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Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress

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Summary

The Arleigh Burke (DDG-51) class destroyer program is one of the longest-running shipbuilding programs in Navy history. The Navy began procuring DDG-51s, also known as Aegis destroyers, in FY1985, and a total of 94 have been procured through FY2024, including two in FY2024. From FY1989 through FY2005, DDG-51s were procured in annual quantities of two to five ships per year. Since FY2010, they have been procured in annual quantities of one to three ships per year. (The Navy did not procure any DDG-51s in FY2006-FY2009. Instead, the Navy in FY2007-FY2009 procured three Zumwalt [DDG-1000] class destroyers. The Navy plans no further procurement of DDG-1000s.)

The Navy's proposed FY2025 budget requests the procurement of two more DDG-51s in FY2025. The Navy's FY2025 five-year (FY2025-FY2029) shipbuilding plan includes 10 DDG-51s, to be procured at a rate of two ships per year.

As part of its FY2023 budget submission, the Navy requested authority for using a multiyear procurement (MYP) contract for DDG-51s scheduled for procurement in FY2023-FY2027. Congress, as part of its action on the Navy's proposed FY2023 budget, approved this request. Four previous MYP contracts for the DDG-51 program covered DDG-51s procured in FY1998-FY2001, FY2002-FY2005, FY2013-FY2017, and FY2018-FY2022.

The first DDG-51 entered service in 1991, and a total of 73 have been delivered as of March 2024. The DDG-51 design has been updated multiple times over the years; the version currently being procured, called the Flight III DDG-51 design, incorporates a new and more capable radar called the SPY-6 radar.

DDG-51s currently cost about $2.5 billion each to procure. The Navy's proposed FY2025 budget estimates the combined procurement cost of the two DDG-51s requested for procurement in FY2025 at $4,958.8 million (i.e., about $5.0 billion). The two ships have received $233.0 million in prior-year Economic Order Quantity (EOQ) funding, which is a kind of advance procurement (AP) funding that can occur under an MYP contract. The Navy's proposed FY2025 budget requests the remaining $4,725.8 million needed to complete the two ships' estimated combined procurement cost. The Navy's proposed FY2025 budget also requests $41.7 million in EOQ funding, $1,683.4 million in procurement funding to cover cost growth on the five DDG-51s procured in FY2023 and FY2024, and $233.5 million in cost-to-complete (CTC) procurement funding to cover cost growth on five DDG-51s procured in FY2016-FY2018. Combining all these funding requests, the Navy's proposed FY2025 budget requests a total of $6,684.4 million (i.e., about $6.7 billion) in procurement funding for the DDG-51 program.

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Introduction

This report presents background information and potential oversight issues for Congress on the Navy's Arleigh Burke (DDG-51) and Zumwalt (DDG-1000) class destroyer programs. The Navy began procuring DDG-51s, also known as Aegis destroyers, in FY1985, and a total of 94 have been procured through FY2024, including two in FY2024. The Navy's proposed FY2025 budget requests the procurement of two more DDG-51s in FY2025.

Potential issues for Congress for the DDG-51 program in FY2025 include the shipbuilding industrial base's capacity for building DDG-51s, and the impact this could have on the DDG-51 procurement rate, and how the Navy proposes to transition several years from now from procurement of DDG-51s to procurement of a successor destroyer design now in development called the DDG(X). Decisions that Congress makes on these issues could substantially affect Navy capabilities and funding requirements, and the U.S. shipbuilding industrial base.

For more on the DDG(X) program, see CRS In Focus IF11679, *Navy DDG(X) Next-Generation Destroyer Program: Background and Issues for Congress*, by Ronald O'Rourke.

Background

Navy's Force of Large Surface Combatants (LSCs)

LSC Definition

Decades ago, the Navy's cruisers were considerably larger and more capable than its destroyers. In the years after World War II, however, the Navy's cruiser designs in general became smaller while its destroyer designs in general became larger. As a result, since the 1980s there has been substantial overlap in size and capability of Navy cruisers and destroyers. (The Navy's new Zumwalt [DDG-1000] class destroyers, in fact, are considerably larger than the Navy's cruisers.)

In part for this reason, the Navy now refers to its cruisers and destroyers collectively as *large surface combatants (LSCs)*, and distinguishes these ships from the Navy's *small surface combatants (SSCs)*, the term the Navy now uses to refer collectively to its frigates, Littoral Combat Ships (LCSs), mine warfare ships, and patrol craft. The Navy's annual 30-year shipbuilding plan, for example, groups the Navy's surface combatants into LSCs and SSCs.[1]

LSC Force as of End of FY2023

As of the end of FY2023, the Navy's LSC force included 87 ships, including 13 Ticonderoga (CG-47) class cruisers,[2] 73 DDG-51s, and one Zumwalt (DDG-1000) class destroyer.

[1] The Navy sometimes also uses the term *Cru-Des* (an abbreviation of cruiser-destroyer, pronounced "crew-dez") to refer collectively to its cruisers and destroyers.

