Congressional Research Service
Informing the legislative debate since 1914

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

Updated April 28, 2022

Congressional Research Service
https://crsreports.congress.gov
RS20643

CRS REPORT
Prepared for Members and
Committees of Congress

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 FY2023 budget requests $2,995.2 million (i.e., about $3.0 billion) in procurement funding for CVN-78 class ships, including $461.7 million for CVN-79, $1,481.5 million for CVN-80, and $1,052.0 million for CVN-81.

CVN-78 (*Gerald R. Ford*) was procured in FY2008. The ship's 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 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. Navy officials state that the ship's first deployment will occur in the fall of 2022, more than five years after it was commissioned into service.

CVN-79 (*John F. Kennedy*) was procured in FY2013. The Navy's proposed FY2023 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 June 2024.

CVN-80 (*Enterprise*) was procured in FY2018. The Navy's proposed FY2023 budget estimates the ship's procurement cost at $12,832.9 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 FY2023 budget submission, like its FY2022 and FY2021 submissions, shows CVN-81 as a ship that was procured in FY2020.) The Navy's FY2023 budget submission estimates the ship's procurement cost at $12,930.0 million (i.e., about $12.9 billion) in then-year dollars. The ship is scheduled for delivery to the Navy in February 2032.

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

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

- the future aircraft carrier force level;
- the procurement of aircraft carriers after CVN-81;
- the delay in CVN-78's first deployment;
- the transfer of parts intended for CVN-79 to CVN-78;
- cost growth in the CVN-78 program, Navy efforts to stem that growth, and Navy efforts to manage costs so as to stay within the program's cost caps; and
- additional CVN-78 program issues that were raised in a January 2022 report from the Department of Defense's (DOD's) Director of Operational Test and Evaluation (DOT&E) and a June 2021 Government Accountability Office (GAO) report on DOD weapon systems.

Contents

Introduction 1
Background 1
Current Navy Aircraft Carrier Force 1
Statutory Requirements for Carriers and Carrier Air Wings 1
Requirement to Maintain Not Less Than 11 Carriers 1
Prohibition on Retiring Nuclear-Powered Aircraft Carriers Prior to Refueling 2
Requirement to Maintain a Minimum of Nine Carrier Air Wings 2
Navy's Aircraft Carrier Force-Level Goal 2
Current Aircraft Carrier Force-Level Goal 2
Emerging Aircraft Carrier Force-Level Goal 2
Projected Number of Aircraft Carriers 3
Incremental Funding Authority for Aircraft Carriers 3
Aircraft Carrier Construction Industrial Base 4
Gerald R. Ford (CVN-78) Class Program 4
Overview 4
CVN-78 (Gerald R. Ford) 5
CVN-79 (John F. Kennedy) 6
CVN-80 (Enterprise) 7
CVN-81 (Doris Miller) 7
Two-Ship Block Buy Contract for CVN-80 and CVN-81 7
Program Procurement Cost Cap 8
Program Procurement Funding 8
Changes in Estimated Unit Procurement Costs Since FY2008 Budget 9
Issues for Congress for FY2023 11
Future Aircraft Carrier Force Level 11
Procurement of Aircraft Carriers After CVN-81 11
Delay in CVN-78's Deployment Due to Weapon Elevators and Other Challenges 13
Overview 13
Weapons Elevators 14
Other Technical Challenges 16
2020 Change in Program Manager 16
Navy Efforts to Address Technical Challenges 17
Potential Oversight Questions 19
Transfer of Parts Intended for CVN-79 to CVN-78 20
Cost Growth and Managing Costs within Program Cost Caps 21
Overview 21
CVN-78 22
CVNs 79, 80, and 81 22
Issues Raised in DOT&E and GAO Reports 25
January 2022 DOT&E Report 26
June 2021 GAO Report 30
Legislative Activity for FY2023 32
Summary of Congressional Action on FY2023 Funding Request 32

Figures

Figure 1. USS *Gerald R. Ford* (CVN-78) 4
Figure 2. USS *Gerald R. Ford* (CVN-78) 5
Figure 3. USS *Gerald R. Ford* (CVN-78) 6

Tables

Table 1. Procurement Funding for CVNs 78, 79, 80, and 81 Through FY2028 9
Table 2. Changes in Estimated Procurement Costs of CVNs 78, 79, 80, and 81 10
Table 3. Congressional Action on FY2023 Procurement Funding Request 32

Appendixes

Appendix. Background Information on Two-Ship Block Buy for CVN-80 and CVN-81 33

Contacts

Author Information..... 37

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 FY2023 budget requests $2,995.2 million (i.e., about $3.0 billion) in procurement funding for the program. Congress's decisions on the CVN-78 program could substantially affect Navy capabilities and funding requirements and the shipbuilding industrial base.

Background

Current Navy Aircraft Carrier Force

The Navy's current aircraft carrier force consists of 11 CVNs,[1] including 10 Nimitz-class ships (CVNs 68 through 77) that entered service between 1975 and 2009, and one Gerald R. Ford (CVN-78) class ship that was commissioned into service on July 22, 2017.[2]

Statutory Requirements for Carriers and Carrier Air Wings

Requirement to Maintain Not Less Than 11 Carriers

10 U.S.C. 8062(b) requires the Navy to maintain a force of not less than 11 operational aircraft carriers.[3] The requirement for the Navy to maintain not less than a certain number of operational aircraft carriers was established by Section 126 of the FY2006 National Defense Authorization Act (H.R. 1815/P.L. 109-163 of January 6, 2006), which set the number at 12 carriers. The requirement was changed from 12 carriers to 11 carriers by Section 1011(a) of the FY2007 John Warner National Defense Authorization Act (H.R. 5122/P.L. 109-364 of October 17, 2006).[4]

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

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

[3] 10 U.S.C. 8062 was previously numbered as 10 U.S.C. 5062. It was renumbered as 10 U.S.C. 8062 by Section 807 of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (H.R. 5515/P.L. 115-232 of August 13, 2018), which directed a renumbering of sections and titles of Title 10 relating to the Navy and Marine Corps. (Sections 806 and 808 of P.L. 115-232 directed a similar renumbering of sections and titles relating to the Air Force and Army, respectively.)

[4] As mentioned in footnote 2, the carrier force dropped from 11 ships to 10 ships between December 1, 2012, when *Enterprise* (CVN-65) was inactivated, and July 22, 2017, when CVN-78 was commissioned into service. Anticipating the gap between the inactivation of CVN-65 and the commissioning of CVN-78, the Navy asked Congress for a temporary waiver of 10 U.S.C. 8062(b) to accommodate the period between the two events. Section 1023 of the FY2010 National Defense Authorization Act (H.R. 2647/P.L. 111-84 of October 28, 2009) authorized the waiver, permitting the Navy to have 10 operational carriers between the inactivation of CVN-65 and the commissioning of CVN-78.

Prohibition on Retiring Nuclear-Powered Aircraft Carriers Prior to Refueling

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

Requirement to Maintain a Minimum of Nine Carrier Air Wings

10 U.S.C. 8062(e), which was added by Section 1042 of the FY2017 National Defense Authorization Act (S. 2943/P.L. 114-328 of December 23, 2016), requires the Navy to maintain a minimum of nine carrier air wings.[5]

Navy's Aircraft Carrier Force-Level Goal

Current Aircraft Carrier Force-Level Goal

In December 2016, the Navy released a force-level goal for achieving and maintaining a fleet of 355 ships, including 12 aircraft carriers[6]—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.[8] Under the Navy's FY2020 30-year shipbuilding plan, for example, carrier procurement

---

[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] Procuring carriers on three-year centers would achieve a 12-carrier force on a sustained basis by about 2030, unless the service lives of one or more existing carriers were substantially extended. Procuring carriers on 3.5-year centers (i.e., a combination of three- and four-year centers) would achieve a 12-carrier force on a sustained basis no earlier than about 2034, unless the service lives of one or more existing carriers were substantially extended. Procuring carriers on

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.[9]

Projected Number of Aircraft Carriers

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

Incremental Funding Authority for Aircraft Carriers

In recent years, Congress has authorized DOD to use incremental funding for procuring certain Navy ships, most notably aircraft carriers.[11] Under incremental funding, some of the funding needed to fully fund a ship is provided in one or more years after the year in which the ship is procured.[12]

---

four-year centers would achieve a 12-carrier force on a sustained basis by about 2063—almost 30 years later than under 3.5-year centers—unless the service lives of one or more existing carriers were substantially extended. (Source for 2063 date in relation to four-year centers: Congressional Budget Office (CBO), in a telephone consultation with CRS on May 18, 2017.)

