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

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Summary

The aircraft carriers CVN-78, CVN-79, CVN-80, and CVN-81 are the first four ships in the Navy's new *Gerald R. Ford* (CVN-78) class of nuclear-powered aircraft carriers (CVNs). The Navy's proposed FY2022 budget requests $2,659.5 million (i.e., about $2.7 billion) in procurement funding for CVN-78 class ships, including $291.0 million for CVN-79, $1,068.7 million for CVN-80, and $1,299.8 million for CVN-81.

CVN-78 (*Gerald R. Ford*) was procured in FY2008. The Navy's proposed FY2022 budget estimates the ship's procurement cost at $13,316.5 million (i.e., about $13.3 billion) in then-year dollars. The ship was commissioned into service on July 22, 2017. The Navy is currently working to complete construction, testing, and certification of the ship's 11 weapons elevators.

CVN-79 (*John F. Kennedy*) was procured in FY2013. The Navy's proposed FY2022 budget estimates the ship's procurement cost at $11,929.7 million (i.e., about $11.9 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 FY2022 budget estimates the ship's procurement cost at $12,405.5 million (i.e., about $12.4 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 FY2022 budget submission, like its FY2021 submission, shows CVN-81 as a ship that was procured in FY2020. The Navy's FY2022 budget submission estimates the ship's procurement cost at $12,483.6 million (i.e., about $12.5 billion) in then-year dollars. The ship is scheduled for delivery to the Navy in February 2032.

CVN-80 and CVN-81 are being procured under a two-ship block buy contract that was authorized by Section 121(a)(2) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (H.R. 5515/P.L. 115-232 of August 13, 2018). The use of the two-ship block buy contract reduced the combined estimated procurement cost of the two ships. Oversight issues for Congress for the CVN-78 program include the following:

- the future aircraft carrier force level;
- the procurement of aircraft carriers after CVN-81;
- a delay in CVN-78's first deployment due to the need to complete work on the ship's weapons elevators and correct other technical problems aboard the ship;
- the potential impact of the COVID-19 pandemic on the execution of U.S. military shipbuilding programs, including the CVN-78 program;
- 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 2021 report from the Department of Defense's (DOD's) Director of Operational Test and Evaluation (DOT&E) and a June 2020 Government Accountability Office (GAO) report on DOD weapon systems.

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Introduction

This report provides background information and potential oversight issues for Congress on the *Gerald R. Ford* (CVN-78) class nuclear-powered aircraft carrier (CVN) aircraft carrier program. The Navy's proposed FY2022 budget requests $2,659.5 million (i.e., about $2.7 billion) in procurement funding for the program. Congress's decisions on the CVN-78 program could substantially affect Navy capabilities and funding requirements and the shipbuilding industrial base.

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 Numbers of Carriers and Carrier Air Wings

Requirement to Maintain Not Less Than 11 Carriers

10 U.S.C. 8062(b) requires the Navy to maintain a force of not less than 11 operational aircraft carriers.[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 Force-Level Goal

Current 12-Carrier Force-Level Goal within 355-Ship Plan of December 2016

In December 2016, the Navy released a force-level goal for achieving and maintaining a fleet of 355 ships, including 12 aircraft carriers[6]—one more than the minimum of 11 carriers required by 10 U.S.C. 8062(b).

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.[7] Under the Navy's FY2020 30-year shipbuilding plan, carrier procurement would shift from five-year centers (i.e., one carrier procured each five years) to four-year centers after the procurement of CVN-82 in FY2028, and a 12-carrier force would be achieved on a sustained basis in the 2060s.[8]

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[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] 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 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.)

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

The Navy and the Department of Defense (DOD) since 2019 have been working to develop a new Navy force-level goal to replace the current 355-ship force-level goal.

December 9, 2020, Document Presented Potential New Goal of 8 to 11 Large Carriers and 0 to 6 Light Carriers

On December 9, 2020, the Trump Administration released a long-range Navy shipbuilding document that called for a Navy with a more distributed fleet architecture, including 382 to 446 manned ships and 143 to 242 large surface and underwater unmanned vehicles (UVs). Within the total of 382 to 446 manned ships, the document called for a total of 8 to 11 CVNs and 0 to 6 smaller aircraft carriers called light aircraft carriers (CVLs). The Navy does not currently operate CVLs.