[2] A total of 27 CG-47s (CGs 47 through 73) were procured for the Navy between FY1978 and FY1988; the ships entered service between 1983 and 1994. The first five ships in the class (CGs 47 through 51), which were built to an earlier technical standard in certain respects, were judged by the Navy to be too expensive to modernize and were removed from service in 2004-2005, leaving 22 ships in operation (CGs 52 through 73). Of the remaining 22, five were retired in FY2022, leaving 17 in service at the end of FY2022.

LSC Force-Level Goal

The Navy's FY2025 30-year (FY2025-FY2054) shipbuilding plans calls for achieving a future fleet of 381 manned battle force ships, including 87 LSCs. Prior to the 381-ship force-level goal shown in the Navy's FY2025 30-year shipbuilding plan, Navy plans called for achieving a future fleet of 355 manned battle force ships, including 104 LSCs. Section 121 of the FY2021 National Defense Authorization Act (H.R. 6395/P.L. 116-283 of January 1, 2021) states

> SEC. 121. LIMITATION ON ALTERATION OF THE NAVY FLEET MIX.
>
> (a) LIMITATION.—
>
> (1) IN GENERAL.—The Secretary of the Navy may not deviate from the large surface combatant requirements included in the 2016 Navy Force Structure Assessment until the date on which the Secretary submits to the congressional defense committees the certification under paragraph (2) and the report under subsection (b).
>
> (2) CERTIFICATION.—The certification referred to in paragraph (1) is a certification, in writing, that the Navy can mitigate the reduction in multi-mission large surface combatant requirements, including anti-air and ballistic missile defense capabilities, due to having a reduced number of DDG–51 Destroyers with the advanced AN/SPY–6 radar in the next three decades.
>
> (b) REPORT.—Not later than 90 days after the date of the enactment of this Act, the Secretary of the Navy shall submit to the congressional defense committees a report that includes—
>
> (1) a description of likely detrimental impacts to the large surface combatant industrial base, and a plan to mitigate such impacts, if the fiscal year 2021 future-years defense program is implemented as proposed;
>
> (2) a review of the benefits to the Navy fleet of the new AN/SPY–6 radar to be deployed aboard Flight III variant DDG–51 Destroyers, which are currently under construction, as well as an analysis of impacts to the warfighting capabilities of the fleet should the number of such destroyers be reduced; and
>
> (3) a plan to fully implement section 131 of the National Defense Authorization for Fiscal Year 2020 (Public Law 116–92; 133 Stat. 1237), including subsystem prototyping efforts and funding by fiscal year.

DDG-51 Program

Overview

The DDG-51 program was initiated in the late 1970s.[3] It is one of the longest-running shipbuilding programs in Navy history, and the DDG-51 class is one of the Navy's numerically largest classes of ships since World War II. The first DDG-51 was procured FY1985, and a total of 94 have been procured through FY2023, including two in FY2024. From FY1989 through FY2005, DDG-51s were procured in annual quantities of two to five ships per year. Since FY2010, they have been procured in annual quantities of one to three ships per year. The Navy

[3] The program was initiated with the aim of developing a surface combatant to replace older destroyers and cruisers that were projected to retire in the 1990s. The DDG-51 was conceived as an affordable complement to the Navy's Ticonderoga (CG-47) class Aegis cruisers. For an early discussion of the DDG-51 program, see Alva M. Bowen and Ronald O'Rourke, "DDG-51 and the Future Surface Navy," *U.S. Naval Institute Proceedings*, May 1985: 176-189.

did not procure any DDG-51s in FY2006-FY2009. Instead, the Navy in FY2007-FY2009 procured three Zumwalt [DDG-1000] class destroyers, which are discussed later in this report.

The first DDG-51 entered service in 1991, and a total of 73 have been delivered as of March 2024. The remaining 21 DDG-51s are in various stages of construction. Earlier DDG-51s, known as the Flight I/II DDG-51s, generally have an estimated service life (ESL) of 35 years, meaning that retirement of these ships could begin in the late 2020s, although a small number of Flight I/II DDG-51s have been certified for a 40-year life. Additional Flight I/II DDG-51s might eventually receive similar certifications, depending on their condition and Navy mission needs. Later DDG-51s, known as the Flight IIA and Flight III DDG-51s, have an estimated service life of 40 years.

DDG-51s (**Figure 1**, **Figure 2** and **Figure 3**) are multi-mission destroyers with an emphasis on air defense (which the Navy refers to as anti-air warfare, or AAW) and blue-water (mid-ocean) operations. DDG-51s, like the Navy's Ticonderoga (CG-47) class cruisers, are equipped with the Aegis combat system, an integrated ship combat system named for the mythological shield that defended Zeus. CG-47s and DDG-51s consequently are often referred to as Aegis cruisers and Aegis destroyers, respectively, or collectively as Aegis ships. The Aegis system has been updated several times over the years. Many DDG-51s (and also some CG-47s) have a capability for conducting ballistic missile defense (BMD) operations.[4]

Figure 1. DDG-51 Class Destroyer

Source: Cropped version of photograph at Huntington Ingalls Industries, "Delbert Black (DDG 119) Completes Builder's Trials," February 26, 2020, accessed November 17, 2021, at https://newsroom.huntingtoningalls.com/file/delbert-black-ddg119-builders-trials.