[9] The projected size of the carrier force in the Navy's FY2020 30-year (FY2020-FY2049) shipbuilding plan reflected the Navy's now-withdrawn FY2020 budget proposal to not fund the RCOH for the aircraft carrier CVN-75 (Harry S. Truman), and to instead retire the ship around FY2024. With the withdrawal of this budget proposal, the projected size of the carrier force became, for the period FY2022-FY2047, one ship higher than what is shown in the Navy's FY2020 budget submission. The newly adjusted force-level projection, reflecting the withdrawal of the proposal to retire CVN-75 around FY2024, were as follows: The force is projected to include 11 ships in FY2020-FY2021, 12 ships in FY2022-FY2024, 11 ships in FY2025-FY2026, 10 ships in FY2027, 11 ships in FY2028-FY2039, 10 ships in FY2040, 11 ships in FY2041, 10 ships in FY2042-FY2044, 11 ships in FY2045, 10 ships in FY2046-FY2047, 9 ships in FY2048, and 10 ships in FY2049.

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

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

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

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

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

Section 121(c) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (H.R. 5515/P.L. 115-232 of August 13, 2018) authorized incremental funding to be used for making payments under the two-ship block buy contract for the construction of CVN-80 and CVN-81. This provision does not limit the total number of years across which incremental funding may be used to procure either ship.

[12] For more on full funding and incremental funding, see CRS Report RL31404, *Defense Procurement: Full Funding*

Aircraft Carrier Construction Industrial Base

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

Gerald R. Ford (CVN-78) Class Program

Overview

The *Gerald R. Ford* (CVN-78) class carrier design (**Figure 1**and **Figure 2**) is the successor to the *Nimitz*-class carrier design. The *Ford*-class design uses the basic *Nimitz*-class hull form but incorporates several improvements, including features permitting the ship to generate more aircraft sorties per day, more electrical power for supporting ship systems, and features permitting the ship to be operated by several hundred fewer sailors than a *Nimitz*-class ship, reducing 50-year life-cycle operating and support (O&S) costs for each ship by about $4 billion compared to the *Nimitz*-class design, the Navy estimates. Navy plans call for procuring at least four Ford-class carriers—CVN-78, CVN-79, CVN-80, and CVN-81.

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

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

Policy—Background, Issues, and Options for Congress, by Ronald O'Rourke and Stephen Daggett, and CRS Report RL32776, *Navy Ship Procurement: Alternative Funding Approaches—Background and Options for Congress*, by Ronald O'Rourke.

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

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

Source: U.S. Navy photograph 200515-N-QI093-1151, showing CVN-78 on May 15, 2020, with the oiler *USNS Patuxent* (T-AO 201) alongside. Accessed March 17, 2021, at https://allhands.navy.mil/Media/Gallery/igphoto/2002340124/.

CVN-78 (Gerald R. Ford)

CVN-78, which was named *Gerald R. Ford* in 2007,[14] was procured in FY2008. The ship's 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.[15] 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. Navy officials state that the ship's first deployment will occur in the fall of 2022,[16] more than five years after it was commissioned into service.

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

[15] See, for example, Marcus Weisgerber, "Surprise! The Navy Declared Its Newest Carrier Battle-Ready Last Year," *Defense One*, April 5, 2022.

[16] See, for example, Mallory Shelbourne, "Navy Says Aircraft Carrier Supply Chain Improving; USS Gerald R. Ford to Deploy by Fall," *USNI News*, January 26, 2022; Megan Eckstein, "Spare Parts Now Flowing, as Carrier Ford Prepares for Maiden Deployment This Year," *Defense News*, January 25, 2022; Aiden Quigley, "First-in-Class Ford Aircraft Carrier to Deploy 'By Fall,'" *Inside Defense*, January 21, 2022.

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

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

CVN-79 (John F. Kennedy)

CVN-79, which was named *John F. Kennedy* on May 29, 2011,[17] was procured in FY2013. The Navy's proposed FY2023 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 June 2024.

[17] 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.

CVN-80 (Enterprise)

CVN-80, which was named *Enterprise* on December 1, 2012,[18] was procured in FY2018. The Navy's proposed FY2023 budget estimates the ship's procurement cost at $12,832.9 million (i.e., about $12.8 billion) in then-year dollars. The ship is scheduled for delivery to the Navy in March 2028.

CVN-81 (Doris Miller)

CVN-81, which was named *Doris Miller* on January 20, 2020,[19] 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 FY2023 budget submission, like its FY2022 and FY2021 submissions, shows CVN-81 as a ship that was procured in FY2020.) The Navy's FY2023 budget submission estimates the ship's procurement cost at $12,930.0 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).[20] (DOD characterized the combined reduction as "nearly $3 billion."[21]) 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.[22] 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**.

---

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

[19] 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.

[20] 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.

[21] 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.

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

Program Procurement Cost Cap

Congress has established and subsequently amended procurement cost caps for CVN-78 class aircraft carriers.[23]

Program Procurement Funding

Table 1 shows procurement funding for CVNs 78, 79, 80, and 81 through FY2028, the final year of funding programmed for CVN-81, under the Navy's FY2023 budget submission. As shown in the table, Navy's proposed FY2023 budget requests $2,995.2 million (i.e., about $3.0 billion) in procurement funding for CVN-78 class ships, including $461.7 million for CVN-79, $1,481.5 million for CVN-80, and $1,052.0 million for CVN-81.

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

Section 122 of the FY2007 John Warner National Defense Authorization Act (H.R. 5122/P.L. 109-364 of October 17, 2006) established a procurement cost cap for CVN-78 of $10.5 billion, plus adjustments for inflation and other factors, and a procurement cost cap for subsequent Ford-class carriers of $8.1 billion each, plus adjustments for inflation and other factors. The conference report (H.Rept. 109-702 of September 29, 2006) on P.L. 109-364 discusses Section 122 on pages 551-552.

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

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

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

Section 121 of the FY2020 National Defense Authorization Act (S. 1790/P.L. 116-92 of December 20, 2019) further amended the cost cap for the CVN-78 program to provide revised caps of $13,224.0 million for CVN-78, $11,398.0 million for CVN–79, $12,202.0 million for CVN–80, and $12,451.0 million for CVN–81. The provision directs the Navy to exclude from these figures costs for CVN–78 class battle spares, interim spares, and increases attributable to economic inflation after December 1, 2018.