June 17, 2021, Document Presents Potential New Goal of 9 to 11 Aircraft Carriers

On June 17, 2021, the Biden Administration released a long-range Navy shipbuilding document that calls for a Navy with a more distributed fleet architecture, including 321 to 372 manned ships and 77 to 140 large surface and underwater UVs. Within the total of 321 to 372 manned ships, the document calls for a total of 9 to 11 aircraft carriers. The document states: "New capability concepts like a light aircraft carrier continue to be studied and analyzed to fully illuminate their potential to execute key mission elements in a more distributed manner and to inform the best mix of a future force."[9]

Comparison of Aircraft Carrier Force-Level Goals

Table 1 compares the current aircraft carrier force-level goal within the 355-ship plan to the potential aircraft carrier force-level goals from the June 17, 2021, and December 9, 2020, long-range Navy shipbuilding documents.

Table 1. Current and Potential Aircraft Carrier Force-Level Goals

	Current force-level goal within 355-ship plan	December 9, 2020, shipbuilding document	June 17, 2021, shipbuilding document
Aircraft carriers	12	n/a [a]	9 to 11
Large aircraft carriers (CVNs	*12*	*8 to 11* [a]	*n/a*
Light aircraft carriers (CVLs)	*0*	*0 to 6* [b]	*n/a* [c]

Source: Table prepared by CRS based on U.S. Navy data. n/a means not available.

a. The document states: "Lower [end of the CVN] range may be enabled by acquisition of cost-effective CVL."

b. The document states: "Further study of cost-effective CVL capabilities and capacity required."

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

[9] U.S. Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2022*, June 2021, p. 4.

c. The document states: "New capability concepts like a light aircraft carrier continue to be studied and analyzed to fully illuminate their potential to execute key mission elements in a more distributed manner and to inform the best mix of a future force."

Incremental Funding Authority for Aircraft Carriers

In recent years, Congress has authorized DOD to use incremental funding for procuring certain Navy ships, most notably aircraft carriers.[10] Under incremental funding, some of the funding needed to fully fund a ship is provided in one or more years after the year in which the ship is procured.[11]

Aircraft Carrier Construction Industrial Base

All U.S. aircraft carriers procured since FY1958 have been built by Huntington Ingalls Industries/Newport News Shipbuilding (HII/NNS), of Newport News, VA. HII/NNS is the only U.S. shipyard that can build large-deck, nuclear-powered aircraft carriers. The aircraft carrier construction industrial base also includes roughly 2,000 supplier firms in 46 states.[12]

Gerald R. Ford (CVN-78) Class Program

Overview

The *Gerald R. Ford* (CVN-78) class carrier design (**Figure 1**, **Figure 2**, and **Table 4**) 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

[10] 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 2**, the Navy made use of the authority in connection with an FY2020 reprogramming action that reprogrammed $86.0 million of funding into FY2012 for CVN-78.

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

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

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

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

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/.

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/.

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-78 (Gerald R. Ford)

CVN-78, which was named *Gerald R. Ford* in 2007,[13] was procured in FY2008. The Navy's proposed FY2022 budget estimates the ship's procurement cost at $13,316.5 million (i.e., about $13.3 billion) in then-year dollars. The ship was commissioned into service on July 22, 2017. The Navy is currently working to complete construction, testing, and certification of the ship's 11 weapons elevators.

[13] §1012 of the FY2007 defense authorization act (H.R. 5122/P.L. 109-364 of October 17, 2006) expressed the sense of Congress that CVN-78 should be named for President Gerald R. Ford. On January 16, 2007, the Navy announced that CVN-78 would be so named. CVN-78 and other carriers built to the same design are consequently referred to as Ford (CVN-78) class carriers. For more on Navy ship names, see CRS Report RS22478, *Navy Ship Names: Background for Congress*, by Ronald O'Rourke.

CVN-79 (John F. Kennedy)

CVN-79, which was named *John F. Kennedy* on May 29, 2011,[14] was procured in FY2013. The Navy's proposed FY2022 budget estimates the ship's procurement cost at $11,929.7 million (i.e., about $11.9 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)

CVN-80, which was named *Enterprise* on December 1, 2012,[15] was procured in FY2018. The Navy's proposed FY2022 budget estimates the ship's procurement cost at $12,405.5 million (i.e., about $12.4 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,[16] 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 FY2022 budget submission, like its FY2021 submission, shows CVN-81 as a ship that was procured in FY2020. The Navy's FY2022 budget submission estimates the ship's procurement cost at $12,483.6 million (i.e., about $12.5 billion) in then-year dollars. The ship is scheduled for delivery to the Navy in February 2032.

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

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

[14] 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.

[15] 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.

[16] 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.

