability by completion of IOT&E.

The Navy plans to eventually upgrade the combat systems suite on CVN 78 to match CVN 79 and follow-on ships. Due to the differences between the combat systems, and the fact that CVN 79 will be the enduring self-defense configuration for the class, it is imperative that CVN 79 self-defense capabilities are adequately tested.

PERFORMANCE

EFFECTIVENESS

Combat System

In April 2022, DOT&E submitted a classified interim report to Congress on the operational effectiveness of CVN 78's self-defense capability against ASCMs.

Regarding the self-defense testing against unmanned aerial vehicles and unmanned small boats in July 2022, no preliminary assessment is available because analysis is not yet complete.

Sortie Generation

The reliability of CVN 78 catapults, arresting gear, and jet blast deflectors (JBDs) continues to have an adverse effect on sortie generation and flight operations efficiency. During an underway period in August of 2022, the ship returned early due to unexpected problems with its JBDs. The early return was necessary to facilitate JBD repairs and did not allow completion of CQ. The ongoing reliability problems with these critical subsystems remains the primary risk to the successful completion of CVN 78 IOT&E. Executing the planned sortie generation-rate testing, as outlined in the Revision E TEMP, will be crucial to evaluating the ship's combat effectiveness and accrediting the high-fidelity Sea Strike/Sea Basing Aviation Model, an essential tool for evaluating the sortie generation rate key performance parameter and supporting life-of-class upgrades.

SUITABILITY

The low or unproven reliability of the following five CVN 78 systems pose the most significant challenge to flight operations:

EMALS [Electromagnetic Aircraft Launch System]

During testing from March through June 2022 (after the PIA), EMALS achieved a reliability of 614 mean cycles between operational mission failures (MCBOMF) during 1,841 catapult launches (where a cycle is the launch of one aircraft). While this reliability is well below the requirement of 4,166 MCBOMF, EMALS showed slight improvement in reliability from FY21 (460 MCBOMF throughout 1,758 catapults). However, during the first underway of IOT&E in September 2022, EMALS reliability appeared to regress and slowed CQ. While the data are still being analyzed, the adverse effect to operations on two of the ten days of CQ was significant. Naval Air Systems Command is working on short- and long-term improvements to address EMALS reliability degraders. Short-term improvements are focused on improving component reliability and are expected to be incorporated on Gerald R. Ford by the end of FY23.

AAG [Advanced Arresting Gear]

During testing from March through June 2022 (after the PIA), AAG achieved a reliability of 460 MCBOMF during 1,841 aircraft recoveries (where a cycle is the recovery of a single aircraft). While this reliability is well below the requirement of 16,500 MCBOMF, AAG showed slight improvement in reliability from FY21 (115 MCBOMF throughout 1,758 catapults). However, during the first underway of IOT&E in September 2022, AAG reliability appeared to regress and slowed CQ. While the data are still being analyzed, the adverse effect to operations on three of the ten days of CQ was significant. Naval Air Systems Command is working on short- and long-term improvements to address AAG reliability degraders. Short-term improvements are focused on improving indications and software and are expected to be incorporated on Gerald R. Ford by the end of 2QFY23 [second quarter of FY2023].

JBDs

During early developmental testing, reliability concerns were identified with the Electro Mechanical Actuators (EMA) that are used to raise and lower the JBDs on the Ford class. Several modifications were implemented on CVN 78 during the PIA to improve reliability. During the August 2022 CQ, the ship experienced EMA failures on all four JBDs, which caused the ship to cancel the remainder of CQ and return early. The cause of the EMA failures was corroded fasteners in various components of the EMA. The root cause of the fastener corrosion is being addressed, and repairs were completed prior to September's CQ [carrier qualification]. During the September CQ, JBD performance did not adversely affect flight operations.

