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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;
- cost growth in the CVN-78 program, Navy efforts to stem that growth, and Navy efforts to manage costs so as to stay within the program's cost caps;
- the delay in CVN-78's first deployment;
- 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 2023 Government Accountability Office (GAO) report on DOD weapon systems; and
- the procurement of aircraft carriers after CVN-81.

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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

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."

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.

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

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.

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, (continued...)

Projected Number of Aircraft Carriers

The Navy's FY2024 30-year (FY2024-FY2053) shipbuilding plan includes three alternative 30-year shipbuilding profiles for the period FY2029-FY2053. Under all the three profiles, the carrier force is projected to include 11 carriers in most years between FY2024 and FY2039. Under the first and second profiles, the carrier force is to include 10 carriers from FY2040 until FY2045, and then 9 or sometimes 10 carriers from FY2046 through FY2053. Under the third profile, the carrier force is projected to include 10 carriers in most years from FY2040 through FY2053.

Incremental Funding Authority for Aircraft Carriers

Congress since the 1990s has authorized DOD to use incremental funding for procuring certain Navy ships, most notably aircraft carriers.⁹ 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.¹⁰

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 as of 2019 also included roughly 2,000 supplier firms in 46 states.¹¹

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 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.

¹⁰ 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.

¹¹ Source: 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.

Gerald R. Ford (CVN-78) Class Program

Overview

The Gerald R. Ford (CVN-78) class carrier design (**Figure 1**, **Figure 2**, and **Figure 3**) 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/>.

CVN-78 (*Gerald R. Ford*)

CVN-78, which was named *Gerald R. Ford* in 2007,¹² 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 2021.¹³ 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

¹² §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.

¹³ See, for example, Marcus Weisgerber, “Surprise! The Navy Declared Its Newest Carrier Battle-Ready Last Year,” *Defense One*, April 5, 2022.

was commissioned into service, and ended on November 26, 2022.¹⁴ The ship reportedly began its first full-length deployment on May 2, 2023.¹⁵

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-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., \$12.7 billion) in then-year dollars. On August 10, 2023, the Navy notified the congressional defense committees that, using authority granted by Section 121 of the FY2020 National Defense

¹⁴ 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 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.

¹⁵ See, for example, Diana Stancy Correll, "USS Gerald R Ford Leaves Norfolk for First Full-Length Deployment," *Navy Times*, May 2, 2023; Aaron-Matthew Lariosa, "Aircraft Carrier USS Gerald R. Ford Departs Norfolk for Worldwide Deployment," *USNI News*, May 2, 2023.

¹⁶ See "Navy Names Next Aircraft Carrier USS John F. Kennedy," *Navy News Service*, May 29, 2011, accessed online on June 1, 2011, at http://www.navy.mil/search/display.asp?story_id=60686. See also Peter Frost, "U.S. Navy's Next 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.

Authorization Act (S. 1790/P.L. 116-92 of December 20, 2019), the Navy was increasing the cost limitation baseline (aka cost cap) for CVN-79 by \$236 million, to \$12,936 million, to support full ship delivery efforts. (For further information on procurement cost caps for the CVN-78 program, see “Program Procurement Cost Cap” below.) CVN-79 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.

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-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.,

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* (continued...))

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 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 and "2-3-4" Approach for Procuring Aircraft Carriers

The Navy's FY2024 30-year (FY2024-FY2053) shipbuilding plan shows the next two carriers after CVN-81 as scheduled for procurement in FY2028 and either FY2032 or FY2033. Some observers reportedly are interested in the option of using another two-ship block buy contract to

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 of Legislative Affairs on June 20, 2019.

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

procure two additional Ford-class carriers, which would be CVN-82 and CVN-83.²² More broadly, some observers have argued in favor of a “2-3-4” approach for procuring carriers that would include two-carrier buys, three years (rather than two years) of advanced procurement funding for each carrier, and four-year centers for building carriers (i.e., starting construction of each carrier four years after the start of the previous carrier’s construction). In association with the 2-3-4 approach, these observers have argued that delaying the procurement of CVN-82 beyond FY2028 could damage the CVN construction industrial base.²³

Section 132 of the FY2023 NDAA (H.R. 7776/P.L. 117-263 of December 23, 2022) required the Navy to submit a report to the congressional defense committees not later than March 1, 2023, on advance procurement funding for CVN-82 and CVN-83 under single-carrier and two-carrier acquisition strategies.

Program Procurement Cost Cap

Congress between established and subsequently amended procurement cost caps for Ford-class aircraft carriers.²⁴

²² See, for example, Megan Eckstein, “US Navy Mulls Timing of New Double-Carrier Award Amid Enterprise Delay,” *Defense News*, October 26, 2023; 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.