Design Changes

The DDG-51 design has been modified and updated periodically over the years. The first 28 DDG-51s (DDGs 51 through 78) are called Flight I/II DDG-51s. In FY1994, the Navy shifted DDG-51 procurement to the Flight IIA DDG-51 design, which incorporated certain changes,

[4] For more on Navy BMD programs, see CRS Report RL33745, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*, by Ronald O'Rourke.

including the addition of a helicopter hangar. A total of 47 Flight IIA DDG-51s (DDGs 79 through 124 and DDG-127) were procured in FY1994-FY2016. In FY2017, the Navy shifted DDG-51 procurement to the current Flight III DDG-51 design, which incorporates a new and more capable radar called the SPY-6 radar (previously known as the Air and Missile Defense Radar, or AMDR), as well as associated changes to the ship's electrical power and cooling systems. DDGs 125 and higher, except for DDG-127 as noted above, are to be Flight III DDG-51s.

Figure 2. DDG-51 Class Destroyer

Source: Cropped version of undated photograph of USS *Jason Dunham* (DDG-109) at "Bath Iron Works," accessed November 17, 2021, at https://www.gd.com/our-businesses/marine-systems/bath-iron-works.

Multiyear Procurement (MYP)

As part of its FY2023 budget submission, the Navy requested authority for using a multiyear procurement (MYP) contract for DDG-51s scheduled for procurement in FY2023-FY2027.[5] Congress, as part of its action on the Navy's proposed FY2023 budget, approved this request.[6] Four previous MYP contracts for the DDG-51 program covered DDG-51s procured in FY1998-FY2001, FY2002-FY2005, FY2013-FY2017, and FY2018-FY2022.

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

[6] See Section 125 of the FY2023 National Defense Authorization Act (NDAA) (H.R. 7776/P.L. 117-263 of December 23, 2022) and Section 8010 of the FY2023 DOD Appropriations Act, (Division C of H.R. 2617/P.L. 117-328 of December 29, 2022).

Figure 3. DDG-51 Class Destroyer

Source: Cropped version of photograph accompanying Oren Liebermann and Natasha Bertrand, "US Warship Had Close Call with Houthi Missile in Red Sea," CNN, February 1, 2024. The article credits the photograph to Mass Communication Specialist 3rd Class Janae Chambers/U.S. Navy.

Shipbuilders, Combat System Lead, and Radar Maker

DDG-51s are built by General Dynamics/Bath Iron Works (GD/BIW) of Bath, ME, and Huntington Ingalls Industries/Ingalls Shipbuilding (HII/Ingalls) of Pascagoula, MS. Lockheed is the lead contractor for the Aegis system installed on all DDG-51s. The SPY-6—the primary radar for the Aegis system on Flight III DDG-51s—is made by Raytheon.

Modernization of In-Service Ships

The Navy is modernizing existing DDG-51s (and a few CG-47s) so as to maintain their mission and cost-effectiveness out to the end of their projected service lives. Older CRS reports provide additional historical and background information on the DDG-51 program.[7]

FY2025 Procurement Funding Request

DDG-51s currently cost about $2.5 billion each to procure. The Navy's proposed FY2025 budget estimates the combined procurement cost of the two DDG-51s requested for procurement in FY2025 at $4,958.8 million (i.e., about $5.0 billion). The two ships have received $233.0 million in prior-year Economic Order Quantity (EOQ) funding, which is a kind of advance procurement (AP) funding that can occur under an MYP contract. The Navy's proposed FY2025 budget requests the remaining $4,725.8 million needed to complete the two ships' estimated combined procurement cost. The Navy's proposed FY2025 budget also requests $41.7 million in EOQ funding, $1,683.4 million in procurement funding to cover cost growth on the five DDG-51s procured in FY2023 and FY2024, and $233.5 million in cost-to-complete (CTC) procurement funding to cover cost growth on five DDG-51s procured in FY2016-FY2018. Combining all these

[7] See CRS Report 94-343, *Navy DDG-51 Destroyer Procurement Rate: Issues and Options for Congress*, by Ronald O'Rourke (April 25, 1994; out of print and available to congressional clients directly from the author), and CRS Report 80-205, *The Navy's Proposed Arleigh Burke (DDG-51) Class Guided Missile Destroyer Program: A Comparison with an Equal-Cost Force Of Ticonderoga (CG-47) Class Guided Missile Destroyers*, by Ronald O'Rourke (November 21, 1984; out of print and available to congressional clients directly from the author).

funding requests, the Navy's proposed FY2025 budget requests a total of $6,684.4 million (i.e., about $6.7 billion) in procurement funding for the DDG-51 program.

DDG-1000 Program

As noted earlier, in FY2007-FY2009, during the time when the Navy was not procuring DDG-51s, the Navy instead procured three Zumwalt (DDG-1000) class destroyers. The Navy plans no further procurement of DDG-1000s.