$2,637.3 million, for a combined reduction of $2,883.9 million (i.e., about $2.9 billion).[17] (DOD characterized the combined reduction as "nearly $3 billion."[18]) 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.[19] 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**.

Program Procurement Cost Cap

Congress has established and subsequently amended procurement cost caps for CVN-78 class aircraft carriers.[20]

Program Procurement Funding

Table 2 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 FY2022 budget submission. As shown in the table, the Navy's proposed FY2022 budget requests $2,659.5 million (i.e., about $2.7 billion) in procurement funding for CVN-78 class ships, including $291.0 million for CVN-79, $1,068.7 million for CVN-80, and $1,299.8 million for CVN-81.

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[17] 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.

[18] 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.

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

[20] 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 2. 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 (requested)	***0***	***291.0 (CC)***	***1,068.7 (FF)***	***1,299.8 (FF)***	***2,659.5***
FY23 (programmed)	*0*	*172.9 (CC)*	*1,188.6 (FF)*	*731.4 (FF)*	*2,092.9*
FY24 (programmed)	*0*	*143.1 (CC)*	*1,053.5 (FF)*	*637.5 (FF)*	*1,834.1*
FY25 (programmed)	*0*	*0*	*2,341.9 (FF)*	*566.4 (FF)*	*2,908.3*
FY26 (projected)	*0*	*0*	*0*	*2,087.2 (FF)*	*2,087.2*
FY27 (projected)	*0*	*0*	*0*	*2,026.8 (FF)*	*2,026.8*
FY28 (projected)	*0*	*0*	*0*	*1,670.7 (FF)*	*1,670.7*
Total	**13,316.5**	**11,929.7**	**12,405.5**	**12,483.6**	**50,135.3**

Source: Table prepared by CRS based on Navy's FY2022 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 10), the authority to use incremental funding for procuring aircraft carriers has been expanded by Congress to permit more than the four years of incremental funding that were permitted at the time that CVN-78 was initially funded.

Changes in Estimated Unit Procurement Costs Since FY2008 Budget

Table 3 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 3. Changes in Estimated Procurement Costs of CVNs 78, 79, 80, and 81

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

Budget	CVN-78		CVN-79		CVN-80		CVN-81	
	Est. proc. cost	Scheduled FY of proc.	Est. proc. cost	Scheduled FY of proc.	Est. proc. cost	Scheduled FY of proc.	Est. proc. cost	Scheduled FY of proc.
FY08	10,488.9	FY08	9,192.0	FY12	10,716.8	FY16	n/a	FY21
FY09	10,457.9	FY08	9,191.6	FY12	10,716.8	FY16	n/a	FY21
FY10	10,845.8	FY08	n/a	FY13	n/a	FY18	n/a	FY23
FY11	11,531.0	FY08	10,413.1	FY13	13,577.0	FY18	n/a	FY23
FY12	11,531.0	FY08	10,253.0	FY13	13,494.9	FY18	n/a	FY23
FY13	12,323.2	FY08	11,411.0	FY13	13,874.2	FY18	n/a	FY23
FY14	12,829.3	FY08	11,338.4	FY13	13,874.2	FY18	n/a	FY23
FY15	12,887.2	FY08	11,498.0	FY13	13,874.2	FY18	n/a	FY23
FY16	12,887.0	FY08	11,347.6	FY13	13,472.0	FY18	n/a	FY23
FY17	12,887.0	FY08	11,398.0	FY13	12,900.0	FY18	n/a	FY23
FY18	12,907.0	FY08	11,377.4	FY13	12,997.6	FY18	n/a	FY23
FY19	12,964.0	FY08	11,341.4	FY13	12,601.7	FY18	15,088.0	FY23
FY20	13,084.0	FY08	11,327.4	FY13	12,335.1	FY18	12,450.7	FY19
FY21	13,316.5	FY08	11,397.7	FY13	12,321.3	FY18	12,450.7	FY19
FY22	13,316.5	FY08	11,929.7	FY13	12,405.5	FY18	12,483.6	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%	
Cumulative % change through FY22								
Since FY08	+27.0%		+29.8%		+15.8%		n/a	
Since FY13	+8.1%		+4.5%		-10.6%		n/a	
Since FY18	+3.2%		+4.9%		-4.6%		n/a	
Since FY19	+2.7%		+5.2%		-1.6%		-17.3%	

Source: Table prepared by CRS based on FY2008-FY2022 Navy budget submissions. n/a means not available.