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

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

FY	CVN-78	CVN-79	CVN-80	CVN-81	Total
FY01	21.7 (AP)	0	0	0	21.7
FY02	135.3 (AP)	0	0	0	135.3
FY03	395.5 (AP)	0	0	0	395.5
FY04	1,162.9 (AP)	0	0	0	1,162.9
FY05	623.1 (AP)	0	0	0	623.1
FY06	618.9 (AP)	0	0	0	618.9
FY07	735.8 (AP)	52.8 (AP)	0	0	788.6
FY08	2,685.0 (FF)	123.5 (AP)	0	0	2,808.5
FY09	2,687.0 (FF)	1,210.6 (AP)	0	0	3,897.6
FY10	851.3 (FF)	482.9 (AP)	0	0	1,334.2
FY11	1,848.1 (FF)	902.5 (AP)	0	0	2,750.6
FY12	86.0 (FF)*	554.8 (AP)	0	0	640.8
FY13	0	491.0 (FF)	0	0	491.0
FY14	588.1 (CC)	917.6 (FF)	0	0	1,505.7
FY15	663.0 (CC)	1,219.4 (FF)	0	0	1,882.4
FY16	123.8 (CC)	1,569.5 (FF)	862.4 (AP)	0	2,555.7
FY17	0	1,241.8 (FF)	1,370.8 (AP)	0	2,612.6
FY18	20.0 (CC)	2,556.4 (FF)	1,569.6 (FF)	0	4,146.0
FY19	0	0	929.1 (FF)	643.0 (FF)	1,572.1
FY20	0	0	1,062.0 (FF)	1,214.5 (FF)	2,276.5
FY21	71.0 (CC)	0	958.9 (FF)	1,606.4 (FF)	2,636.3
FY22	0	291.0 (CC)	1,062.0 (FF)	1,287.7 (FF)	2,640.7
FY23 (requested)	***0***	***461.7 (CC)***	***1,481.5 (FF)***	***1,052.0 (FF)***	***2,995.2***
FY24 (programmed)	*0*	*624.6 (CC)*	*1,119.8 (FF)*	*774.3 (FF)*	*2,518.7*
FY25 (programmed)	*0*	*0*	*2,416.6 FF)*	*634.1 (FF)*	*3,050.7*
FY26 (programmed)	*0*	*0*	*0*	*1,959.2 (FF)*	*1,959.2*
FY27 (programmed)	*0*	*0*	*0*	*2,035.5 (FF)*	*2,035.5*
FY28 (projected)	*0*	*0*	*0*	*1,723.3 (FF)*	*1,723.3*
Total	**13,316.5**	**12,700.0**	**12,832.9**	**12,930.0**	**51,779.4**

Source: Table prepared by CRS based on Navy's FY2023 budget submission.

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

Changes in Estimated Unit Procurement Costs Since FY2008 Budget

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

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

(As shown in FY2008-FY2023 budgets, in millions of then-year dollars)

	CVN-78		CVN-79		CVN-80		CVN-81	
Budget	**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
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%	
Cumulative % change through FY23 from actual procurement dates of FY08, FY13, FY18, and FY19								
Since FY08	+27.0%		+38.2%		+19.7%		n/a	
Since FY13	+8.1%		+11.3%		-7.5%		n/a	
Since FY18	+3.2%		+11.6%		-1.3%		n/a	
Since FY19	+2.7%		+12.0%		+1.8%		-14.3%	

Source: Table prepared by CRS based on FY2008-FY2023 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 FY2023

Future Aircraft Carrier Force Level

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

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

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

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

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

Procurement of Aircraft Carriers After CVN-81

A related issue for Congress concerns the procurement of aircraft carriers after CVN-81. The question of whether the Navy should shift at some point from procuring CVNs like the CVN-78

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

class to procuring smaller and perhaps nonnuclear-powered aircraft carriers has been a recurrent matter of discussion and Navy study over the years.

As mentioned earlier, the Navy's FY2023 30-year shipbuilding plans shows the next aircraft carrier after CVN-81 being procured in FY2028. The Navy has not stated that this ship would be something other than CVN-82 (i.e., a fifth CVN-78 class carrier).

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

> The Navy's engineering community has already started conducting light carrier design and engineering studies, even as the Navy and the joint force still consider whether they'd even want to invest in a CVL to supplement supercarriers to bring more distributed capability to the fleet for less cost.
>
> The idea of a light carrier resurfaced last summer as a Pentagon-led Future Naval Force Study was nearing its completion. The idea hadn't appeared in Navy and Marine Corps plans, but then-Defense Secretary Mark Esper had a growing interest in the topic as he sought ways to keep future shipbuilding and sustainment costs down and as he worried about the Navy's ability to conduct maintenance on its nuclear-powered aircraft carriers at Navy-run public shipyards.
>
> The FNFS and the plan it produced, Battle Force 2045, ultimately recommended between zero and six light carriers and noted much more study would need to be done.
>
> That work is already happening at Naval Sea Systems Command within the engineering and logistics directorate (SEA 05).
>
> Rear Adm. Jason Lloyd, the SEA 05 commander and deputy commander for ship design, integration and engineering, said last week that his Cost Engineering and Industrial Analysis team has been studying different options to understand what operational utility the Navy would get out of each design and for what cost compared to the Ford-class carrier, "and then let the operators really, and the Navy, decide, hey, do we want that capability for that cost?"
>
> "We have looked at an America-class possibility,[26] we have looked at a Ford-class-light,[27] we've looked at various different options and done cost studies on all those options. There are also capabilities studies on all those options," Lloyd said last week while speaking at a virtual event hosted by the American Society of Naval Engineers.[28]

Advocates of smaller carriers traditionally have argued that they are individually less expensive to procure, that the Navy might be able to employ competition between shipyards in their

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

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

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

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

procurement (something that the Navy cannot do with large-deck, nuclear-powered carriers like the CVN-78 class, because only one U.S. shipyard, HII/NNS, can build aircraft carriers of that size), and that today's aircraft carriers concentrate much of the Navy's striking power into a relatively small number of expensive platforms that adversaries could focus on attacking in time of war.

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

Section 128(d) of the FY2016 National Defense Authorization Act (S. 1356/P.L. 114-92 of November 25, 2015) required the Navy to submit a report on potential requirements, capabilities, and alternatives for the future development of aircraft carriers that would replace or supplement the CVN-78 class aircraft carrier. The report, which was conducted for the Navy by the RAND Corporation, was delivered to the congressional defense committees in classified form in July 2016. An unclassified version of the report was then prepared and issued in 2017 as a publicly released RAND report.[29] The question of whether to shift to smaller aircraft carriers was also addressed in three studies on future fleet architecture that were required by Section 1067 of the FY2016 National Defense Authorization Act (S. 1356/P.L. 114-92 of November 25, 2015).

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

Overview

Another oversight issue for Congress concerns the delay in CVN-78's first deployment due to the need to complete work on the ship's weapons elevators and correct other technical problems aboard the ship.[30] Challenges in completing the construction, testing, and certification of the ship's 11 weapon elevators were first reported in November 2018,[31] and the issue became a matter of continuing congressional oversight. Navy officials state that the 11th and final weapon elevator was completed, tested, and certified on December 22, 2021.

As noted earlier, Navy officials state that the ship achieved initial operational capability (IOC) in December 2021, and that the ship's first deployment will occur in the fall of 2022, more than five years after it was commissioned into service. The delay in the ship's first deployment has lengthened a period during which the Navy has been attempting to maintain policymaker-desired levels of carrier forward deployments with its 10 other carriers—a situation that can add to operational strains on those 10 carriers and their crews.

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

[30] See, for example, Dave Ress, "Years Late and Billions More: The USS Gerald R. Ford Is a Lesson in How the Navy Builds Ships," *Newport News Daily Press*, May 23, 2021.

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

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. 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 include the following:

- For much of 2019, the Navy continued to report that two of the 11 AWEs were completed, tested, and certified.[32]
- On October 23, 2019, the Navy reported that the figure had increased to four of 11.[33]
- 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.[34]

---

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

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

[33] 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.

[34] 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 July 23, 2020, the Navy announced that the sixth AWE had been certified.[35]
- 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.[36]
- 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.[37]
- On March 23, 2021, Navy Admiral John Aquilino testified that nine of the 11 AWEs had been "repaired."[38]
- 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.[39]
- 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."[40]
- The Navy stated that the 11th and final AWE was completed, tested, and certified on December 22, 2021.[41]

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.)

[35] Gina Harkins, "Supercarrier Ford Could Soon Have More Than Half of Its Weapons Elevators Working," *Military.com*, June 19, 2020.

[36] Mallory Shelbourne, "USS Gerald R. Ford Making Steady Progress Ahead of Deployment," *USNI News*, November 24, 2020.

[37] 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.

[38] 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.

[39] 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 Suciu, "The Navy's New, Powerful Aircraft Carrier Is Heading to 'Shock Trials,'" *Business Insider*, May 24, 2021.