Advanced Weapons Elevators (AWE)

The Navy conducted a partial ammunition onload in April 2022 and a full ammunition onload in September 2022. DOT&E observed the September ammunition onload; data are still being analyzed. Observation of the lower stage AWE performance was very promising as the ordnance was transferred from the hangar bay to the magazines more efficiently than on a Nimitz-class carrier. Through the first 19,767 elevator dispatches, 109 individual elevator failures were reported. AWE system reliability will be critical as the Navy develops standard procedures for moving ordnance from magazines to the flight deck. The Navy's planned service-retained employment of CVN 78 in 1QFY23 [first quarter of FY2023] will provide the first operationally representative opportunity to fully stress the AWE system.

DBR [dual-band radar]

Through June 2022, DBR demonstrated a reliability of 100 hours mean time between operational mission failures, which does not meet the minimum threshold of 339 hours mean time between operational mission failures. DBR was operationally available 94% of the time, compared to the 98% requirement.

SURVIVABILITY

An adequate survivability assessment depends upon a combination of Full Ship Shock Trials (FSST), extensive modeling based on surrogate testing, and a total-ship survivability test (TSST). Sufficient data to assess ship survivability against close-aboard explosions should be available by the end of FY23.

From June-August 2021, the Navy conducted FSST on CVN 78 including three shock events of increasing effect. The FSST identified several survivability improvement opportunities for CVN 78 against underwater threat engagements. In 1QFY23, DOT&E will publish a classified FSST report that details these results.

The Navy plans for the Naval Surface Warfare Center Carderock Division to provide model-based vulnerability assessment reports that assess the class's vulnerability to threat weapons in 2QFY23.

The TSST is scheduled for 3QFY23 [third quarter of FY2023]. TSST is an onboard, extensive damage-control test of both the crew and associated systems.

The Revision E TEMP outlines a strategy to use land-based cyber testing in 2022 and 2023 to build up to a shipboard cybersecurity test in 2024. The first cybersecurity test event was a cyber-survivability assessment of EMALS and AAG, using systems installed at Joint Base McGuire-Dix-Lakehurst, New Jersey in June 2022. Many subsystems on the ship were tested to various degrees in both developmental and operational testing on other ship platforms. However, required CVN 78 platform-level testing has not yet occurred, and some systems specific to CVN 78 have yet to undergo any operational cyber survivability assessments.

The survivability of CVN 78 in a contested and congested electromagnetic spectrum environment has not been evaluated. Tests to do so in FY24 are part of the second phase of the test plan.

RECOMMENDATIONS

The Navy should:

1. Continue to improve reliability for EMALS, AAG, JBDs, DBR, and AWE.
2. Execute planned sortie generation and self-defense tests, as outlined in the Revision E TEMP and the IOT&E Test Plan.
3. Address combat system deficiencies identified in the classified USS Gerald R. Ford (CVN 78) Self-Defense Interim Assessment report, dated April 2022.

4. Continue to develop more robust capabilities to test the cyber survivability of shipboard industrial control systems.
5. Fund the modeling and simulation suite required to assess the CVN 78 PRA requirement.
6. Upon release of DOT&E's CVN 78 FSST report, develop and resource a way forward to correct deficiencies and provide it to DOT&E.
7. Complete and deliver the vulnerability assessment reports and supporting documentation.
8. Update the CVN 78 TEMP to complete the test strategy and provide resources for requirements to adequately test the combat system on CVN 79.
9. Continue to fund the maintenance availability for the SDTS to ensure its readiness to support CVN 79 combat systems testing.
10. Update the IOT&E Test Plan to complete the test requirements and scheduling for the second phase of IOT&E.⁵³

A March 7, 2023, opinion piece stated:

While the Navy puts on a brave face on the carrier's well-publicized technical problems, balancing the drumbeat of bad news with morale-boosting press visits, credulous "gee-whiz" media coverage, and showpiece deployments, the IOT&E tests, when completed in late FY 2024, are likely to carry a far less positive message about the USS Ford's warfighting capabilities—the ultimate business case for what will be, at a minimum, a class of four expensive vessels....