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

Issues for Congress for FY2022

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 December 9, 2020, long-range Navy shipbuilding document submitted by the Trump Administration called for a future fleet with 8 to 11 CVNs and 0 to 6 light aircraft carriers (CVLs), and the June 17, 2021, long-range Navy shipbuilding document calls for a future fleet with 9 to 11 aircraft carriers. 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);
- the cancellation of one or more planned RCOHs for Nimitz-class carriers that have not yet received RCOHs, and the consequent early retirement of one or more of these ships;
- a deferral or cancellation of the procurement of CVN-82, which under the Navy's FY2020 30-year shipbuilding plan was 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 class to procuring smaller and perhaps nonnuclear-powered aircraft carriers has been a recurrent matter of discussion and Navy study over the years, and is currently an active discussion in the Navy.

The Navy's FY2020 30-year shipbuilding plan called for procuring the next carrier in FY2028 and for that carrier to be a CVN, which would make it CVN-82. The December 9, 2020, long-range Navy shipbuilding document called for procuring the next aircraft carrier in FY2028. The June 17, 2021, long-range Navy shipbuilding document does not include projected procurements of aircraft carriers (or any other Navy ship type) for FY2023 or subsequent years.

As mentioned earlier, the Navy does not currently operate CVLs. As discussed in another CRS report, however, 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.[21] A February 1, 2021, press report 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,[22] we have looked at a Ford-class-light,[23] 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.[24]

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

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

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

[23] 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.

[24] 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.

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.[25] 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 a delay in CVN-78's first deployment due to the need to complete the construction, testing, and certification of the ship's weapons elevators and to correct other technical problems aboard the ship.[26] Challenges in completing the construction, testing, and certification of CVN-78's weapon elevators were first reported in November 2018,[27] and the issue has been a matter of continuing oversight attention since then.

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. The Navy has struggled since November 2018 to meet promises it has repeatedly made to the defense oversight committees to get the elevators completed, tested, and certified. Reported developments include the following:

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

[26] 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.

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

- For much of 2019, the Navy continued to report that two of the 11 weapon elevators were completed, tested, and certified.[28]
- On October 23, 2019, the Navy reported that the figure had increased to four of 11.[29]
- On April 22, 2020, the Navy announced that the fifth elevator 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 undergoes Full Ship Shock Trials (FSSTs) in the third quarter of FY2021.[30]
- On July 23, 2020, the Navy announced that the sixth elevator had been certified.[31]

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[28] 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.

[29] 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.

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

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

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

- In November 2020, it was reported that the seventh elevator 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.[32]
- On March 16, 2021, it was reported that seventh elevator 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 elevators considered together was 93% or 94% complete, and that the remaining three elevators would be completed during 2021.[33]
- On March 23, 2021, Navy Admiral John Aquilino testified that nine of the 11 elevators had been "repaired."[34]
- On May 13, 2021—about four years after the ship was delivered to the Navy—it was reported that four of the 11 elevators would not be certified until later in 2021.[35]

The Navy states that lessons learned in building, testing, and certifying CVN-78's AWEs will be applied to the AWEs of subsequent CVN-78 class carriers.[36] In November 2020, it was reported that HII/NNS had formed a single team to fix and install the elevators on both CVN-78 and CVN-79.[37]

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. Technical issues regarding the weapon elevators and other ship systems have delayed the ship's first deployment to 2022 at the earliest, which would be about five years after the ship was commissioned into service.[38] The delay in the ship's first deployment is lengthening a period during which the Navy is attempting to maintain policymaker-desired

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

[33] 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.

[34] 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.

[35] 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.

[36] 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.

[37] Michael Fabey, "Newport News Shipbuilding Forms One Team for Ford-class Weapons Elevators," *Jane's*, November 23, 2020.

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

levels of carrier forward deployments with its 10 other carriers—a situation that can lead to operational strains on those 10 carriers and their crews.

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 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.[39]

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.

[39] 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.

> 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 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.[40]

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.

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

> The Ford and the ships and air wing in its strike group also completed a long distance maritime strike exercise, a critical war-gaming test in which it had to escape from another task force seeking to disable it and then attack in its turn.
>
> "We have accelerated the timeline for Gerald R. Ford," Clapperton said ….
>
> During the Ford's latest at-sea exercise, its 18th since starting post delivery tests and trials, its electromagnetic catapult, for launching planes, and arresting gear, for keeping them from plunging into the sea when landing, hit the 8,000 launch-and-recovery cycle mark, said Capt. Joshua Sager, air wing commander.
>
> That's a key measure, since that is roughly the number of sorties an air-wing will fly during the several months of a deployment overseas.
>
> Sager said the new electromagnetic technology means the air-wing can get into the air—and return to the battle after rearming and refueling—faster than with the traditional steam-and-hydraulics systems that have been the mainstay for decades.
>
> "Now we've gone past the point of showing the Ford can do what Nimitz class can do…. Now we're at the point of taking it to the next level," he said, referring the class of 10 nuclear carriers now in service.[41]

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.[42]

Potential Oversight Questions

Potential oversight questions for Congress include the following:

[41] 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.