DDG-1000s are multi-mission destroyers with an originally intended emphasis on naval surface fire support (NSFS)[8] and operations in littoral (i.e., near-shore) waters. Consistent with that mission orientation, the ship was designed with two new-design 155mm guns called Advanced Gun Systems (AGSs). The AGSs were to fire a new 155mm, gun-launched, rocket-assisted guided projectile called the Long-Range Land-Attack Projectile (LRLAP, pronounced LUR-lap). In November 2016, however, it was reported that the Navy had decided to stop procuring LRLAP projectiles because the projected unit cost of each projectile had risen to at least $800,000.[9]

In December 2017, it was reported that, due to shifts in the international security environment and resulting shifts in Navy mission needs, the mission orientation of the DDG-1000s would be shifted from an emphasis on NSFS to an emphasis on surface strike, meaning the use of missiles to attack surface ships and perhaps also land targets.[10]

To further optimize the three ships for conducting surface strike missions, the Navy plans to remove on of the AGSs on each ship, along with its associated below-deck equipment, and replace it with large-diameter vertical launch tubes capable of storing and firing the Navy's new hypersonic Conventional Prompt Strike (CPS) missile, with a goal of having the first CPS-equipped DDG-1000 class ship ready for testing by 2025. Each DDG-1000 class ship reportedly is to be equipped with four of the large-diameter tubes, with each tube capable of holding three CPS missiles, for a total of 12 CPS missiles per ship.[11]

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[8] NSFS is the use of naval guns to provide fire support for friendly forces operating ashore.

[9] Christopher P. Cavas, "New Warship's Big Guns Have No Bullets," *Defense News*, November 6, 2016; Sam LaGrone, "Navy Planning on Not Buying More LRLAP Rounds for Zumwalt Class," *USNI News*, November 7, 2016; Ben Guarino, "The Navy Called USS Zumwalt A Warship Batman Would Drive. But at $800,000 Per Round, Its Ammo Is Too Pricey to Fire," *Washington Post*, November 8, 2016.

[10] Megan Eckstein, "New Requirements for DDG-1000 Focus on Surface Strike," *USNI News*, December 4, 2017. See also Richard Abott, "Navy Will Focus Zumwalt On Offensive Surface Strike," *Defense Daily*, December 5, 2017; David B. Larter, "The Navy's Stealth Destroyers to Get New Weapons and a New Mission: Killing Ships," *Defense News*, February 15, 2018.

[11] See, for example, Diana Stancy, "Time to Test a Ship-Based Hypersonic Missile Launcher," *Military Times*, December 31, 2023; Mallory Shelbourne, "Navy Planning for December 2025 Hypersonic Missile Test off USS Zumwalt," *USNI News*, February 1, 2023; Kyle Mizokami, "The Navy's Stealth Destroyers Are Getting a Serious Upgrade: 12 Hypersonic Missiles Each," *Popular Mechanics*, December 1, 2022; Sam LaGrone, "Navy Details Hypersonic Missile Plan for Zumwalt Destroyers, Virginia Submarines," *USNI News*, November 3, 2022; Sam LaGrone, "HII Set to Install First Hypersonic Missiles on USS Zumwalt, USS Michael Monsoor During Repair Period," *USNI News*, August 12, 2022; Sam LaGrone, "Latest Zumwalt Hypersonic Missile Installation Plan Calls For Removing Gun Mounts," *USNI News*, March 16, 2022; Joseph Trevithick, "The Navy's Stealth Destroyers Will Have Their Deck Guns Replaced With Hypersonic Missiles," *The Drive*, November 2, 2021; Rich Abott, "Navy Plans to Field 12 Hypersonic Missiles on Each Zumwalt Destroyer, Replacing Gun," *Defense Daily*, June 8, 2021; Jason Sherman, "Navy Plans to Pack Each DDG-1000 with 12 Long-Range Hypersonic Strike Missiles," *Inside Defense*, June 8, 2021; Jason Sherman, "Navy to Rip Out DDG-1000 Advanced Gun System Mounts to Make Room for Hypersonic Weapons," *Inside Defense*, May 26, 2021; Sam LaGrone, "CNO: Hypersonic Weapons at Sea to Premiere on Zumwalt Destroyers in 2025," *USNI News*, April 28, 2021; David B. Larter, "What Should Become of the Zumwalt Class? The US Navy Has Some Big Ideas," *Defense News*, March 25, 2021; Joseph Trevithick, "Navy Wants Triple-
(continued...)

The Navy reportedly also wants to replace some of the combat system equipment on the three ships with equipment more similar to, and interoperable with, combat system equipment on other U.S. Navy surface combatants. The Navy refers to this as the Zumwalt Enterprise Upgrade Solution (ZEUS).[12]

For additional background information on the DDG-1000 program, see the **Appendix**.

Surface Combatant Construction Industrial Base

All cruisers and destroyers procured since FY1985 have been built at GD/BIW and HII/Ingalls. Both of these shipyards have long histories of building larger surface combatants. Construction of Navy surface combatants in recent years has accounted for virtually all of GD/BIW's ship-construction work and for a significant share of HII/Ingalls' ship-construction work. (HII/Ingalls also builds amphibious ships for the Navy and cutters for the Coast Guard.) Navy surface combatants are overhauled, repaired, and modernized at GD/BIW, HII/Ingalls, and other U.S. shipyards.