[40] 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.

[41] 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.

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 CVN-78 class carriers.[42]

Other Technical Challenges

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

> Four years after the U.S. Navy's costliest warship was hobbled by a flaw in its propulsion system, prime contractor Huntington Ingalls Industries Inc. and subcontractor General Electric Co. are still haggling over who will pay for fixing the defect.
>
> The $13 billion USS Gerald R. Ford was forced to return to port during post-delivery sea trials in early 2018 after the failure of a main thrust bearing, a key propulsion system component that's made by GE.
>
> Huntington Ingalls has repaired the faulty gear, and the Navy advanced funds for the work. The "actual root cause" of the defective part was "machining errors" by GE workers, according to Navy documents. The bearing, one of four that transfers thrust from the ship's four propeller shafts, overheated but "after securing the equipment to prevent damage, the ship safely returned to port," the Navy said in a March 2018 memo to Congress.
>
> The Ford returned to sea for additional trials after the damage was contained....
>
> Vice Admiral Thomas Moore, then head of the Naval Sea Systems Command, told reporters in 2019 that the Navy was paying for the repairs until GE and Huntington "figure out who has the liability for it. At some point you've got to pay them to get the work done." The Navy has declined to say how much it paid Huntington, although in 2018 it asked Congress to shift $30 million from other accounts to start work.
>
> The companies are still hashing things out.
>
> "We are continuing to work on a final agreement with GE to resolve this claim," Danny Hernandez, a spokesman for Newport News, Virginia-based Huntington Ingalls, said in a statement. Sean Smith, a spokesman for Boston-based GE, said "we continue working with the U.S. Navy and Huntington Ingalls to resolve this issue." GE hasn't commented publicly on the Navy's contention that its workers were at fault.[43]

2020 Change in Program Manager

A July 2, 2020, press report stated

> The Navy removed its program manager for the first-in-class USS Gerald R. Ford (CVN-78), as Navy acquisition chief James Geurts looks to boost performance in the new carrier program.
>
> Capt. Ron Rutan has been moved from the program office to the Naval Sea Systems (NAVSEA) staff, and Capt. Brian Metcalf has taken over the program office. Metcalf previously served as the San Antonio-class amphibious transport dock (LPD-17) program

[42] 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.

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

manager and was working as the executive assistant to the commander of NAVSEA prior to his reassignment to the CVN-78 program office (PMS 378).

"Readiness of USS Gerald R. Ford (CVN-78) is the Navy's top priority, and the progress the team made during the Post Shakedown Availability (PSA) met requirements while the subsequent eight months of CVN 78's post-delivery test and trials (PDT&T) period has been impressively ahead of plan. Even in the face of a global pandemic, the team has kept a lightning pace, and we will continue to do so, for our Navy and our nation, until USS Gerald R. Ford completes her post-delivery obligations and is fully available and ready for tasking by the Fleet," NAVSEA spokesman Rory O'Connor told USNI News.

Still, he said, "with 10 months left in PDT&T, followed by full-ship shock trials in [Fiscal Year 2021], we must ensure that the team takes the opportunity to recharge and allow for fresh eyes on upcoming challenges as required. While there is no perfect time for leadership transitions, it is prudent to bring in renewed energy now to lead the CVN 78 team through the challenges ahead. Capt. Metcalf's proven program management acumen and extensive waterfront experience will be a tremendous asset to the CVN 78 team in the months ahead."

Metcalf took command of the program office on July 1.

O'Connor reiterated that there was no specific incident or causal factor that led to Geurts' decision to remove Rutan from the office and bring Metcalf in, but rather it was reflective of the program's performance over time.[44]

Navy Efforts to Address Technical Challenges

A February 2, 2021, opinion column by two Navy admirals states

As the USS Gerald R. Ford (CVN 78) steamed off the coast of Virginia last week—qualifying naval aviators from fleet replacement squadrons—The Virginian-Pilot and Daily Press published a Jan. 28 editorial offering a dated and inaccurate assessment of the aircraft carrier's performance and operational accomplishments over the last several months. Ford is in month 16 of its Post-Delivery Test and Trials (PD&T) period, testing a host of combat systems, while serving as the primary East Coast carrier qualification platform for fleet naval aviators.

The ship has conducted nine underway periods since beginning PDT&T in November 2019, and yet the editorial cited a "new assessment," which omitted data from the last three underways logged in late 2020—a critical period in the development of both the ship's systems and the crew.

In November, for instance, Ford was at sea with her entire Carrier Strike Group (CSG) for integrated operations. During this underway, CSG-12, Carrier Air Wing (CVW) 8, Destroyer Squadron Two and elements from the group's Air and Missile Defense and Information Warfare teams conducted operations consistent with a CSG's pre-deployment training cycles. As previously reported in the newspaper, Ford was "averaging some 50 sorties a day," with a partial air wing of roughly 35 aircraft flying, approximately 50% of a fully outfitted air wing using Electromagnetic Aircraft Launch System (EMALS) and Advanced Arresting Gear (AAG) with great success.

Ford has successfully launched and recovered aircraft nearly 6,500 times, and in December, the crew completed more than 840 launches and arrestments while qualifying 58 new aviators. The ship also recorded a new single-day record of 170 launches and 175 arrestments in an eight-and-a-half-hour period, eclipsing Ford's previous record set in

[44] Megan Eckstein, "Navy Removes Ford Carrier Program Manager, Citing Performance Over Time," *USNI News*, July 2, 2020. See also Geoff Ziezulewicz, "Navy Fires Program Manager for Troubled Ford Aircraft Carrier," *Navy Times*, July 7, 2020.

> April. In 2020, FORD completed 5,700 aircraft launches and recoveries across six at-sea periods, which was a sevenfold increase from the ship's totals in 2018.
>
> The editorial also overlooked Ford's progress in testing the ship's command and control systems during strike group readiness exercises, which play a crucial role in preparing Ford's crew and systems for operational employment well ahead of the timeline stated in the editorial. These integrated strike group operations were conducted in parallel with planned ship testing and trials, accelerating the Navy's ability to exercise the ship's command and control capability prior to full ship shock trials scheduled for this summer and the follow-on planned incremental availability.
>
> As the hard-working shipbuilders of Newport News Shipbuilding and countless citizens of this region have likely seen in local news reports, Ford and her exceptional crew have been marking significant planned milestones since completing the aircraft carrier's Post-Shakedown Availability in October 2019. These milestones include certifying the flight deck, completing aircraft compatibility testing, embarking the strike group and airwing, qualifying more than 400 naval aviators, and conducting combat systems certification preparations during approximately 200 days underway.
>
> Ford is providing significant operational readiness to the fleet commanders, even while in a test and trial status. In each of Ford's at-sea periods, the ship's crew and embarked squadrons continue to validate and to refine Ford's technological innovations—technologies never realized before on any combatant of its kind….
>
> While the editors are right that it is not unusual for the first ship of a class to have unexpected challenges and delays, Ford is vigorously testing its new technology and aggressively resolving issues. Ford-class aircraft carriers will serve as the centerpiece of strike group operations through the 21st century, supporting national strategic objectives.[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 that its current—a schedule that was in its turn roughly two years later than the Navy had hoped when it started working on the carrier nearly two decades ago.
>
> After a set of live-fire exercises over the past several weeks at sea, the Ford has certified the missiles and cannons that are its last line of a defense.
>
> The Ford and the ships and air wing in its strike group also completed a long distance maritime strike exercise, a critical war-gaming test in which it had to escape from another task force seeking to disable it and then attack in its turn.
>
> "We have accelerated the timeline for Gerald R. Ford," Clapperton said….
>
> During the Ford's latest at-sea exercise, its 18th since starting post delivery tests and trials, its electromagnetic catapult, for launching planes, and arresting gear, for keeping them from plunging into the sea when landing, hit the 8,000 launch-and-recovery cycle mark, said Capt. Joshua Sager, air wing commander.
>
> That's a key measure, since that is roughly the number of sorties an air-wing will fly during the several months of a deployment overseas.