[42] 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.

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

Potential Impact of COVID-19 Pandemic

Another issue for Congress concerns the potential impact of the COVID-19 pandemic on the execution of U.S. military shipbuilding programs, including the CVN-78 program. An August 13, 2020, press report stated

> The Navy's top acquisition official said the service is reassessing the timeline for the future aircraft carrier USS John F. Kennedy (CVN-79) due to both the COVID-19 pandemic and the switch from a dual to single-phase delivery plan.
>
> James Geurts told reporters during a phone press roundtable Wednesday [August 12] that "obviously we are watching with some concern, the workforce levels at all our shipyards, but in particular at Newport News there, given the relatively high number of cases in there."…
>
> Geurts said the Navy is trying to understand the impacts from both COVID and moving to a single-phase delivery for CVN-79 and then "understanding the opportunity that going to a single phase delivery puts together and then leveraging that opportunity to build a more efficient schedule from here on out for that ship."[43]

Another August 13, 2020, press report stated

> Geurts told reporters during a telephone news conference that he was particularly worried about Newport News Shipbuilding, the Huntington Ingalls Industries (HII) yard in Virginia, "given the relatively high number of cases in there"….
>
> The USN is trying to assess what the impacts of the workforce reductions will mean to the schedule of the aircraft carrier John F. Kennedy (CVN 79), the Ford-class ship recently launched at Newport News Shipbuilding….

[43] Rich Abott, "Navy Reassessing CVN-79 Schedule Due To Pandemic And Phase Change," *Defense Daily*, August 13, 2020.

> After the media call, Geurts told Janes, "While we still are seeing major reductions in labour hours in CVN 79 versus CVN 78, we are also looking for opportunities to mitigate some of the Covid impacts as we shift to a single-phase delivery plan for that ship. Single-phase delivery will allow us to adjust some of the manpower and trade skill phasing to take into account the Covid impacts to date. We are working on those adjustments."[44]

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

Cost Growth and Managing Costs within Program Cost Caps

Overview

Another issue for Congress concerns cost growth in the CVN-78 program. Navy efforts to stem that growth and manage costs 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.[45]

As shown in **Table 3**, the estimated procurement costs of CVN-78, CVN-79, and CVN-80 have grown 27.0%, 29.8%, and 15.8%, respectively, since the submission of the FY2008 budget. As shown in **Table 2**, cost growth on CVN-78 required the Navy to program $1,465.9 million in cost-to-complete (CC) procurement funding for the ship in FY2014-FY2016, FY2018, and FY2021 and to request and program $607.0 million in CC funding for CVN-79 for FY2022-FY2024.

CVN-78

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

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[44] Michael Fabey, "Covid-19: Virus Impacts Force US Navy Schedule Reassessments for Carrier Kennedy and Other Programmes," *Jane's Navy International*, August 13, 2020.

[45] 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.

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

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

Confidence Levels

The Navy states that it is working to control cost growth on CVNs 79, 80, and 81. Even so, the Navy states that its confidence levels for its estimated procurement costs (not including costs for class-wide spare parts) for CVNs 79, 80, and 81 were 36%, 22%, and 20% as of June 2019, respectively, meaning that the Navy as of June 2019 estimated that the risk of future cost growth on CVNs 79, 80, and 81 were 64%, 78%, and 80%, respectively.[47]

October 2019 CBO Report

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

> The Navy's current estimate of the total cost of the USS Gerald R. Ford, the lead ship of the CVN-78 class, is $13.1 billion in nominal dollars appropriated over the period from 2001 to 2018. CBO used the Navy's inflation index for naval shipbuilding to convert that figure to $16.2 billion in 2019 dollars, or 25 percent more than the corresponding estimate when the ship was first authorized in 2008. Neither the Navy's nor CBO's estimate includes the $5 billion in research and development costs that apply to the entire class.
>
> Because construction of the lead ship is finished, CBO used the Navy's estimate for that ship to estimate the cost of successive ships in the class. But not all of the cost risk has been eliminated; in particular, the ship's power systems, advanced arresting gear (the system used to recover fixed-wing aircraft landing on the ship), and weapons elevators are

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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.)