²³ Rich Abott, “HII Argues For Two Carrier Block Buys With Three Years Advance Work, Warns If CVN-82 Delayed,” *Defense Daily*, January 8, 2024; Audrey Decker, “Delaying Aircraft Carrier Order Would Hurt Supply Chain, Shipbuilder Says,” *Defense Daily*, January 8, 2024; Megan Eckstein, “HII Warns of Potential Carrier, Amphib Issues in Fy25 Budget Request,” *Defense News*, January 8, 2024; Brett Davis, “Delay to CVN 82 Buy Could Endanger Industrial Base, New Industry Report Says,” *Seapower*, January 17, 2024.

²⁴ 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 (continued...)

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.

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.

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.

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 9), 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).²⁵

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 FY2024 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.

²⁵ 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.

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.²⁶

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.²⁷

²⁶ 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 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.

²⁷ 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* (continued...))

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.

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.²⁸

October 2023 CBO Report

An October 2023 Congressional Budget Office (CBO) report on the potential cost of the Navy's FY2024 30-year shipbuilding plan states

The Navy estimates that [CVN-79] will cost \$14.8 billion (in [constant FY]2023 dollars, or \$12.7 billion in nominal dollars). CBO's estimate for the ship is almost the same: \$14.9 billion (in [constant FY]2023 dollars)....

In the 2024 budget, under the two-carrier [CVN-80 and CVN-81] buy, the Navy estimated that the CVN-80 will cost \$12.3 billion (in [constant FY]2023 dollars, or \$12.6 billion in nominal dollars). By contrast, CBO is less certain about the savings the two-carrier purchase will generate. On the basis of the costs of the two previous ships, CBO estimates that the CVN-80 will cost \$14.0 billion (in [constant FY]2023 dollars), about 13 percent more than the Navy's estimate. Similarly, the Navy estimates that the CVN-81 will cost \$12.0 billion (in [constant FY]2023 dollars, or \$12.9 billion in nominal dollars). By contrast, CBO estimates that the CVN-81 will cost \$13.6 billion (in [constant FY]2023 dollars), which is also 13 percent more than the Navy's estimate.

The Navy's estimates for future carriers are much higher than its estimates for the CVN-80 or CVN-81. In the [Navy's] 2024 [30-year] shipbuilding plan, the Navy estimates that the 6 carriers purchased under [30-year] Alternatives 1 and 2 would each cost about \$17 billion (in [constant FY]2023 dollars), on average, and the 7 carriers purchased under [30-year] Alternative 3 would each cost about \$16 billion.... The difference between those two estimates for the alternatives is driven largely by the effect of building carriers every five

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.)

²⁸ Source: Navy information paper provided to CRS by Navy Office of legislative Affairs on June 20, 2019.

years under the first two alternatives versus every four years under the third alternative. The Navy expects that if future carriers can be purchased repeatedly using the two-carrier buy strategy over the next 30 years, then the costs could be lower than the estimates provided in the [FY]2024 [30-year shipbuilding] plan.

In a report to the Congress, the Navy estimates that a two-ship buy strategy would save about 7 percent, if the carriers were purchased every five years. If those ships were purchased every four years, then the estimated savings would double, to about 14 percent under Alternatives 1 and 2. Under Alternative 3, the savings would be a little less than 7 percent because the Navy already envisions buying carriers every four years under that alternative. Even so, the Navy's recent estimates suggest that the industry is experiencing growth in real costs. The increase in its estimates for the [FY]2024 [30-year shipbuilding] plan, compared with those in the [FY]2023 [30-year shipbuilding] plan, amounts to roughly \$500 million more per ship than is accounted for by shipbuilding inflation alone (using the same assumptions about how frequently the Navy would buy the ships).

CBO estimates that under the first two alternatives, carriers would cost, on average, \$16.6 billion—3 percent less than the Navy's estimate. CBO's estimate for carrier purchases under the third alternative is \$15.7 billion per ship—2 percent less than the Navy's estimate. Although using the two-carrier buy strategy should generate savings, it is not clear that the large savings the Navy anticipates would occur. The savings that could be realized with two-carrier buys will be better understood once the CVN-80 and CVN-81 are complete.²⁹

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,³⁰ 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.

As noted earlier, on August 10, 2023, the Navy notified the congressional defense committees that, using authority granted by Section 121 of the FY2020 National Defense Authorization Act (S. 1790/P.L. 116-92 of December 20, 2019), the Navy was increasing the cost limitation baseline (aka cost cap) for CVN-79 by \$236 million, to \$12,936 million, to support full ship delivery efforts.

²⁹ Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2024 Shipbuilding Plan*, October 2023, p. 24.

³⁰ 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.

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 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.³¹

Delay in CVN-78's First Deployment

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 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 2018,³² 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.³³

³¹ Megan Eckstein, "Navy Says Digital Work Instructions, Lessons Learned Are Improving Construction of Third Ford-Class Carrier," *Defense News*, March 7, 2022.

³² See Anthony Capaccio, "U.S. Navy's Costliest Carrier Was Delivered Without Elevators to Lift Bombs," *Bloomberg*, November 2, 2018.

³³ 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 Abbott, "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 (continued...)"