To be blunt, the USS Ford has yet to demonstrate the ability to operate at sea—uninterrupted and without a port call—for more than 35 days at a stretch. It also seems unable—or the Navy is simply unwilling—to even carry out a standard set of sortie-generation tests—allowing an easy “apples-to-apples” comparison with the Navy's legacy Nimitz class carriers.

The fact remains that the USS Ford, 6 years after delivery, still appears unable to match the sortie generation performance a World War II-era carrier, USS Midway (CV-41) exhibited during Desert Storm.

It is a big problem—and it won't go away anytime soon....

DOT&E has been very clear about linking the carrier's technical problems to concrete measures of carrier performance. The testing agency, in their 2023 annual report, did a great job of tying pilot certification challenges to the USS Ford's unreliable flight deck systems. The message was clear—the Ford's reliability challenges inflict real consequences on naval missions.

The Navy, obviously uncomfortable with DOT&E's focus on mission accountability, grasped for a positive spin. It abruptly shifted gears on the media, introducing a reliability metric that it has never used before in public discussions of the aircraft carrier's poor-performing electromagnetic launch (EMALS) and recovery systems (Advanced Arresting Gear, or AAG).

Tellingly, the Navy's new reliability metric indicated “improvement in the reliability of the catapult and arresting gear systems” but it somehow lacked a direct tie to carrier performance.

⁵³ Department of Defense, *Director, Operational Test & Evaluation*, January 2023, pp. 168-171.

The Navy, when pressed for clarification, said, it “has addressed EMALS and AAG issues via a reliability growth plan that has resulted in an average Operational Availability of ~ 0.98 for the last 5,500 (~45%) launches and recoveries across both systems.”

And yet, somehow, the carrier, despite great operational availability scores, struggled to qualify pilots.

This gets at the root of the problem. Essentially, the Navy seems content to merely field something that looks and acts like a carrier. And by introducing another metric, the Service is refusing to even acknowledge the launch-and-recovery problems exist, effectively discrediting Pentagon weapons testers by muddying their very real concerns about the USS Ford’s ability to accomplish the platform’s central mission—generating more aircraft sorties faster than any previous U.S. aircraft carrier...

The Navy, in a statement that took nine days to generate, focused on the DOT&E’s primary measurement of EMALS and AAG reliability, or, in the technological lingo, “Mean cycles Between Operational Mission Failures”. The unsophisticated measure tallies the number of launches and recoveries that occur between system failures, and then averages them. As a mean, the Pentagon’s testing measure isn’t perfect, and can be overly influenced by outliers.

For the Navy, “the reliability requirements for EMALS and AAG are expressed in terms of ‘Operational Availability’, which is the measure of how often a system is available to perform a mission versus not.”

The Navy’s statement continued, explaining that “EMALS and AAG Operational Availability measures the amount of time the system is available for operational use and is a ratio of system uptime divided by total time uptime and downtime. Downtime is a result of failures which prevent the system from accomplishing its mission. Total downtime is a function of time required to diagnose the issue, complexity of repair, and availability of spare parts.”

DOT&E responded, issuing a statement saying that the organization will continue to “collect operationally representative effectiveness and suitability data from flight operations”.

The Pentagon said it focused on mean cycles between operational mission failure because the testing organization considers it “to be the most applicable metric during developmental test, and it remains applicable during operational test” and that “no combat representative scenarios have been scored to date” where operational availability might matter.

The Pentagon statement put the focus right back onto the mission, saying that “the ship and air wing have additional operational metrics” that add context to the measurements cited by both DOT&E and the Navy, cautioning that a “combination of all three are needed to best capture how reliability and availability may impact combat flight operations.”

In short, the Navy—unless it can get its act together—is soon going to face the music about their troubled aircraft carrier. It needs to show that the positive metrics it has proffered to the press can translate into the basic mission of launching and recovering aircraft.