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

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 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….[48]

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

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,[49] 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.

An August 5, 2020, press report stated

> The Navy vowed that a runaway budget wouldn't be allowed again after the USS Gerald Ford, the first in a new class of aircraft carriers, cost a record $13.3 billion. Now, the price for the second ship is creeping up.
>
> The service's estimate for shipbuilder Huntington Ingalls Industries Inc. to design and construct the USS John F. Kennedy has increased to $3.58 billion, up 7% from the $3.35 billion contract awarded in 2015, according to the carrier program's Selected Acquisition Report for fiscal 2021.
>
> That underscores previous warnings that the fully outfitted carrier may exceed an $11.4 billion cost cap imposed by Congress. The contractor is falling short by a key measure of labor efficiency, the Navy said in the report obtained by Bloomberg News.
>
> Its workforce performed 91 cents of work for every Navy dollar spent in the last year, down from the more acceptable level of 95 cents per dollar over the same timeframe, according to the report.
>
> Huntington Ingalls also is falling short of a Navy goal to reduce cumulative labor hours by at least 18% from the first ship. With the vessel 69% complete, the Kennedy is performing at a 16% improvement over the Ford at the same point, Captain Danny Hernandez, a Navy spokesman, said in an email.
>
> Hernandez said the cost report's figures stem in part from changes such as improvements in warfare capability and lessons learned from the Ford's recent post-delivery "shakedown" sea trials. There are additional costs "from congressional direction" requiring that the Kennedy be capable of deploying with F-35 jets by mid-2025, he said.
>
> The cost increases are also "due to delays relating to electrical, sheet metal, painting and platform engineering work," the Navy said in the Selected Acquisition Report. The JFK is expected to be delivered in 2024….

[49] 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.

> But the report warned that "if the current cost performance continues, then the budget will be exhausted prior to the completion" of the carrier. That could force the Defense Department to make the case to lawmakers for easing the cost cap.
>
> Beci Brenton, a spokeswoman for Newport News, Virginia-based Huntington Ingalls, said the carrier's construction is about 72% complete. The company "continues to see the benefits associated with significant build strategy changes and incorporation of lessons learned" from its predecessor.
>
> "We track cost and schedule trends continuously and share that information with our customer," the Navy, Brenton said.[50]

Issues Raised in DOT&E and GAO Reports

Another oversight issue for Congress concerns CVN-78 program issues raised in a January 2021 report from DOD's Director, Operational Test and Evaluation (DOT&E)—DOT&E's annual report for FY2020—and the 2020 edition of the Government Accountability Office's (GAO's) annual report surveying selected DOD weapon acquisition programs, which was published in June 2020.

January 2021 DOT&E Report

Regarding the CVN-78 program, the January 2021 DOT&E report stated the following in part:

> **Assessment**
>
> • As noted in previous annual reports, the test schedule has been aggressive. The extension in PSA [post-shakedown availability][51] delayed both phases of initial operational testing until FY22.
>
> • TEMP [test and evaluation master plan] Revision D outlines the Navy's cybersecurity strategy to test CVN 78, but has not translated the strategy into an actionable test plan.
>
> **Reliability**
>
> • Four of CVN 78's new systems stand out as critical to flight operations: EMALS, AAG, DBR, and AWE. Overall, the low reliability demonstrated by AAG, EMALS, and DBR, along with the uncertain reliability of AWE, could further delay the CVN 78 IOT&E [initial operational test and evaluation]. Reliability estimates derived from test data for EMALS, AAG, and DBR are discussed in following subsections. For AWE, preliminary reliability estimates have been provided on 6 of the 11 elevators, the only ones certified.
>
> **EMALS**[52]

[50] Anthony Capaccio, "Next Carrier's Cost Creeps Up After First One Hit $13.3 Billion," *Bloomberg*, August 5, 2020.

[51] A post-shakedown availability is a maintenance availability (i.e., a maintenance period) that takes place after a ship's shakedown cruise, which an initial cruise that is intended in part to identify problems with the ship's construction and equipment.