[45] John Meier and Craig Clapperton, "Opinion: Cutting-Edge USS Ford Cruising Toward Certification," *Virginian-Pilot*, February 2, 2021.

> 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]

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.[47]

Potential Oversight Questions

Potential oversight questions for Congress include the following:

- Why did the Navy accept delivery of CVN-78 from the shipbuilder and commission the ship into service if most or all of its weapon elevators were not completed, tested, and certified?
- What steps has the Navy taken since CVN-78 was delivered to the Navy on May 31, 2017, to keep Congress informed of challenges regarding the ship's weapon elevators and other ship systems?
- Why did it take so long to complete, test, and certify the weapon elevators?
- How much did it cost to complete, test, and certify the weapon elevators, and has the Navy included all of this cost in the ship's total reported procurement cost?
- How much additional operational stress has the delay in CVN-78's first deployment placed on the Navy's 10 other aircraft carriers?

---

[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.

[47] 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.

- What steps is the Navy taking to ensure that a similar situation does not arise regarding the construction and initial deployments of CVN-79, CVN-80, and CVN-81?

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

Regarding the construction of CVN-79, a November 15, 2021, press report states

> The Navy is taking parts from an aircraft carrier currently under construction and placing them on USS Gerald R. Ford (CVN-78) so the lead ship is ready to deploy next year, USNI News has learned.
>
> The parts are coming from the future USS John F. Kennedy (CVN-79), the second ship in the Ford class of aircraft carriers that is currently under construction at Huntington Ingalls Industries' Newport News Shipbuilding in Newport News, Va.
>
> Capt. Clay Doss, the Navy's acquisition spokesman, told USNI News the parts taken from Kennedy for Ford range from pumps to limit switches.
>
> "Examples of parts include HMI screens for stores elevators as well as motor controllers, power supplies, small pumps, limit switches and valve actuators for various systems throughout the ship," Doss said. "This is not unusual early in a program and will occur less often as supply support matures."
>
> Doss described the decision to take parts from Kennedy for Ford as a "project management tool" the service uses across programs.
>
> "It occurred only after confirming the parts or materials were not available in the supply system and/or that alternate sources were not available," Doss told USNI News. "A replacement plan was also required in each case. None of the parts transferred to CVN 78 are projected to impact the CVN 79 construction schedule."
>
> In a separate statement, Naval Sea Systems Command said the procedures were in line with Navy maintenance rules.
>
> "In accordance with the Navy's Joint Fleet Maintenance Manual, cannibalizations are being used as part of the process to augment readiness of CVN 78, and are only initiated after non-availability of materials has been established in the supply system or verification that alternate sources are not available," Naval Sea Systems Command spokesman Alan Baribeau told USNI News in a statement....
>
> A spokesperson for HII said the shipbuilder and the Navy are creating a supply network for the carrier class so the ships have access to spare parts.
>
> "A common shipbuilding practice for the first ship in class is to share parts between ships in order to maximize readiness until a class-wide supply system is established," Duane Bourne told USNI News. "A relatively small volume of materials from the aircraft carrier John F. Kennedy (CVN 79) has been used on first-of-class U.S.S. Gerald R. Ford (CVN 78) without impacting schedules. We are working with our Navy customer to build a supply system to include spare parts for the Ford class."[48]

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

A January 26, 2022, press report states

> The Navy is confident in its supply chain and the availability of spare parts to build and sustain its aircraft carriers, as the lead ship in the Gerald R. Ford class gears up for its first deployment, two service officials said last week.
>
> After taking parts from the future USS John F. Kennedy (CVN-79), the Navy is beginning to receive orders to replace those parts. The parts from JFK—which is currently under construction at Huntington Ingalls Industries' Newport News Shipbuilding—were placed on USS Gerald R. Ford (CVN-78) so the lead ship is ready deploy this year.
>
> "The backfill of the parts that were taken from JFK—those are starting to come in. So we don't see that it's going to have any future impacts on [the construction of] JFK," Jay Stefany, who is currently performing the duties of the assistant secretary of the Navy for research, development and acquisition, told reporters on Friday [January 21].
>
> The sustainment parts for Ford—which is set to deploy this fall—are on the carrier, Rear Adm. James Downey, the program executive officer for carriers, said last week....
>
> As it prepares for the lead ship in the class to deploy for the first time later this year, the Navy is continuing to work with both industry and its field activities to ensure the carrier has the parts it needs, according to Downey.[49]

Cost Growth and Managing Costs within Program Cost Caps

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 several years. Congress in recent years has passed legislation on the issue that is in addition to the earlier-mentioned legislation that established and amended cost caps for the ships.[50]

As shown in **Table 2**, the estimated procurement costs of CVN-78, CVN-79, and CVN-80 have grown 27.0%, 38.2%, and 19.7%, 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 or program $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.

---

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

[50] 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 CVN-78 class carriers.

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.[51]

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%,

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

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

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.[52]

October 2019 CBO Report

An October 2019 CBO report on the potential cost of the Navy's FY2020 30-year shipbuilding plan states the following regarding the CVN-78 program:

> The Navy's current estimate of the total cost of the USS Gerald R. Ford, the lead ship of the CVN-78 class, is $13.1 billion in nominal dollars appropriated over the period from 2001 to 2018. CBO used the Navy's inflation index for naval shipbuilding to convert that figure to $16.2 billion in 2019 dollars, or 25 percent more than the corresponding estimate when the ship was first authorized in 2008. Neither the Navy's nor CBO's estimate includes the $5 billion in research and development costs that apply to the entire class.
>
> Because construction of the lead ship is finished, CBO used the Navy's estimate for that ship to estimate the cost of successive ships in the class. But not all of the cost risk has been eliminated; in particular, the ship's power systems, advanced arresting gear (the system used to recover fixed-wing aircraft landing on the ship), and weapons elevators are not yet working properly. It is not clear how much those problems will cost to fix, but current Navy estimates suggest that it will be several tens of millions of dollars or more. CBO does not have enough information to independently estimate those final repair costs.
>
> The next carrier after the CVN-78 is the CVN-79, the John F. Kennedy, which is expected to be completed in 2024 and deployed in 2026. Funding for the ship began in 2007, the Congress officially authorized its construction in 2013, and the planned appropriations for it were completed in 2018. The Navy estimates that the ship will cost $11.3 billion in nominal dollars (or $11.9 billion in 2019 dollars). The Navy's 2014 selected acquisition report on the CVN-79 states that "the Navy and shipbuilder have made fundamental changes in the manner in which the CVN 79 will be built to incorporate lessons learned from CVN 78 and eliminate the key contributors to cost performance challenges realized in the construction of CVN 78." Nevertheless, the Navy informed CBO that there is a greater than 60 percent chance that the ship's final cost will be more than the current estimate. Although CBO expects the Navy to achieve a considerable cost reduction in the CVN-79 compared with the CVN-78, as is typical with the second ship of a class, CBO's estimate is higher than the Navy's. Specifically, CBO estimates that the ship will cost $12.4 billion in nominal dollars (or $12.9 billion in 2019 dollars), about 9 percent more than the Navy's estimate.
>
> In 2018, the Congress authorized the third carrier of the class, the Enterprise (CVN-80). Appropriations for that ship began in 2016 and are expected to be complete by 2025. In 2019, the Congress authorized the Navy to purchase materials jointly for the CVN-80 and the next ship, the CVN-81, to save money by buying in greater quantity. It also authorized the Navy to change the sequencing involved in building the ships to gain greater efficiencies in their construction. Although that legislative action is known as a "two-carrier buy," the Navy would not be building both ships at exactly the same time. Purchasing the two ships together would accelerate the CVN-81's construction by only one year compared with buying the ships individually as envisioned in the 2019 shipbuilding plan.
>
> In the 2020 budget, the Navy estimated that the CVN-80 would cost $12.3 billion in nominal dollars (or $11.4 billion in 2019 dollars). That represents a savings of $300 million compared with the Navy's estimate in the 2019 budget. In contrast, CBO estimates that the CVN-80 would cost $13.6 billion in nominal dollars (or $12.4 billion in 2019 dollars), about 9 percent more than the Navy's estimate. In information provided to CBO as part of