Lockheed Martin and Raytheon are generally considered the two leading Navy surface combatant radar makers and combat system integrators. Lockheed is the lead contractor for the DDG-51 combat system (the Aegis system), while Raytheon is the lead contractor for the DDG-1000 combat system, the core of which is called the Total Ship Computing Environment Infrastructure (TSCE-I). Lockheed has a share of the DDG-1000 combat system, and Raytheon has a share of the DDG-51 combat system. Lockheed, Raytheon, and Northrop competed to be the maker of the SPY-6 radar to be carried by the Flight III DDG-51. On October 10, 2013, the Navy announced that it had selected Raytheon to be the maker of the SPY-6.

The surface combatant construction industrial base also includes hundreds of additional firms that supply materials and components. Several Navy-operated laboratories and other facilities support the Aegis system and other aspects of the DDG-51 and DDG-1000 programs.

Issues for Congress

Shipbuilding Industrial-Base Capacity and DDG-51 Procurement Rate

One issue for Congress concerns the shipbuilding industrial base's capacity for building DDG-51s, and the impact this could have on the DDG-51 procurement rate, specifically on the question of whether to procure two or three DDG-51s per year. A March 21, 2023, press report stated

> The Navy is keeping a two-ship-per-year cadence for its destroyer line because that's a realistic goal for industry to work toward, according to the Pentagon's top budget officer.

Packed Hypersonic Missile Modules On Its Stealthy Zumwalt Destroyers," *The Drive*, March 19, 2021; Paul McLeary, "Exclusive[:] Eying China, CNO Plans Hypersonics & Lasers On Zumwalt Destroyers," *Breaking Defense*, February 26, 2021. For more on the CPS program, see CRS Report R41464, *Conventional Prompt Global Strike and Long-Range Ballistic Missiles: Background and Issues*, by Amy F. Woolf.

[12] See, for example, Kyle Mizokami, "The Navy's Stealth Destroyers Are Getting a Serious Upgrade: 12 Hypersonic Missiles Each," *Popular Mechanics*, December 1, 2022; Mallory Shelbourne, "Navy Exploring 'Surface Strike' Upgrades for Zumwalt Destroyers," *USNI News*, November 28, 2022; Justin Katz, "Navy Eyeing 'ZEUS,' an Upgrade Program for the Zumwalt Destroyers," *Breaking Defense*, November 22, 2022.

Despite Congress' push for the Navy to start buying three Arleigh Burke-class Flight III destroyers per year, the Fiscal Year 2024 budget request unveiled last week showed the service buying two destroyers. That's because U.S. shipyards are not yet able to build two destroyers per year, let alone three, Mike McCord said last week.

"I'm not hating on DDGs—my only point was that last year Congress added a third and the reason we didn't budget for three is, again, we don't see the yards being able to produce three a year. We don't see them being able to produce two a year. And that's just data. It's not what we wish to be true. But everybody's struggling with skilled labor. Everybody's struggling with supply chain. So it's not getting better very fast from the data that I've seen – whether with submarines or DDGs. So two a year seems to be a reasonable place," McCord told USNI News at the McAleese Conference.

During the [FY2024] budget rollout last week, McCord said industry is currently building 1.5 destroyers per year, a number Chief of Naval Operations Adm. Mike Gilday has also cited when arguing that the shipyards have limited capacity.

McCord also argued that asking for more destroyers than industry can build takes away leverage from the Navy to negotiate with shipbuilders on price.

"If you keep sort of placing orders for things faster than they can be delivered, it's good for the books, the balance sheets of the companies. But are you really, as the buyer, are you in the best place you'd like to be with any leverage or are you actually short of leverage when, you produce on time or you don't produce on time. It doesn't matter to me – I'm going to keep writing you checks," McCord told USNI News.

The comptroller said both he and Susanna Blume, the director of the Cost Assessment and Program Evaluation (CAPE) Office of the Secretary of Defense, don't think putting more funding toward an extra destroyer is a wise use of resources that will help shipbuilders deliver it to the Navy quicker.

"It's just sort of piling up in the orders book and we're still going to have the same problems of the yards producing faster until we get through the supply chain and the workforce issues," McCord said. "It is not to say that we would not be interest[ed] in a more robust production world where in having three DDGs or moving to three submarines, but it doesn't seem to be … realistic."

General Dynamics Bath Iron Works, one of the yards that build the destroyers, has spent the last several years digging through a backlog of work at its Maine yard that the COVID-19 pandemic exacerbated. HII's Ingalls Shipbuilding, the other yard that builds the Arleigh Burke destroyers, has performed better. Ingalls is also winding down the Coast Guard's Legend-class National Security Cutter production line, which could open up more capacity at its yard in Pascagoula, Miss.

A spokeswoman for Ingalls Shipbuilding told USNI New in a statement that the yard is ready to support building three destroyers per year should the Navy go this route.