[52] For additional discussion regarding the reliability of EMALS, see Sam LaGrone, "USS Gerald Ford EMALS Launching System Suffers Fault During Testing Period," *USNI News*, June 8 (updated June 12), 2020; Rich Abott, "Ford EMALS Went Down During Testing At Sea," *Defense Daily*, June 8, 2020; Mallory Shelbourne, "EMALS Aboard Ford Went Out, Interrupting Flight Operations," *Inside Defense*, June 9, 2020; Gina Harkins, "Navy Carrier Ford's High-Tech EMALS Catapult System Breaks During Sea Trials," *Military.com*, June 11, 2020; Mallory Shelbourne, "Geurts: Navy Still Working to Diagnose Problem That Caused EMALS Failure on Ford," *Inside Defense*, June 18, 2020; Megan Eckstein, "Navy Unsure If Recent EMALS Fault Was Equipment or Procedure Problem, But Workaround Has Been Validated," *USNI News*, June 19, 2020.

• The delivery of the EMALS launch bulletins allows CVN 78 to launch all aircraft in the ship's Air Wing.

• During the 3,975 catapult launches conducted post PSA through ISE [independent steaming event] 11, EMALS demonstrated an achieved reliability of 181 mean cycles between operational mission failure (MCBOMF), where a cycle is the launch of one aircraft. This reliability is well below the requirement of 4,166 MCBOMF.

• During ISE 8, two separate failures caused individual EMALS catapults to go down for 3 days. One of the failures was attributed to a legacy component.

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

AAG

• Through the first 3,975 recoveries, AAG demonstrated an achieved reliability of 48 MCBOMF, where a cycle is the recovery of a single aircraft. This reliability estimate falls well below the requirement of 16,500 MCBOMF.

• While in port prior to ISE 9, during maintenance troubleshooting, the AAG system experienced a failure of an Energy Storage Capacitor Bank, which rendered all three engines inoperative. It took the Navy 7 days to investigate the failure and bring AAG back into service by mechanically isolating the failed capacitor bank. The failed parts were repaired during a later in-port period.

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

Combat System

• Post-PSA sea-based developmental test events show the DBR still experiences clutter tracks, but to a smaller extent and of a different origin than previously reported. The events also show that CEC [cooperative engagement capability],[53] in certain conditions, provides inaccurate tracking of air contacts. During these events, SEWIP [surface electronic warfare improvement program][54] Block 2 created undesired emitter tracks that could cause the ship to expend more ESSMs [Evolved Sea Sparrow Missiles] and RAMs [Rolling Airframe Missiles] than necessary to destroy incoming threats.

• The Navy is satisfied with the DBR track support for Air Traffic Control (ATC) after post-PSA at-sea testing. The DBR successfully suppresses the disclosure of the majority of environmental tracks when it sends tracks to [the] TPX-42 [shipboad air traffic control (ATC) system]. The Navy does not plan to conduct any further ATC-type aircraft flights during sea-based developmental testing.

• During the August 2020 missile firing operational test on SDTS [self-defense test ship], the system demonstrated good tracking performance of the targets by MFR [multi-function radar] and CEC, and good engagement support by the SSDS [ship self-defense system] MK 2 Mod 6 element, which correctly provided scheduling and weapon assignments. SEWIP Block 2 emitter reporting interfered with optimal engagements against threats.

[53] The CEC system permits data from sensors on multiple ships to be fused together, so as to improve radar tracking and target engagement.

[54] The SEWIP system is the Navy's new surface-ship electronic warfare system.

Several problems contributed to the failure of some ESSMs and RAMs to destroy their intended targets.

• Results of live testing completed to date indicate that CVN 78 has limited self-defense capability against ASCM [anti-ship cruise missile] surrogates, but several challenges persist with respect to the efficacy of the ship's combat system.

• Post PSA through ISE 11, DBR demonstrated a mean time between operational mission failures (MTBOMF) of 100 hours, below the requirement of 339 hours.

• Preliminary results of EASR's [enterprise air surveillance radar][55] early developmental testing indicate that electromagnetic interference, tracking performance, electronic protection, and power compliance testing are focal areas for ongoing system developmental work and improvements. Until operationally relevant reliability data are supplied to DOT&E, system reliability remains a significant risk area for EASR. EASR's combat system integration remains untested.

• Planned operational tests of the CVN 78 combat system continue to be delayed or have been canceled. In the 2006 Capstone Enterprise Air Warfare Ship Self-Defense TEMP, the Navy planned to leverage commonality between the DDG 1000 [destroyer] and CVN 78 combat systems to reduce the number of operational test events conducted on each ship. However, subsequent changes to the DDG 1000 combat system reduced commonality between the two ships and negated the ability to leverage testing and resources across the two combat systems.