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

> the 2019 budget presentation, the Navy indicated that there was a greater than 60 percent chance that the ship's final cost will be more than it estimated; in contrast, with the 2020 budget, the Navy puts that figure at 78 percent. Thus, it is not clear whether the service's 2020 estimates incorporate savings stemming from a two-carrier buy or simply an acceptance of increased risk of future cost growth.
>
> With respect to the CVN-81, the pattern is similar. In the 2019 budget, the Navy estimated the CVN-81 at $15.1 billion in nominal dollars. In the 2020 budget with the two-carrier buy, the Navy estimated the cost of the ship at $12.6 billion in nominal dollars (or $10.5 billion in 2019 dollars), for a savings of $2.5 billion. However, the Navy also told CBO that there is an 80 percent chance that the final cost will be higher than the current estimate, compared with the roughly 40 percent chance indicated in the 2019 budget. CBO estimates that the CVN-81 would cost $14.4 billion in nominal dollars (or $11.9 billion in 2019 dollars), or 14 percent more than the Navy's estimate.
>
> Overall, the Navy estimates an average cost of $12.7 billion (in 2019 dollars) for the 7 carriers (CVN-81 through CVN-87) in the 2020 shipbuilding plan. CBO's estimate is $13.0 billion per ship….[53]

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,[54] by turning down opportunities to add features to the ship that would have made the ship more capable than CVN-78 but would also have increased CVN-79's cost, and by using a build strategy for the ship that incorporates improvements over the build strategy that was used for CVN-78. These build-strategy improvements, Navy officials have said, include the following items, among others:

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

A March 7, 2022, press report stated

> Aircraft carrier manufacturer Newport News Shipbuilding is revamping its processes to become more efficient as it builds the Gerald R. Ford class of carriers, a company official said.
>
> Brian Fields, the vice president of aircraft carrier construction for CVN-80 and CVN-81, told reporters Feb. 18 the company had a plan going into construction on the Gerald R. Ford, but lessons learned are driving down cost and schedule as the company works through the John F. Kennedy and now the Enterprise.

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

[54] 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.

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.[55]

Issues Raised in DOT&E and GAO Reports

Another oversight issue for Congress concerns CVN-78 program issues raised in a January 2022 report from DOD's Director, Operational Test and Evaluation (DOT&E)—DOT&E's annual

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

report for FY2021—and in the 2021 edition of the Government Accountability Office's (GAO's) annual report surveying selected DOD weapon acquisition programs, which was published in June 2021.

January 2022 DOT&E Report

Regarding the CVN-78 program, the January 2022 DOT&E report stated the following in part:

> **Test Adequacy**
>
> In December 2020, the Navy concluded the Self-Defense Test Ship phase of CVN 78 ICS [Integrated Combat System] operational test by conducting a test against supersonic ASCM [anti-ship cruise missile] surrogates. The Navy completed three of the four planned Self-Defense Test Ship tests in the DOT&E-approved test plan, and those that were completed deviated from the approved test plan. Testing was not adequate to assess the combat system's capability against supersonic ASCMs and subsonic maneuvering ASCMs, and there are no future test events planned that could provide additional data against these threats. DOT&E will issue an interim assessment of CVN 78 self-defense capabilities in FY22.
>
> Only a limited assessment of CVN 78 combat system effectiveness is possible. The 2008 DOT&E-approved Enterprise TEMP [Test and Evaluation Master Plan] called for the use of DDG 1000 [Zumwalt-class destroyer][56] combat system performance data to supplement the evaluation of the CVN 78 combat system; however, the redesigned DDG 1000 system differs significantly from the CVN 78 system. The Navy did not supplement the CVN 78 test campaign to compensate for the 10 test events it originally expected to leverage from DDG 1000 testing.
>
> The Navy tested the combat system aboard CVN 78 during Combat Systems Ship's Qualification Trials (CSSQT) and combat systems operational rehearsal events. This testing was not covered by a DOT&E-approved test plan.
>
> From June to August 2021, the Navy completed FSST [Full-Ship Shock Trial] to assess CVN 78's combat shock survivability. The trial was adequate to evaluate the ship's operational survivability after exposure to an underwater threat induced shock. The trial consisted of a series of three nearby underwater explosions of increasing severity up to two-thirds of the design level requirement/specification. The ship was manned and operational during each shot. Testing included a demonstration of the ship's ability to continue its primary missions after shock. Where shock-hardened ship systems and equipment could not continue operating after shock, trial cards were written to identify shock deficiencies for correction. In accordance with the approved trial plan, the ship was not outfitted with live ordnance or an air wing, and most JP-5 aviation fuel was removed.
>
> The Navy expects to begin IOT&E [Initial Operational Test and Evaluation] in 2QFY23 [the second quarter of FY2023], following planned incremental availability at Newport News Shipyard. The Navy is planning to conduct IOT&E in accordance with draft TEMP Revision E and DOT&E reports to Congress dated November 30, 2018 and November 26, 2019, but the TEMP Revision E and required test plans have not yet been submitted for approval by DOT&E.
>
> While the Navy has proposed several strategies to test the cyber survivability of CVN 78, none of these strategies have been finalized, adequately resourced, or formally approved by DOT&E.

[56] For more onthe DDG-1000 class, see CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke.

Performance

Effectiveness

Combat System

In accordance with the CVN-78 Security Classification Guide, the effectiveness of the combat system is detailed in the Controlled Unclassified Information edition of this report. The report details the capability of the combat system to detect, track, engage, and defeat the types of threats for which the system was designed.

Sortie Generation Rate (SGR)

CVN 78 is unlikely to achieve its SGR requirement. The target SGR threshold is well above achieved historical rates and based on unrealistic assumptions, including fair weather and unlimited visibility, along with the expectation that aircraft emergencies, failures of shipboard equipment, ship maneuvers, and manning shortfalls will not negatively affect flight operations. Poor reliability of key systems that support sortie generation on CVN 78 could cause a cascading series of delays during flight operations that would likely negatively affect CVN 78's ability to generate sorties. The reliability of these critical subsystems represents the most risk to the successful completion of CVN 78 IOT&E.

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 (ISEs) in developmental test, but some operational limitations and restrictions are expected to persist into IOT&E and deployment. The Navy will need to develop capability assessments at differing levels of system use to inform decisions on system employment.

Suitability

Reliability

The low reliability of the following four new CVN 78 systems stand out as the most significant challenges expected to affect the ship's flight operations:

Electromagnetic Aircraft Launch System (EMALS)

During the 8,157 catapult launches conducted through ISE 18, EMALS achieved a reliability of 272 mean cycles between operational mission failures (MCBOMF), where a cycle is the launch of one aircraft. This reliability is well below the requirement of 4,166 MCBOMF. The reliability concerns are amplified by the fact that the crew cannot readily electrically isolate EMALS components during flight operations because of the shared nature of the Energy Storage Groups and Power Conversion Subsystem inverters on board CVN 78. The process for electrically isolating equipment is time-consuming. Spinning down the EMALS motor and generators alone is a 1.5-hour process, precluding some EMALS maintenance during flight operations.

Advanced Arresting Gear (AAG)

During 8,157 recoveries, AAG achieved a reliability of 41 MCBOMF, where a cycle is the recovery of a single aircraft. This reliability estimate falls well below the requirement of 16,500 MCBOMF.

The reliability concerns are amplified by the AAG's design, which does not allow the Power Conditioning Subsystem equipment to be electrically isolated from high power buses, limiting corrective maintenance on below-deck equipment during flight operations.

Advanced Weapons Elevators (AWE)

While all 11 AWEs have been installed, only 8 of the 11 have been formally delivered to the Navy. The other three are installed, but are still the responsibility of the manufacturer. Therefore, only preliminary reliability estimates are available to compare to the requirement of 932 hours between operational mission failure. Through the first 14,842 elevator cycles, 68 operational mission failures were reported. AWE system reliability will be critical as the Navy completes delivery of the remaining three elevators and develops standard procedures for moving ordnance from magazines to the flight deck.