- On October 23, 2019, the Navy reported that the figure had increased to four of 11.³⁴
- 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 underwent Full Ship Shock Trials (FSSTs), which was then scheduled for the third quarter of FY2021.³⁵
- On July 23, 2020, the Navy announced that the sixth AWE had been certified.³⁶
- 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 2021.³⁷
- 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 2021.³⁸
- On March 23, 2021, Navy Admiral John Aquilino testified that nine of the 11 AWEs had been “repaired.”³⁹

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.

³⁴ 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.

³⁵ 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.)

³⁶ Gina Harkins, “Supercarrier Ford Could Soon Have More Than Half of Its Weapons Elevators Working,” *Military.com*, June 19, 2020.

³⁷ Mallory Shelbourne, “USS Gerald R. Ford Making Steady Progress Ahead of Deployment,” *USNI News*, November 24, 2020.

³⁸ 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.

³⁹ 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.

- 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 2021.⁴⁰
- 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.”⁴¹
- The Navy stated that the 11th and final AWE was completed, tested, and certified on December 22, 2021.⁴²

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.⁴³

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.”

⁴⁰ 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.

⁴¹ 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.

⁴² 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 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.

⁴³ 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.

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.⁴⁴

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 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.⁴⁵

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.

⁴⁴ Anthony Capaccio, “Priciest U.S. Warship Spurs Haggling on Who Pays for Crucial Fix,” *Bloomberg*, January 21, 2022.

⁴⁵ 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.

“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.⁴⁶

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?

Issues Raised in DOT&E and GAO Reports

Another oversight issue for Congress concerns CVN-78 program issues raised in a January 2024 report from DOD’s Director, Operational Test and Evaluation (DOT&E)—DOT&E’s annual report for FY2023—and in the 2023 edition of the Government Accountability Office’s (GAO’s) annual report surveying selected DOD weapon acquisition programs, which was published in June 2023.

January 2024 DOT&E Report

Regarding the CVN-78 program, the January 2024 DOT&E report stated the following in part:

TEST ADEQUACY

The Navy began CVN 78 IOT&E [Initial Operational Test & Evaluation] in September 2022 and is conducting it in accordance with TEMP [Test and Evaluation Master Plan]

⁴⁶ 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.

Revision E and the DOT&E-approved portions of the IOT&E test plan. However, analysis of the data provided to DOT&E to date revealed gaps in data collection, which, if not rectified, could result in insufficient data to inform conclusive assessments of reliability, maintainability, logistics and/or availability (RMLA) for some key subsystems. In addition to affecting suitability assessments, these data gaps could also affect effectiveness assessments due to the on-demand nature of many key subsystems and the reliance upon accurate RMLA data in both the self-defense and SGR models. The Navy has acknowledged these shortcomings, committed to improve data collection, and will update the IOT&E test plan for the major remaining tests such as SGR [sortie generation rate], self-defense, and cyber survivability tests. In April 2023, DOT&E submitted a classified CVN 78 Ford-class Aircraft Carrier EFR [early fielding report] to Congress, detailing operational and live fire test results to date.

Prior to deployment, CVN 78 conducted two significant underway periods during IOT&E that included fixed-wing flight operations, both of which were in accordance with the DOT&E-approved test plan and observed by DOT&E. A brief summary is below, and detailed results of the underway periods can be found in DOT&E's classified EFR.

In the first significant underway period of IOT&E, CVN 78 executed a service-retained early employment from October 4 to November 26, 2022, as part of CSG 12 [Carrier Strike Group 12] that included Tailored Ship's Training Availability (first deployment work-up integrated with CSG); port calls in Halifax, Canada and Portsmouth, England; and multiple operations with allies and partners. The early employment was the first time the air wing, destroyer squadron staff, and CSG staff embarked on the ship together, and the first period of consistent cyclic flight operations for the Ford class, which resulted in 896 arrested landings (not including carrier qualifications). During the early employment, the maximum air wing compliment was approximately 75 percent of the full air wing.

In the second significant underway period of IOT&E, CVN 78 completed its first COMPTUEX [Composite Training Unit Exercise] (final pre-deployment workup) from March 2 to April 2, 2023, off the U.S. east coast. Administered by CSG 4, COMPTUEX was the first time CVN 78 operated with an operationally representative air wing embarked, conducting consistent, combat-representative scenarios. During COMPTUEX, CVN 78 executed 1,600 total arrested landings, including 1,185 arrested landings during cyclic and alert flight operations. At the end of COMPTUEX, CVN 78 had conducted a total of 14,177 catapult launches and arrested landings since its commissioning. In July 2023, the second of three planned CVN 78 land-based cyber survivability operational tests was completed on SSDS, CEC, and SEWIP [Surface Electronic Warfare Improvement Program]. The test was conducted in accordance with the DOT&E-approved test plan and observed by DOT&E. These land-based tests are intended both to inform planning for shipboard testing and to perform testing deemed too risky to conduct during shipboard cyber survivability tests prescribed by TEMP Revision E.