The smart money is on DOT&E’s concerns over the Ford’s battle readiness. With a history of broken performance promises, public relations games, little accountability, and an active “revolving door” of high-level carrier decision-makers going to work for the carrier’s builder, America’s sea service hasn’t exactly covered itself in glory during the USS Ford’s acquisition process.⁵⁴

⁵⁴ Craig Hooper, “Put Up Or Shut Up Time For America’s Troubled New Aircraft Carrier,” *Forbes*, March 7, 2023. See also Sam LaGrone, “VIDEO: Navy’s Newest Carrier USS Gerald R. Ford Faces Toughest Test Yet,” *USNI News*, March 11 (updated March 12), 2023.

June 2022 GAO Report

A June 2022 GAO report—the 2022 edition of GAO’s annual report assessing selected major weapon acquisition programs—stated the following about the CVN-78 program:

Technology Maturity, Design Stability, and Production Readiness

While CVN 78’s 12 critical technologies are mature, according to the program office, challenges persist in demonstrating their reliability. As of December 2021, the Navy delivered all 11 weapons elevators to operate on the ship. If future testing identifies issues with the elevators, changes are likely to be costly and time-consuming to address.

The Navy also continues to struggle with the reliability of the electromagnetic aircraft launch system and advanced arresting gear needed to meet requirements to rapidly deploy aircraft. Since our last detailed report on these systems in 2014, reliability has only slightly increased. The Navy anticipates achieving reliability goals in the 2030s. Until then, however, these low levels may prevent the ship from demonstrating one of its key requirements—rapidly deploying aircraft.

The Navy declared initial operational capability for the lead ship (CVN 78) in December 2021, 5 months later than the planned date the Navy reported last year and 8 months before starting operational testing, which determines the effectiveness of ship systems. In August 2021, CVN 78 completed at-sea trials to test the ship’s ability to withstand shock from underwater explosions. Officials from the office of the Director, Operational Test and Evaluation (DOT&E) said the trials were generally successful, but identified vulnerabilities in ship systems.

Program officials anticipate receiving approval of their updated test and evaluation master plan before operational testing begins in August 2022. DOT&E officials described risks if the test plan was not approved before testing starts, namely that the program may not be properly planning and budgeting for needed resources, which could delay testing’s start. Program officials told us there had been no impact to testing as a result of the test plan pending approval. The Navy recently provided a draft version of the updated test plan, which included information on CVN 79 testing, such as incorporating that ship’s new radar, but did not include detailed test dates that we could compare to previous test schedules. We plan to conduct a more detailed review of the test plan in future assessments.

Software and Cybersecurity

The CVN 78 program’s software and cybersecurity approach has not changed since last year. Dates for completing evaluation of cybersecurity vulnerabilities vary by system and test event. The Navy plans for continuous testing over system life cycles through 2024.

Other Program Issues

The CVN 78 cost cap is currently \$13.2 billion—more than \$2.7 billion higher than its initial cap—as a result of construction and critical technology issues. If testing reveals deficiencies, the Navy may continue requesting additional funding, further increasing the true cost of the ship. In addition to the class’s baseline capabilities, CVN 78 is also relying on different types of funding, such as operations and maintenance or research and development—not subject to the construction cost cap—to address issues like modernization to support the Joint Strike Fighter.

As of September 2021, the Navy increased the CVN 79 cost cap by \$1.3 billion primarily due to contract overruns. According to the CVN 79 program office, these overruns are mainly due to shipbuilder performance. At over 85 percent complete, CVN 79 is in a phase of construction when additional cost growth is most likely. Cost growth also resulted from changes for CVN 79 such as shifting to a single-phase delivery schedule and incorporating F-35 modifications, among other things. It is unclear how this updated delivery schedule will affect testing time frames for CVN 79. If the new schedule results in less time for

testing in a maritime environment, it will introduce greater risk to the CVN 79 schedule. The Navy plans to address this cost growth in future budget submissions. According to program officials, the shipbuilder’s COVID-19 pandemic mitigations reduced construction efficiency, although the shipbuilder has yet to provide assessments of the cost and schedule effects.