Dual Band Radar (DBR)

Through ISE 18, DBR demonstrated a reliability of 102 hours mean time between operational mission failures. This is below the requirement of 339 hours. However, DBR was operationally available 96 percent of the time, close to the 98 percent requirement.

Survivability

While shock trial data analysis is ongoing, the Navy has already identified several survivability improvement opportunities for the CVN 78 class against underwater threat engagements. Details will be provided in an interim, classified CVN 78 FSST report expected to be published 2QFY22 after all data and observations have been adequately reviewed and analyzed.

The survivability of CVN 78 in a cyber-contested environment has not yet been evaluated. Many subsystems on the ship were tested to various degrees in both developmental testing and operational testing on other ship platforms. However, required CVN 78 platform-level testing has not yet occurred, and some systems specific to CVN 78 have yet to undergo any operational cyber survivability assessments. These assessments will need to be conducted as part of CVN 78 IOT&E.

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

Recommendations

The Navy should:

1. Address combat system issues identified during CVN 78 ICS testing during CSSQT and on the SDTS.

2. Fund the M&S suite required to assess the CVN 78 Probability of Raid Annihilation requirement for subsonic targets.

3. Implement the recommendation contained in DOT&E's FY20 report to complete Self-Defense Test Ship test events.

4. Continue to improve availability and reliability for EMALS, AAG, DBR, and AWE.

5. Implement major fixes to CIWS hardware and software to improve the system's reliability and operational availability.

6. Continue to characterize the electromagnetic spectrum environment on board CVN 78 and develop operating procedures to maximize system effectiveness and maintain safety. As applicable, the Navy should use the lessons learned from CVN 78 to modify the design of CVN 79 and future carriers.

7. Implement design changes to address survivability issues identified during the FSST.

> 8. Complete validation of the M&S [modeling and simulation] tools supporting the LFT&E [Live Fire Test & Evaluation] assessment, including comparing the FSST data to relevant M&S predictions.
>
> 9. Continue to fund the maintenance availability for the current SDTS [Self-Defenes Test Ship] (e.g., Paul F. Foster) to ensure its readiness to support CVN 79 combat system testing.
>
> 10. Continue to fund the procurement and installation of the necessary CVN 79 combat system elements on the Self-Defense Test Ship.
>
> 11. Conduct a shore-based operational assessment of EASR [Enterprise Air Surveillance Radar][57] at Wallops Island, Virginia. This testing should evaluate EASR's contributions to air traffic control and self-defense missions, as well as provide an early assessment of electromagnetic interference and radiation hazard concerns.
>
> 12. Update the CVN 78 platform TEMP to include cybersecurity testing on CVN 78 and testing of the combat system on CVN 79 to assess the effectiveness and suitability of the new combat system with EASR.[58]

A January 25, 2022, press report about the DOT&E report stated

> The combat system for the Navy's newest and costliest warship, the $13 billion Gerald R. Ford, "has yet to demonstrate that it can effectively" defend the aircraft carrier from anti-ship missiles and other threats, according to a new assessment by the Pentagon's testing office.
>
> Mixed performance by missile interceptors, radar and data dissemination systems on a testing vessel limited the ability to destroy replicas of incoming weapons even though sensor systems "satisfactorily detected, tracked and engaged the targets," according to the report obtained by Bloomberg News in advance of its release.
>
> The carrier built by Huntington Ingalls Industries Inc. is still dogged as well by the "poor or unknown reliability" of its aircraft launch and recovery systems, according to the five-page report. And recent shock tests to assess the vulnerability of key systems "identified several design shortfalls not previously discovered," the testing office said. It said "the Navy has already identified several survivability" opportunities to improve the four-carrier class of ships "against underwater threat engagements."...
>
> The report, which contains unclassified and "controlled unclassified" information and has been circulated to the Navy, found that "only a limited assessment" of the combat system's effectiveness is possible at this point. It said Nickolas Guertin, the new head of the testing office, plans to send Congress an interim report on the Ford's self-defense capabilities by Sept. 30.
>
> The Naval Sea Systems Command said in a statement that it "welcomed the opportunity to review and provide comment on" the assessment draft. "Overall," it said, recent post-delivery testing of the Ford "indicate the risk of system reliability impacting mission accomplishment is decreasing."...
>
> The Navy's three tests so far of the Ford's self-defense system on board a specialized vessel designed to evaluate performance were "not adequate to assess the combat system's capability against supersonic antiship cruise missiles and subsonic maneuvering missiles,

[57] The use of the word *Enterprise* in the name of this radar is not a reference to the Navy's now-retired aircraft carrier *Enterprise* (CVN-65); it instead signals that the radar has potential applicability across a business area (i.e., enterprise), the enterprise in this case being Navy surface ships of various types.

[58] Department of Defense, Director, Operational Test & Evaluation, *FY2021 Annual Report*, January 2022, pp. 143-145.

> and there were no future test events planned against threats that could provide additional data," according to the testing office.
>
> The vessel's Gatling gun-like system "experienced numerous reliability failures that in several cases prevented the system from executing its mission," the test office said....
>
> [James Downey, the Navy's program executive officer for aircraft carriers,] said the Navy is confident in the vessel's combat systems. "She's been engaged against her required threats and we've done those tests at sea, they've been evaluated and she's achieved her certification in the combat systems area," Downey said....
>
> The testing office said the Ford is unlikely to achieve its goal for the number of sorties it can launch over a 24-hour period, saying it's "based on unrealistic assumptions."
>
> It also said that during 8,157 takeoffs and recoveries through last year, the carrier's new electromagnetic catapult system made by General Atomics demonstrated a reliability of 272 launches "between operational mission failure," or "well below" its required 4,166. Similarly, its system to snag landing aircraft demonstrated a 41-landing reliability rate "well below the requirement of 16,500," the testing office said.
>
> The Naval Sea Systems Command said that during the Ford's recent at-sea phase, the carrier "completed all required testing, accomplished work ahead of plan, improved system reliability for new technologies and served as an East Coast platform for conducting pilot carrier qualifications for over 400 newly qualified and re-qualifying pilots."
>
> More than 8,100 launch and landing operations "highlighted the Ford's increasing capability and provide growing confidence that a fully trained Ford crew and embarked air wing will achieve the required sorties generation rate," the command said.[59]

June 2021 GAO Report

A June 2021 GAO report—the 2021 edition of GAO's annual report assessing selected major weapon acquisition programs—stated the following:

> **Technology Maturity, Design Stability, and Production Readiness**
>
> Although Navy officials report that the program's 12 critical technologies are fully mature, challenges persist with using these technologies and demonstrating their reliability. For example, as of October 2020, the Navy had certified only six of the 11 elevators to operate on the ship. Further, according to Navy officials, while six elevators are currently operational—three Upper Stage, one utility elevator, and two Lower Stage—only the two Lower Stage elevators are capable of delivering munitions to the main deck. The Navy is working with the shipbuilder to complete the five remaining elevators—all Lower Stage units—by the spring of 2021. The Navy plans to begin testing at a land-based site in early 2022—following a one-year delay due to contract issues—to assess the elevators' performance and reliability. With units already operating on CVN 78, any changes to the elevators resulting from land-based testing are likely to be costly and time-consuming for the Ford-class program.
>
> The Navy also continues to struggle with achieving the reliability of the electromagnetic aircraft launch system (EMALS) and Arresting Gear (AAG) in support of its requirement to rapidly deploy aircraft. The Navy is conducting shipboard testing as it prepares for operational testing to begin in the summer of 2022. However, if these systems do not

[59] Anthony Capaccio, "Navy's $13 Billion Carrier Sows Doubt That It Can Defend Itself," *Bloomberg*, January 25, 2022. See also Rich Abott, DOT&E Says Ford Unlikely To Meet Sortie Generation Rate, Critical of Self-Defense," *Defense Daily*, January 27, 2022; Aidan Quigley, "DOT&E: 'Several' Design Shortfalls Identified During Ford Full-Ship Shock Trials," *Inside Defense*, January 27, 2022; Michael Fabey, "US Navy Disputes Pentagon Report of Carrier Ford Design 'Shortfalls,'" *Jane's Defence Weekly*, January 28, 2022.

reliably function during this test phase, CVN 78 may not be able to demonstrate it can rapidly deploy aircraft. The Navy also does not expect EMALS and AAG to demonstrate their required reliability until after CVN 78 has begun deploying to the fleet.