Many systems specific to CVN 78 have yet to undergo any operational cyber survivability assessments. In June 2023, the Navy updated its cyber survivability testing strategy by replacing the third land-based cyber survivability test with additional testing during shipboard cyber assessments after deployment. The third land-based test was scheduled for late FY23, and its focus was on hull, mechanical, and electrical systems. This change in strategy was primarily due to a lack of existing, robust cyber survivability testing facilities for shipboard industrial control systems. The Navy needs to conduct the shipboard tests to assess CVN 78's overall cyber survivability and enable post hoc accreditation of the test facilities used in completed land-based cyber survivability tests. The Navy is still developing these shipboard cyber survivability test plans.

The CVN 78 Total Ship Survivability Trial (TSST) has been delayed by approximately one year, until 4QFY24 [fourth quarter of FY2024], due to the ship's deployment being earlier than planned. The TSST is an onboard, extensive damage-control test to demonstrate how

the ship design enables the crew to perform its recoverability-related procedures. For the CVN 78 TSST to be adequate, the testing will require at-sea execution with participation of an embarked air wing. Planning is ongoing to ensure that this adequacy requirement is met.

In 1QFY24, the Navy intends to publish two vulnerability assessment reports (VARs) examining the class's survivability against above-water and underwater kinetic threats. These reports will include findings from survivability testing and modeling of the ship conducted since 2007. However, these reports as drafted do not accurately model the ship as built and do not include findings from more recent testing. Without updating the models, the analysis in the VARs will not support conclusions on the survivability of the CVN 78 class against threat weapons. The Navy intends to issue a final survivability assessment report that will include the findings from recent testing and update model-based survivability analysis by 4QFY25. If the survivability modeling and simulation (M&S) is updated to accurately model the ship as built, this assessment will support DOT&E's report on the survivability of the class against threat weapons.

Together the CVN 78 TEMP Revision E and the Capstone Enterprise Air Warfare Ship Self-Defense (AW SSD) TEMP 1714 of March 2008 provide for a series of live missile fire events aboard CVN 78 against specific types of ASCM threat surrogates to assess the ship's anti-air warfare capabilities. The Navy intends to execute these tests in FY25. These live tests are necessary to assess ship self-defense capability of the as-built, deployed combat system, and to provide validation data for the M&S suite of the CVN 78 combat system. While these live fire tests, as planned, are adequate, DOT&E has concerns with the Navy's ability to adequately resource them. The M&S is intended to assess the Navy's PRA KPP [Probability of Raid Annihilation Key Performance Parameter]. These tests, combined with those conducted on the self-defense test ship, and the PRA model runs are required to determine CVN 78's operational effectiveness against specific types of ASCM [anti-ship cruise missile] threats. In FY23, the Navy continued to develop a draft new Enterprise TEMP in support of SSDS Mk 2 Baseline 12 and SPY-6 V(2) and V(3) platforms [ships equipped with SPY-6 V(2) and V(3) radars] (TEMP 1910) that includes FOT&E [Follow-on Operational Test and Evaluation] on CVN 79. While CVN 79 self-defense test design will mature during the TEMP 1910 development, any delay in the current timeline for testing the CVN 79 combat systems will be challenged by the planned deactivation timeline for the self-defense test ship, the ex-USS Paul F. Foster. The Navy should maintain the capability of the self-defense test ship, currently provided by the ex-USS Paul F. Foster.

The CVN 78 SGR evaluation comprises M&S (for both Ford and Nimitz class), a four-day sustained test on CVN 78, a one-day surge test on CVN 78, and flight operations observations on a Nimitz-class carrier. Development of the M&S suite intended to evaluate the SGR, the Sea Strike/Sea Basing Aviation Model (SSAM), is ongoing. The CVN 78 SGR tests are incomplete. The CVN 78 sustained SGR test was originally scheduled for the first COMPTUEX; however, due to COMPTUEX syllabus changes, ship and air wing schedule changes, and resourcing, it was deferred to the second COMPTUEX, now expected to occur in FY25. The Navy plans to apply lessons from the CVN 78 sustained SGR test to the surge SGR test which is currently unscheduled. A Nimitz-class COMPTUEX to collect flight operations data to support a Nimitz-class SGR M&S suite (part of SSAM) for comparative analysis is planned for FY24. DOT&E approved these deferments in Revision 1 to the IOT&E test plan. The Navy needs to provide an updated test plan prior to conducting these events.

PERFORMANCE

EFFECTIVENESS

Insufficient data are available to determine CVN 78's operational effectiveness due to IOT&E being incomplete. Observations based on testing to date are below.

Combat System

Self-defense testing against unmanned aerial vehicles (UAVs) and high-speed maneuvering surface targets (small boats) was conducted in July 2022. Details can be found in DOT&E's classified EFR. The Navy is developing fixes to combat system deficiencies identified in DOT&E's classified USS Gerald R. Ford (CVN 78) Self-Defense Interim Assessment report dated April 2022. However, to date the fixes remain largely unfunded.