"Our shipbuilders will position to support whatever destroyer cadence the Navy needs and we have started by building, testing and taking the first Flight III ship to sea, which will be delivered later this year. We are a committed partner to not only our customers but to our network of nearly 1,200 suppliers as well. Together, we can build three DDGs a year if that is what the Navy and our country need," Kimberly Aguillard said in a statement.

A spokesperson for Bath Iron Works told USNI News that it's "working to aggressively recover schedule" at the shipyard.

"We support the call for a consistent demand signal that gives shipyards and suppliers the predictability to make major investments in workforce and facilities, both to expand destroyer production and to ensure that capability remains intact well into the future," David Hench said in a statement. "Those capital investments are currently underway in

> Bath, and we are confident there will be significant schedule improvement so we can meet the Navy's expectations by the time construction begins on the anticipated multi-year contract."
>
> Lawmakers have urged the Navy to work toward buying three destroyers per year and added a third destroyer on top of the Navy's request for two in FY 2023. Congress also included a provision in the FY 2023 policy bill that would allow the Navy to ink a multi-year procurement deal for as many as 15 Flight III destroyers. If the multi-year procurement contracts are for fewer than 15 destroyers, the Navy must include at least one "pre-priced option" so it has the opportunity to buy 15 ships, according to the bill language.[13]

A Congressional Budget Office (CBO) analysis of DDG-51 delivery dates shown in annual budget-justification books for the Navy's shipbuilding account shows, in the FY2025 budget-justification book, an average 18-month delay for DDG-51s procured between FY2015 and FY2022 compared with delivery dates for those ships shown in the FY2023 budget justification book.[14]

Transition of Procurement from DDG-51s to DDG(X)s

Another issue for Congress concerns how the Navy proposes to transition several years from now from procurement of DDG-51s to procurement of a successor destroyer design now in development called the DDG(X). Navy plans for transitioning from procurement of DDG-51s to procurement of DDG(X)s have been an oversight focus for the defense committees. DON's prepared statement for the April 26, 2022, hearing on DON investment programs before the Seapower subcommittee of the Senate Armed Services Committee states

> The Navy is committed to a smooth and successful transition from DDG 51 to DDG(X) starting around FY 2030.[15] The transition will preserve the critical shipbuilding and supplier industrial base by executing a collaborative design process with current DDG 51 shipyards and transitioning to a proven limited competition model between these shipyards at the right point in ship construction.[16]

A January 10, 2024, press report states

> The Navy is looking for a three-year overlap between the start of construction on its next-generation guided-missile destroyer DDG(X) and its current crop of Flight III Arleigh Burke DDGs, the director of Navy surface warfare told USNI News on Wednesday [January 10]….
>
> The service is keen on feathering in the DDG(X) to create a smooth transition at the yards from the Flight IIIs.

[13] Mallory Shelbourne, "OSD Comptroller Says U.S. Shipyards Can't Build 3 Destroyers a Year," *USNI News*, March 21 (updated March 22), 2023.

[14] Source: CBO email to CRS, May 15, 2024.

[15] Under the Navy's proposed FY2024 budget, procurement of the first DDG(X) has been deferred from FY2030 to FY2032.

[16] Statement of Frederick J. Stefany, Principal Civilian Deputy, Assistant Secretary of the Navy (Research, Development and Acquisition), Performing the Duties of the Assistant Secretary of the Navy (Research, Development and Acquisition), and Vice Admiral Scott Conn, Deputy Chief of Naval Operations, Warfighting Requirements and Capabilities (OPNAV N9), and Lieutenant General Karsten S. Heckl, Deputy Commandant, Combat Development and Integration, Commanding General, Marine Corps Combat Development Command, before the Subcommittee on Seapower of the Senate Armed Services Committee on Department of the Navy Fiscal Year 2023 Budget Request for Seapower, April 26, 2022, PDF page 10 of 37.

> "The answer is three years to make sure we do no harm to our shipbuilding industry, whether it's Bath Iron Works or [Ingalls]," Pyle said.[17]

For more on the DDG(X) program, see CRS In Focus IF11679, *Navy DDG(X) Next-Generation Destroyer Program: Background and Issues for Congress*, by Ronald O'Rourke.

Cost, Technical, and Schedule Risk in Flight III DDG-51 Effort

Another issue for Congress concerns cost, technical, and schedule risk for the Flight III DDG-51.

June 2024 GAO Report

A June 2024 Government Accountability Office (GAO) report—the 2024 edition of GAO's annual report surveying DOD major acquisition programs—stated the following in its assessment of the Flight III DDG-51:

> **Current Status**
>
> Since last year's assessment, the Navy completed the acceptance trial for the lead Flight III ship—DDG 125—and took delivery of the ship in June 2023 as planned. The program experienced cost growth for the first two Flight III ships, with the program office stating that it requested an additional $290 million for fiscal years 2023 and 2024 to cover the government's portion of cost overruns for certain contracts. The program office stated that issues at both shipyards with hiring, retention, and workforce experience—and the associated construction inefficiencies—contributed to the cost growth.
>
> Shipyard performance is also significantly hindering the schedule for follow-on ships. The program office estimates delivery delays ranging from 6 to 25 months for the 13 follow-on ships purchased during fiscal years 2017-2022. The Navy awarded new contracts to both shipbuilders in August 2023 that support procurement of nine more DDG 51 Flight III ships, with options for additional ships in fiscal years 2023 through 2027. Further delivery delays could have significant consequences for the Navy's efforts to counter current and future air and surface threats.
>
> The program office stated that it plans to complete Flight III initial operational test and evaluation by fiscal year 2028. The plan's first test period focuses on ballistic missile defense, surface warfare, and initial integrated air and missile defense events. The program office expects the results from this test period to inform an initial operational capability determination for Flight III planned for August 2024. The program office also noted risk to achieving initial operational capability as scheduled because of all the test events planned to be accomplished in what the program considers a compressed timeline.
>
> **Program Office Comments**
>
> We provided a draft of this assessment for program office review and comment. The program office provided technical comments, which we incorporated where appropriate. The program office stated that the DDG 51 program is one of the Navy's longest-running production lines and has delivered 73 ships to the fleet. The program office also stated that, of the 26 Arleigh Burke class ships under contract, 12 ships are in various stages of production and the rest are in pre-construction activities. The program office added that, in addition to progressing toward delivery of the final few Flight IIA ships, the program is making significant progress in testing the first Flight III ship.[18]

[17] Sam LaGrone, "Navy Wants 3-Year Overlap Between Arleigh Burkes and DDG(X), Considering Propulsion System," *USNI News*, January 10, 2024.

[18] Government Accountability Office, *Weapon Systems Annual Assessment[:] DOD Is Not Yet Well-Positioned to Field Systems with Speed*, GAO-24-106831, June 2024, p. 151.

Regarding the SPY-6 (AMDR) radar specifically, the report stated the following:

> **Technology Maturity, Design Stability, and Production Readiness**
>
> Program officials reported that the contractor has produced seven of nine AMDR AN/SPY-6(V)1 radars and expect delivery of the remaining two by August 2024. Three of the delivered radars are now installed on DDG 51 Flight III ships. According to AMDR officials, the program also installed two of the smaller EASR radar variants on other ship classes. According to program officials, AMDR radar production is outpacing ship production of DDG 51 Flight III ships, which may result in storage of completed radars prior to their final installation. We assess the DDG 51 Flight III ship program separately in this report and reported that DDG 51 Flight III ship production is delayed by 6 to 25 months.
>
> The program continues to identify and address issues discovered during environmental qualification testing. For example, program officials stated that the program resolved an issue we previously reported on with the Transmit/Receive Integrated Microwave Modules that would have affected both AMDR and EASR radars. They added that they made additional engineering changes to the inverter modules, a critical part of the power supply system, to address issues discovered during shock testing. These engineering changes are being incorporated into the radars, with plans to retrofit 13 inverter module systems already delivered, according to the program.
>
> In June 2023, during acceptance trials for the DDG 125, Navy inspectors identified major integration deficiencies between the AN/SPY-6(V)1 radar and ACS. According to program officials, these deficiencies caused errors in tracking performance and processing during the test. As a result of these deficiencies, DDG 125 has yet to demonstrate that it is capable of completing the air warfare mission. Officials stated that they have taken steps to address the deficiencies; however, some software that needs to successfully interface with the ACS may not be certified until August 2024.
>
> The next opportunity to test the AN/SPY-6(V)1 at sea with the ACS and DDG 125 is combined developmental and operational testing, which the Navy began in December 2023. The Navy expects to continue operational testing through 2028. Discovery of additional deficiencies during testing could result in costly and time-intensive revisions, particularly if rework is required for installed radars. Program officials acknowledged this risk and noted it is somewhat mitigated by other opportunities to identify and correct defects during transits and other underway periods.
>
> **Software and Cybersecurity**
>
> Program officials continue to track a risk from cyber threats related to countermeasures seeking to defeat the radar and plan to address this risk as part of combined radar and combat system operational testing with DDG 125. Further, program officials plan to continually update software, beginning with a release in spring 2024, to add countermeasures as the system encounters new threats, such as jamming. The program also expects to conduct a cooperative vulnerability and penetration assessment and an adversarial assessment in 2025.
>
> **Other Program Issues**
>
> Program officials reported that the low-rate initial production contract was at its price ceiling due to global inflation increasing material and component pricing. The Navy reported converting the low-rate initial production contract from fixed-price-incentive to firm-fixed-price in August 2023. Program officials stated that, while this resulted in the government paying a higher price, they believe that the Navy negotiated better pricing on the hardware production and sustainment contract as a result.
>
> The Navy plans to begin backfitting a SPY-6 radar variant on mid-life DDG 51 destroyers starting in fiscal year 2026, according to program officials. These officials noted that a

limited supplier base for components could affect pricing, but that there is sufficient industrial base capacity to support additional radar quantities. They explained that recent sustainment contracts include the backfitting plan and represent a demand signal to the supplier base. The Navy plans to use funding for the surface combatant industrial base to accelerate purchases of equipment and larger quantities, as well as encourage competition for critical components to reduce the cost and schedule risk caused by the limited supplier base.