Since 2013, we have identified concerns with the Ford Class test schedule, which have been borne out as the start of operational testing has now been delayed by over 5 years to a planned date of August 2022. Most recently, program officials confirmed that the lead ship (CVN 78) will reach initial capability in July 2021—4 months later than they reported last year—to align with the completion of post-delivery testing. The Navy will declare initial capability without demonstrating capability or performance through successful operational testing, missing an opportunity to determine whether the ship is capable of conducting mission operations. The Navy plans to complete operational testing in November 2023.

Further, the 2013 test and evaluation master plan is no longer current and program officials told us they anticipate sending the revised plan for Navy leadership review in early 2021. Without an approved test plan, we cannot comment on the Navy's test events and whether current areas of technical risk inform the plan. We found past test plans to be optimistic, with little margin for delays. Program officials stated that test plan revisions are not delaying any required testing.

Software and Cybersecurity

Separate program offices manage software development for CVN 78's critical technologies. The CVN 78 program is scheduled to complete an evaluation for potential cybersecurity vulnerabilities connected with section 1647 of the National Defense Authorization Act for Fiscal Year 2016 in May 2022.

Other Program Issues

The lead ship (CVN 78) cost cap is currently $13.2 billion, more than $2.7 billion higher than its initial cap. Program officials do not believe they will need additional funding to correct deficiencies found in CVN 78's acceptance trials. However, until CVN 78's testing is completed, the risk of discovering more costly deficiencies persists.

The Navy is unlikely to obtain planned cost savings on CVN 79 due to several factors. CVN 79 is 74 percent complete, but as of June 2020, ship construction is lagging behind cost saving goals. Further, according to program officials, the shipbuilder's COVID-19 pandemic mitigations also reduced construction efficiency. Officials also explained that the Navy is making additional changes for CVN 79, including integrating F-35 aircraft and adjusting to a new single-phase delivery schedule, but has yet to assess how these factors will affect cost and schedule. The Navy reported awarding fixed-price contracts for CVNs 80 and 81 in January 2019, which it expects to limit cost liability and incentivize shipbuilder performance. The Navy made optimistic assumptions that this two-ship contract will save over $4 billion. We previously reported that the Navy's own cost analysis showed that CVNs 80 and 81 have a high likelihood of cost overruns, which aligns with our findings on CVN 78 and CVN 79 cost growth.

Program Office Comments

We provided a draft of this assessment to the program office for review and comment. The program office provided technical comments, which we incorporated where appropriate. The program office stated that CVN 78 has completed 15 of 18 months of the ship's post-delivery test schedule. It added that during this time, CVN 78 recorded nearly 6,400 aircraft launches and recoveries. According to the program office, the ship completed carrier qualification for over 400 aviators and cleared 99 percent of discrepancies from its acceptance trials. The program office noted that CVN 78 broke records for number of aircraft landings in one day and for consecutive days at sea. Additionally, the program

office stated that CVN 80 will start construction in February 2022. Lastly, the program office reported that COVID-19 continues to affect construction performance.[60]

Legislative Activity for FY2023

Summary of Congressional Action on FY2023 Funding Request

Table 3 summarizes congressional action on the FY2023 procurement funding request for the CVN-78 program. The request for CVN-79 is for cost-to-complete (CC) funding to cover cost growth on CVN-79 following the completion in FY2018 of the ship's original full funding.

Table 3. Congressional Action on FY2023 Procurement Funding Request

(Millions of dollars, rounded to nearest tenth)

		Authorization			Appropriation		
	Request	HASC	SASC	Enacted	HAC	SAC	Enacted
CVN-79	461.7						
CVN-80	1,481.5						
CVN-81	1,052.0						
Total above	**2,995.2**						

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

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

[60] Government Accountability Office, *Weapon Systems Annual Assessment[:] Updated Program Oversight Approach Needed*, GAO-21-222, June 2021, p. 169.

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

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

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

Section 121(a)(2) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (H.R. 5515/P.L. 115-232 of August 13, 2018) permitted the Navy, after 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

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

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

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

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

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

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

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

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

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

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

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

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

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

> ship deliveries which allows more schedule overlap, and therefore more shop-level and assembly-level production efficiencies than two single-ship buys.
>
> Procuring two ships to a single technical baseline reduces the requirement for engineering labor hours when compared to single-ship estimates. The ability to rollover production support engineering and planning products maximizes savings while recognizing the minimum amount of engineering labor necessary to address obsolescence and regulatory changes on CVN 81. The two-ship agreement with the shipbuilder achieves a 55 percent reduction in construction support engineering hours on CVN 81 and greater than 18 percent reduction in production support and planning hours compared to single ship procurements.
>
> The two-ship procurement strategy allows for serial production opportunities that promote tangible learning and reduced shop and machine set-up times. It allows for efficient use of production facilities, re-use of production jigs and fixtures, and level loading of key trades. The continuity of work allows for reductions in supervision, services and support costs. The result of these efficiencies is a production man-hours step down that is equivalent to an 82 percent learning curve since CVN 79.
>
> Key to achieving these production efficiencies is Integrated Digital Shipbuilding (iDS). The Navy's Research, Development, Test, and Evaluation (RDT&E) and the shipbuilder's investment in iDS, totaling $631 million, will reduce the amount of production effort required to build FORD Class carriers. The two-ship buy will accelerate the benefits of this approach. The ability to immediately use the capability on CVN 81 would lead to a further reduction in touch labor and services in affected value streams. The two-ship agreement with the shipbuilder represents a production man-hours reduction of over seven percent based on iDS efficiencies. Contractual authority for two ships allows the shipbuilder to maximize economic order quantity material procurement. This allows more efficient ordering and scheduling of material deliveries and will promote efficiencies through earlier ordering, single negotiations, vendor quotes, and cross program purchase orders. These efficiencies are expected to reduce material costs by about six percent more when compared to single-ship estimates. Improved material management and flexibility will prevent costly production delays. Furthermore, this provides stability within the nuclear industrial base, de-risking the COLUMBIA and VIRGINIA Class programs. The two-ship buy would provide economic stability to approximately 130,000 workers across 46 States within the industrial base.
>
> Change order requirements are likewise reduced as Government Furnished Equipment (GFE) providers will employ planning and procurement strategies based on the common technical baseline that minimize configuration changes that must be incorporated on the follow ship. Change order budget allocations have been reduced over 25 percent based on two-ship strategies.
>
> In addition to the discrete savings achieved with the shipbuilder, the two-ship procurement authority provides our partner GFE providers a similar opportunity to negotiate economic order quantity savings and achieve cross program savings when compared to single-ship estimates.[69]

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

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

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

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

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

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

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

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

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

Author Information

Ronald O'Rourke
Specialist in Naval Affairs

Disclaimer

This document was prepared by the Congressional Research Service (CRS). CRS serves as nonpartisan shared staff to congressional committees and Members of Congress. It operates solely at the behest of and under the direction of Congress. Information in a CRS Report should not be relied upon for purposes other than public understanding of information that has been provided by CRS to Members of Congress in connection with CRS's institutional role. CRS Reports, as a work of the United States Government, are not subject to copyright protection in the United States. Any CRS Report may be reproduced and distributed in its entirety without permission from CRS. However, as a CRS Report may include copyrighted images or material from a third party, you may need to obtain the permission of the copyright holder if you wish to copy or otherwise use copyrighted material.