Sortie Generation

In FY23, CVN 78 conducted almost as many flight operations (as measured by the number of aircraft launch and recoveries) as it had in the previous five years combined since commissioning. From the first arrested landing on CVN 78 in July 2017 until the end of FY22, CVN 78 had conducted 10,826 arrested landings. In FY23 alone, CVN 78 conducted 9,266 arrested landings. The reliability and maintainability of CVN 78's EMALS and AAG continue to adversely affect sortie generation and flight operations, which remains the greatest risk to demonstrating operational effectiveness and suitability in IOT&E. Despite these continuing reliability challenges, DOT&E observed general increases in crew proficiency and decreases in some repair times. While this has improved sortie generation compared to previous years, SGR tests have not been completed yet nor have training sortie rates flown to date approached that of the KPP requirement. CVN 78 earned the flight operations efficiency portion of its Blue Water Certification as part of the Navy's deployment certification process. Observations during COMPTUEX suggests that the Ford-class flight deck design improves the efficiency of aircraft turnarounds compared to that of a Nimitz-class flight deck. Additional details on sortie generation effectiveness can be found in DOT&E's classified EFR. Executing the planned SGR testing, as outlined in TEMP Revision E, will be crucial to evaluating the ship's combat effectiveness and accrediting the high-fidelity SSAM which is an essential tool for evaluating the SGR KPP and supporting life-of-class upgrades.

Electromagnetic Spectrum Compatibility

Developmental testing identified significant electromagnetic radiation hazard and interference problems. The Navy implemented some mitigation measures and conducted follow-on characterization testing during independent steaming events in developmental test, but some operational limitations and restrictions are expected to persist into IOT&E and deployment. The Navy should verify developmental test electromagnetic spectrum compatibility during operational test, particularly when integrated with CSG operations in an advanced electronic attack environment. This will enable capability assessments at differing levels of system use to inform decisions on system employment.

SUITABILITY

Insufficient data are available to determine CVN 78's operational suitability. However, the following four new CVN 78 systems have shown low or unproven reliability and are highlighted as the most significant challenge to flight operations.

AAG

During FY23, DOT&E observed AAG reliability similar to recent developmental testing (115 mean cycles between operational mission failures [MCBOMF] in FY21 and 460 MCBOMF in FY22). Despite some software and hardware improvements in AAG, reliability has not appreciably changed because the FY23 data reflects many short-duration failures that were unreported in developmental test, as well as system-of-systems degradations, all of which would have prevented landing. Naval Air Systems Command (NAVAIR) delivered hardware updates after early employment and before COMPTUEX, along with a software update before deployment. NAVAIR continues to work on short- and long-term improvements to address AAG reliability degraders. However, difficulties

such as obtaining replacement parts and the reliance on off-ship technical support remain a challenge. The Navy is also using IOT&E to inform the decision of whether to retrofit the fourth AAG engine on Ford-class aircraft carriers (as designed, which would make it similar to the arresting gear engine/wire configuration on CVN 76 and CVN 77). The fourth AAG engine was not installed as a cost savings measure. In a 2016 requirements review board, the Navy committed to informing a potential retrofit decision with the results of IOT&E. The criteria on which to base a potential retrofit decision were not specified, and with changes to the IOT&E schedule, more data will be available before the end of IOT&E. The fourth engine would improve the reliability and availability of AAG, improve pilot boarding rate, and restore barricade redundancy. Additional details on AAG suitability can be found in DOT&E's classified EFR.

EMALS

During FY23, DOT&E observed EMALS reliability remained consistent with recent developmental test (460 MCBOMF in FY21 and 614 MCBOMF in FY22). Despite engineering upgrades to hardware and software, reliability has not appreciably changed from prior years and reliance on off-ship technical support remains a challenge. As part of an effort to provide short- and long-term improvements to address EMALS reliability degraders, NAVAIR delivered a software update and upgraded all catapult position sensor blocks prior to CVN 78's deployment and is continuing development on further improvements. Furthermore, a situational awareness display was added in the EMALS Maintenance Workstation that facilitates troubleshooting during operations. Additional details can be found in DOT&E's classified EFR.

Advanced Weapons Elevators (AWEs)

The early employment and COMPTUEX provided CVN 78's first operationally representative opportunities to demonstrate ordnance movement during cyclic flight operations. The AWEs met operational mission needs during these underway periods, but preliminary data suggest AWE is unlikely to meet its operational availability requirement of 99.7 percent. Of note, the crew is reliant on off-ship technical support for correction of hardware and software failures. As of the end of COMPTUEX, the ship had conducted 23,042 total AWE cycles. The Navy has yet to build and transfer ordnance to the flight deck at combat-representative rates. DOT&E expects the SGR tests to be the first operationally representative demonstration of high ordnance throughput. Additional details can be found in DOT&E's classified EFR.