The Navy reported awarding fixed-price contracts for CVNs 80 and 81 in January 2019 and expects to save over \$4 billion combined based on optimistic cost estimates. However, the Navy already identified additional funds needed to transition CVN 80 to a digital construction model. Based on our past findings that the Ford class cost estimate was based on optimistic assumptions, additional costs are likely.

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. According to the Navy, CVN 78 completed five testing and maintenance periods in 2021 and the program addressed nearly all the issues identified when the ship was delivered. Further, the Navy reported declaring initial operational capability for the electromagnetic aircraft launch system and advanced arresting gear in 2021. For CVN 79, the Navy reported that \$313 million in other cost offsets will help mitigate the increase in CVN 79 costs to \$12.7 billion, though that ship still has a net procurement cost increase of nearly \$1 billion. The Navy is also still planning for cost savings from its two-ship acquisition of CVNs 80 and 81. Keel-laying for CVN 80 and CVN 81 is scheduled for the third quarter of fiscal year 2022 and in fiscal year 2026, respectively.⁵⁵

Legislative Activity for FY2024

Summary of Congressional Action on FY2024 Funding Request

Table 3 summarizes congressional action on the FY2024 procurement funding request for the CVN-78 program. The request for CVN-79 is for cost-to-complete (CC) funding to cover cost growth on CVN-79 following the completion in FY2018 of the ship’s original full funding.

Table 3. Congressional Action on FY2024 Procurement Funding Request
(Millions of dollars, rounded to nearest tenth)

	Request	Authorization			Appropriation		
		HASC	SASC	Final	HAC	SAC	Final
CVN-79	624.6						
CVN-80	1,115.3						
CVN-81	800.5						
Total above	2,540.4						

Source: Table prepared by CRS based on Navy’s FY2024 budget submission, committee and conference reports, and explanatory statements on FY2024 National Defense Authorization Act and FY2024 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. The request for CVN-79 is for

⁵⁵ Government Accountability Office, *Weapon Systems Annual Assessment[:] Challenges to Fielding Capabilities Faster Persist* GAO-22-105230, June 2022, p. 164.

cost-to-complete (CC) funding to cover cost growth on CVN-79 following the completion in FY2018 of the ship's original full funding.

Appendix. 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 Ford-class carriers under a two-ship block buy contract had been discussed in this CRS report since April 2012.⁵⁶ In earlier years, the discussion focused on the option of using a block buy contract for procuring CVN-79 and CVN-80. In subsequent 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.⁵⁷

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 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 January 31, 2019, the Navy

⁵⁶ 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.

⁵⁷ 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.

announced that it had awarded a two-ship fixed-price incentive (firm target) (FPIF) contract for CVN-80 and CVN-81 to HII/NNS.⁵⁸

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 was procured in FY2019 [or, according to the Navy's FY2021-FY2024 budget submissions, in FY2020]).⁵⁹ 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 Equipment⁶⁰ and production change orders."⁶¹ Within the total estimated combined reduction in cost, HII/NNS reportedly expects to save up to \$1.6 billion in contractor-furnished equipment.⁶²

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,⁶³ and facility investments which improve the shipbuilder trade effectiveness. A two-ship buy assumes four years between

⁵⁸ 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.

⁵⁹ 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.

⁶⁰ Government-furnished equipment (GFE) is equipment that the government purchases from supplier firms and then provides to the shipbuilder for incorporation into the ships.

⁶¹ 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.

⁶² 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.

⁶³ 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.⁶⁴

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.

⁶⁴ 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.⁶⁵

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⁶⁵ 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.