• DOT&E recognizes that the CVN 78 Air Warfare test program is resource-limited because the Enterprise Air Warfare approach was not executable due to the divergence of the DDG 1000 and CVN 78 combat systems. DOT&E accepts this limitation expecting that the Navy will plan and execute an adequate air warfare test program for CVN 79. The CVN 79 test campaign is also intended to inform CVN 78 combat system performance once it is retrofitted with planned changes.

SGR

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

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

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

Manning

• Reduced manning requirements drove the design of CVN 78. The berthing capacity is 4,660, or 1,100 fewer than Nimitz-class carriers. Based on current expected manning, the berthing capacity for officers and enlisted will be exceeded with some variability in the estimates depending on the specific scenario examined.

[55] The use of the word *enterprise* in this context is not a reference to the name of CVN-80; it is instead a reference to the surface ship community, or enterprise. The use term in the radar's name denotes that the Navy envisages installing the radar on multiple ship classes within the community.

Electromagnetic Compatibility

• Developmental testing identified significant electromagnetic radiation hazard and interference problems. The Navy implemented some mitigation measures and conducted follow-on characterization testing during ISEs, 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 in order for commanders to make informed decisions on system employment.

Live Fire Test & Evaluation

• In FY20, the Navy continued with the shock qualification testing of CVN 78 components to support the survivability evaluation of CVN 78 to underwater threat engagements. Due to scarcity of test assets, some components and systems (e.g., DBR) will not be shock qualified before the FSST [full-ship shock trial].

• Adequate use of M&S [modeling and simulation] in the vulnerability evaluation of the ship against underwater threats is at risk. Challenges with the Navy Enhanced Sierra Mechanics M&S tool prompted the Navy to switch back to the Dynamic Systems Mechanics Advanced Simulation M&S tool to complete the vulnerability assessment report. While necessary, the change will require additional verification and validation to ensure the credibility of the survivability evaluation.

Recommendations

The Navy should:

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

2. Implement the required software changes to multiple combat system elements to allow cueing from external sources necessary to conduct one of the two remaining SDTS test events.

3. Conduct both remaining SDTS combat system test events for CVN 78.

4. Correct the cause of combat system failures that led to ESSMs and RAMs missing their intended targets, and demonstrate the correction in a future phase of operational testing.

5. Fund the CVN 78 lead ship combat system operational testing and the M&S suite required to support assessment of the CVN 78 PRA [probability of raid annihilation][56] requirement.

6. Conduct an operational assessment of EASR at Wallops Island, Virginia. This testing should evaluate EASR's contributions to the air traffic control and self-defense missions, as well as provide an early assessment of electromagnetic interference and radiation hazard concerns.

7. Update TEMP 1610 to include cybersecurity testing on CVN 78 and CVN 79 testing driven by the changes to the ship's combat system, including the introduction of EASR.

8. Complete validation of the M&S tools supporting the LFT&E [live-fire test and evaluation] assessment, including comparison of the FSST data to relevant M&S predictions.

[56] PRA is a measurement of the ship's ability to defeat (i.e., annihilate) an attack (i.e., raid) consisting of multiple enemy anti-ship missiles.

9. Continue to improve availability and reliability for EMALS, AAG, DBR, and AWE.[57]

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 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**

[57] Department of Defense, Director, Operational Test & Evaluation, *FY2020 Annual Report*, January 2021, pp. 137-139.

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.[58]

Legislative Activity for FY2022

Summary of Congressional Action on FY2022 Funding Request

Table 4 summarizes congressional action on the FY2022 procurement funding request for the CVN-78 program.

Table 4. Congressional Action on FY2022 Procurement Funding Request

Millions of dollars, rounded to nearest tenth.

		Authorization			Appropriation		
	Request	HASC	SASC	Conf.	HAC	SAC	Conf.
CVN-78	0						
CVN-79	291.0						
CVN-80	1,068.7						
CVN-81	1,299.8						
Total above	**2,659.5**						

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

Source: Table prepared by CRS based on Navy's FY2022 budget submission, committee and conference reports, and explanatory statements on FY2022 National Defense Authorization Act and FY2022 DOD Appropriations Act.

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

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.[59] 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.[60]

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

[59] 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.

[60] 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.[61]

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).[62] 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[63] and production change orders."[64] Within the total estimated combined reduction in cost, HII/NNS reportedly expects to save up to $1.6 billion in contractor-furnished equipment.[65]

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

[61] 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.

[62] 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.

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

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

[65] 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.

[66] 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.[67]

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.

[67] 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.[68]

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.[69]

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.

[68] 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.

[69] 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.

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