DBR

During COMPTUEX, DBR availability was observed to be lower than that during developmental testing. This is in part due to the operational expectation of continuous radar coverage. Reliability concerns are amplified due to the one-of-a-kind nature of the DBR. The radar relies on embarked contractor support and there is uncertainty on sourcing replacement parts as the system ages. The Navy should ensure replacement parts are manufactured and available for the life of the system or develop a timeline and strategy for replacing DBR with EASR [Enterprise Air Surveillance Radar⁴⁷] on CVN 78 to bring it in line with CVN 79's radar configuration. Additional details on DBR suitability can be found in DOT&E's classified EFR.

Manning and Berthing

Per the Navy's Shipboard Habitability Program, all new ships are required to have a growth allowance of 10 percent of ship's company when the ship delivers. This Service Life Allowance provides both empty bunks to allow for changes in the crew composition over the ship's life and berthing to support crew turnover, visitors, and personnel temporarily

⁴⁷ The term *Enterprise* in this instance is not a reference to CVN-80; it instead means a piece of equipment that is to be installed on multiple types of ships across the Navy (i.e., across the naval enterprise).

assigned to the ship for repairs, inspections, test, and training. However, sufficient berthing is not installed for CVN 78 to conduct combat operations with all hands assigned a bed. While the ship's company manning is reduced from Nimitz-class carriers by approximately 500 personnel, the lack of berthing capacity is driven by embarked units. Based on the composition of the ship and embarked units during COMPTUEX and their respective manning documents, if each was at 100 percent manning, the ship would have a shortfall of 159 beds. These berthing shortfalls will affect quality of life onboard and could reduce the Navy's operational flexibility in employing the ship across its full spectrum of missions and logistical support roles for the CSG. Furthermore, there is potential that the berthing shortfalls could increase as the air wing diversifies to include CMV-22, F-35, and MQ-25, none of which are on CVN 78 today. Additional details on manning and berthing can be found in DOT&E's classified EFR.

SURVIVABILITY

An adequate survivability assessment of the CVN 78 class depends upon a combination of FSST, TSST, and related modeling of the class supported by component and surrogate testing. To date, the Navy has completed all planned LFT&E [Live Fire Test and Evaluation], with the exception of TSST, the VARs, and the final survivability assessment. From June to August 2021, the Navy conducted FSST on CVN 78, including three shock events of increasing severity. In December 2022, DOT&E published a classified FSST report that details findings from the trial, and in July 2023, the Navy published its own FSST report. Both reports identify deficiencies that, if addressed, will improve the class's survivability against weapon events.

The survivability of CVN 78 in a cyber-contested environment has not yet been fully evaluated. Results from the land-based cyber survivability tests will inform the shipboard cyber survivability tests. Some systems specific to CVN 78 have yet to undergo any operational cyber survivability assessments.

The survivability of CVN 78 in contested and congested electromagnetic spectrum environments has not been evaluated. Discussions on how to evaluate CVN 78 survivability in these environments are ongoing with the Navy.

RECOMMENDATIONS

The Navy should:

1. Improve the suitability of AAG, EMALS, AWE, and DBR while minimizing the requirement for off-ship and/or contractor technical support.
2. Reevaluate the timeline and better define the criteria for a decision to retrofit the fourth AAG engine.
3. Collect data in accordance with the test plan for the remainder of IOT&E.
4. Resource and execute the testing per Enterprise AW SSD TEMP 1714 and CVN 78 TEMP, including the planned SGR testing, along with completing, verifying, and validating the SGR M&S suite; shipboard cyber survivability testing; and self-defense tests and PRA modeling.
5. Address the recommendations in DOT&E's classified self-defense interim assessment report from April 2022, and the additional recommendations in DOT&E's classified EFR from April 2023.
6. Develop a plan to sustain DBR on CVN 78 or replace it as soon as possible with the EASR configuration on CVN 79 and subsequent Ford-class carriers.
7. Re-examine manning and berthing for future ships of the class to ensure sufficient berthing is available and that 10 percent Service Life Allowance is allocated to allow future growth.

8. Submit for DOT&E approval a test plan revision to update the test plan schedule.
9. Continue to develop more robust capabilities to test the cyber survivability of shipboard industrial control systems.
10. Execute the TSST with an embarked air wing in FY24.
11. Prioritize and correct deficiencies identified in DOT&E's classified FSST report of December 2022.
12. Produce a project schedule to complete required updates to the vulnerability modeling and simulation by 4QFY24 to support accurate vulnerability reporting in the CVN 78 final survivability assessment report in 4QFY25.
13. Submit for DOT&E approval in 1QFY25 an update of the CVN 78 TEMP, aligned with the new Enterprise TEMP 1910, that provides the test strategy and test resources to determine operational effectiveness of new and/or upgraded capabilities on CVN 79.
14. Ensure the availability of the capability provided by ex-USS Paul F. Foster, the Navy's self-defense test ship, to support combat system testing.
15. To better inform effectiveness and survivability, verify developmental test electromagnetic spectrum compatibility during operational test, particularly when integrated with CSG operations in an advanced electronic attack environment.⁴⁸

June 2023 GAO Report

A June 2023 GAO report—the 2023 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

The Navy continues to face challenges with demonstrating the reliability of key systems, and the CVN 78 program remains about a decade away from demonstrating their reliability. Consequently, the ship may not meet a key performance requirement by the planned end of operational testing in November 2023.

Metrics used to assess system reliability for the electromagnetic aircraft launch system (EMALS) and advanced arresting gear (AAG) are slowly increasing. CVN 78 completed multiple at-sea events, including thousands of aircraft launches and recoveries or landings. These launch and recovery cycles help the program demonstrate system reliability, conduct testing, and certify aircraft on the systems. However, the Director, Operational Test and Evaluation, continues to highlight reliability as a risk to CVN 78's ability to rapidly launch and recover aircraft.

The Navy expects to install the first Enterprise Air Surveillance Radar (EASR) on CVN 79, which it is currently developing for other ship classes. EASR, along with other systems, will replace the program's original Dual Band Radar. The Navy has delivered EASR to the shipyard as it continues testing. However, CVN 79 delivery, planned for late in fiscal year 2024, could be delayed if EASR problems discovered during testing require rework.

The Director, Operational Test and Evaluation, approved the April 2022 CVN 78 Test and Evaluation Master Plan, after the program implemented changes to the test strategy. The Navy subsequently began operational testing in August 2022. Given that operational testing is ongoing, CVN 78 has yet to demonstrate that it is operationally effective and suitable for combat. Any deficiencies discovered during operational testing may lead to a backlog of maintenance issues that the fleet will need to address during future maintenance periods.

⁴⁸ Director, Operational Test & Evaluation, *FY 2023 Annual Report*, January 2024, pp. 177-182.

Software and Cybersecurity

The CVN 78 program's software and cybersecurity approach has not changed since last year. According to program officials, the program conducted an evaluation of potential cybersecurity vulnerability for EMALS and AAG in June 2022. They stated that other ship systems will undergo cybersecurity assessments in fiscal years 2023 through 2025.

Other Program Issues

Since our report last year, program costs increased by \$3.8 billion. Some of the main drivers are CVN 79 contract overruns and EMALS and AAG configuration changes on CVN 80 and CVN 81.

The Navy reported final CVN 78 construction costs of \$13.2 billion. Maintenance or other funding categories will cover any additional costs. For example, according to program officials, the Navy is considering replacing the Dual Band Radar with EASR during a maintenance period to ensure a more reliable supply chain for maintenance. The Navy only has one operational Dual Band Radar unit—installed on CVN 78—which makes sourcing and procuring spare parts more expensive, according to program officials.

In August 2021, the Navy increased CVN 79's cost baseline by \$1.3 billion to \$12.7 billion, primarily due to contract overruns. At over 88 percent complete, CVN 79 is in the complex, final phases of construction when cost growth is most likely. Program officials stated that they do not expect CVN 79 would require additional funding. However, our analysis shows that, based on current performance, the shipbuilder is unlikely to achieve its cost estimate at completion.

The Navy reported saving \$4 billion by concurrently awarding contracts for CVN 80 and CVN 81, compared with buying the ships individually. CVN 80 is 25 percent complete, and the Navy requested additional funding to complete the transition from using paper drawings for construction to a digital model. The Navy estimated the new model would reduce production labor hours by 5 to 7 percent. However, program officials indicated that it is too early to determine if the shipbuilder will achieve this target. Additionally, program officials reported that industrial base issues, including supply chain delays and inflation of material costs, could contribute to the unlikelihood of it achieving anticipated savings.

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 program office, CVN 78 completed ship construction at a total cost of \$13.2 billion. It stated that from October to November 2022, CVN 78 conducted an at-sea deployment and completed more than 1,250 aircraft flights, expended 78 tons of weaponry, and completed 13 resupply efforts at sea. The program office noted that CVN 79 costs increased due to the transition to a new delivery schedule in January 2022 to enable delivery of the ship with its complete warfare systems. It added that costs also increased due to modifications to ensure CVN 79 will be capable of operating and deploying F-35C aircraft upon the completion of the next maintenance period. CVN 80 conducted its keel laying ceremony in August 2022 and the CVN 81 keel laying is scheduled for fiscal year 2026. The program office stated that it expects that the two-ship acquisition strategy for CVN 80 and CVN 81 will deliver significant savings to the government compared with the Navy's cost estimate to procure these ships separately.⁴⁹

⁴⁹ Government Accountability Office, *Weapon Systems Annual Assessment[:] Programs Are Not Consistently Implementing Practices That Can Help Accelerate Acquisitions*, GAO-23-106059, June 2023, p. 142.

Procurement of Aircraft Carriers After CVN-81

Another 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 FY2024 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.⁵⁰ 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,⁵¹ we have looked at a Ford-class-light,⁵² we've looked at various different options and done cost studies on all those options. There

⁵⁰ See CRS Report R43543, *Navy LPD-17 Flight II and LHA Amphibious Ship Programs: Background and Issues for Congress*, by Ronald O'Rourke.

⁵¹ This is a reference to a CVL whose design is based on that of the America (LHA-6) class amphibious assault ship.

⁵² 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.⁵³

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.⁵⁴

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.⁵⁵ 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).

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.

⁵³ 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.

⁵⁴ See, for example, Talbot Manvel, “The Lightning Carrier Isn’t Either,” *U.S. Naval Institute Proceedings*, July 2023.

⁵⁵ Bradley Martin and Michael McMahon, *Future Aircraft Carrier Options*, Santa Monica, CA, RAND Corporation, 2017, 87 pp.

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	624.6	624.6	624.6	624.6	624.6	
CVN-80	1,115.3	1,275.3	1,115.3	1,115.3	1,104.4	1,115.3	
CVN-81	800.5	800.5	800.5	800.5	800.5	800.5	
Total above	2,540.4	2,700.4	2,540.4	2,540.4	2529.5	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 cost-to-complete (CC) funding to cover cost growth on CVN-79 following the completion in FY2018 of the ship’s original full funding.

FY2024 National Defense Authorization Act (H.R. 2670/S. 2226)

House

The House Armed Services Committee, in its report (H.Rept. 118-125 of June 30, 2023) on H.R. 2670, recommended the funding levels shown in the HASC column of **Table 3**. The recommended increase of \$160.0 million for CVN-80 is for “Navy [FY2024] UPL [Unfunded Priorities List]—CVN 75 and CVN 80 SEWIP [Surface Electronic Warfare Improvement Program] BLK III.” (Page 445)

Senate

The Senate Armed Services Committee, in its report (S.Rept. 118-58 of July 12, 2023) on S. 2226, recommended the funding levels shown in the SASC column of **Table 3**.

Section 121 of S. 2226 would amend 10 U.S.C. 8062(e) to require the Navy to maintain a minimum of nine carrier air wings until the date on which additional operationally deployable aircraft carriers can fully support a 10th carrier air wing, after which point the Navy is to maintain a minimum of 10 carrier air wings.

Regarding Section 121, S.Rept. 118-58 states

Reduction in the minimum number of Navy carrier air wings and carrier air wing headquarters required to be maintained (sec. 121)

The committee recommends a provision that would amend section 8062(e) of title 10, United States Code, to relieve the Navy of a requirement to maintain 10 carrier air wings.

The Department of Defense has asked for relief from the requirements of this section, which directs the Secretary of the Navy to ensure that the Navy maintains 9 carrier air wings until additional deployable aircraft carriers can fully support 10 carrier air wings, or October 1, 2025, whichever is earlier. Thereafter, the Navy would be required to maintain 10 carrier air wings.

The Navy intends to maintain 9 carrier air wings as the fleet returns to 11 operational aircraft carriers. The Navy argues that even with 11 operational aircraft carriers, two of

those carriers are regularly unavailable for worldwide deployment due to routine or scheduled maintenance or repair to include refueling and complex overhauls, docking planned incremental availabilities, or planned incremental availabilities. Thus, the Navy believes that maintaining 9 carrier air wings is sufficient to support 11 operational aircraft carriers and that maintaining 10 carrier air wings is unnecessary. (Page 7)

Conference

The conference report (H.Rept. 118-301 of December 6, 2023) on H.R. 2670 recommended the funding levels shown in the authorization final column of **Table 3**.

Section 121 of H.R. 2670 amends 10 U.S.C. 8062(e) to require the Navy to maintain a minimum of nine carrier air wings, each with a dedicated and fully staffed headquarters, with the amendment to take effect one year after the Navy submits to Congress a report on potential approaches to the manning, operation, and deployment of a 10th aircraft carrier and associated carrier air wing to determine how the Navy can mobilize such a carrier and air wing if required by operational needs. H.Rept. 118-301 states

Sec. 121—Modification of requirements for minimum number of carrier air wings of the Navy

The Senate amendment contained a provision (sec. 121) that would amend section 8062(e) of title 10, United States Code, to relieve the Navy of a requirement to maintain 10 carrier air wings.

The House bill contained no similar provision.

The House recedes with an amendment that would provide a sunset for the requirement to maintain 10 carrier air wings 12 months after the Secretary of the Navy submits a report on potential approaches to manning, operating, and deploying a 10th aircraft carrier and associated carrier air wing to determine how the Navy could mobilize such a carrier air wing if required by operational needs. (Page 995)

FY2024 DOD Appropriations Act (H.R. 4365/S. 2587)

House

The House Appropriations Committee, in its report (H.Rept. 118-121 of June 27, 2023) on H.R. 4365, recommended the funding levels shown in the HAC column of **Table 3**. The recommended reduction of \$10.876 million for CVN-80 is for “Joint precision aircraft landing system early to need.” (Page 145)

Senate

The Senate Appropriations Committee, in its report (S.Rept. 118-81 of July 27, 2023) on S. 2587, recommended the funding levels shown in the SAC column of **Table 3**.

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

Author Information

Ronald O'Rourke
Specialist in Naval Affairs

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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.