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 it remains on track to support combat systems for all variants including radars for DDG Flight III, DDG Flight IIA backfit, and other ship types. According to the program, DDG 125 was delivered and conducted a successful live-fire Anti-Air Warfare intercept upon sail-away in September 2023. It also noted that discovery and correction of defects continues as underway time permits opportunities to collect data. It added that resolution of defects identified in acceptance trials remains on-plan to be corrected in May 2024 and that all SPY-6 variants remain on schedule to support shipbuilding schedules, with variants SPY-6(V)2 and (V)3 installed in other ship classes and undergoing trials.

In May 2024, after our cutoff date for new information, the program office reported that planned initial capability was delayed until fiscal year 2027.[19]

January 2024 DOT&E Report

A January 2024 report from DOD's Director, Operational Test and Evaluation (DOT&E)—DOT&E's annual report for FY2023—stated the following regarding the SPY-6 (AMDR) radar:

TEST ADEQUACY

In December 2022, OPTEVFOR [the Navy's Operational Test and Evaluation Force] conducted an OA [operational assessment] of AN/SPY-6(V)1 at the Advanced Radar Detection Laboratory (ARDEL) on Pacific Missile Range Facility, in Kauai, Hawaii. The OA evaluated capability of AN/SPY-6(V1) to detect and track fighter aircraft, anti-ship cruise missile surrogates, unmanned aerial vehicles, helicopters, airborne early warning and control aircraft, and small-boat targets. Test events were executed in both clear and electromagnetic-contested environments and included projection from tower-based simulators. OPTEVFOR conducted the OA in accordance with a DOT&E-approved test plan with observation by DOT&E.

The OA provides early evaluation of the AN/SPY-6(V)1 radar performance and identifies modifications that can optimize performance at system employment. The OA additionally informs planning of IOT&E [Initial Operational Test and Evaluation] campaign test events. The OA was not intended to determine operational effectiveness and suitability of the delivered AMDR due to the AN/SPY-6(V)1 at ARDEL being an engineering development model (EDM) that uses obsolete T/R Integrated Microwave Modules from that of the delivered system and not enough test data are available on the delivered AMDR. The AMDR program did not evaluate cyber survivability due to differences that the delivered AMDR will have from the AMDR EDM version at ARDEL. DOT&E expects to deliver a classified AN/SPY-6(V)1 OA report in 2QFY24 upon completion of data analysis.

Assessment of the resident AN/SPY-6(V)1 at ARDEL is limited by the following:

[19] Government Accountability Office, *Weapon Systems Annual Assessment[:] DOD Is Not Yet Well-Positioned to Field Systems with Speed*, GAO-24-106831, June 2024, p. 151.

- The AN/SPY-6(V)1 is an EDM version that is in a degraded state and requires upgrade to provide representative performance. The AN/SPY-6(V)1 was adequate to support OA objectives but will not be adequate for IOT&E. The AMDR program plans to address within POM 25 [Program Objective Memorandum for FY2025[20]] adjustments to their program budget.
- The current aerial anti-ship cruise missile targets do not emulate more stressing threats, including advanced electronic attack capabilities. Aerial targets are needed to demonstrate performance and validate the modeling and simulation for IOT&E.
- The operational test strategy within the AN/SPY-6(V)1, DDG 51 Flight III, and AWS [Aegis Weapon System] Baseline 10 TEMP [Test and Evaluation Master Plan] that supports IOT&E for all three programs depends upon using the AN/SPY-6(V)1 at ARDEL to evaluate some specific capabilities which cannot be tested in an at-sea environment. However, the OA did not fully demonstrate the intended method of test, for this specific test objective, due to the system setup and software configuration issues.

PERFORMANCE

EFFECTIVENESS

The AMDR OA demonstrated radar performance in a limited set of scenarios. DOT&E expects to provide performance results and risks to IOT&E in a classified AMDR OA report in 2QFY24 [the second quarter of FY2024]. DOT&E expects to report operational effectiveness of AMDR in a classified IOT&E report in FY28 after IOT&E.

SUITABILITY AND SURVIVABILITY

Suitability and survivability were not assessed as part of the AMDR OA due to the expected differences between the AMDR EDM and the delivered AMDR. DOT&E expects to report operational suitability and survivability of AMDR in a classified IOT&E report in FY28 after IOT&E.

RECOMMENDATIONS

The Navy should:

1. Replace the AN/SPY-6(V)1 EDM version at ARDEL with a production representative system to support AMDR IOT&E.

2. Update aerial anti-ship cruise missile targets to better emulate more stressing threats, including advanced electronic attack, and support AMDR IOT&E.

3. Validate the method of test used during the AMDR OA at ARDEL for assessing specific AN/SPY-6(V)1 capabilities which cannot be tested in an at-sea environment during IOT&E.

4. Continue to develop and submit the combined AN/SPY-6(V)2, AN/SPY-6(V)3, and the Ship Self-Defense System Baseline 12 Combat System TEMP for DOT&E approval in FY24.[21]

[20] The Program Objective Memorandum for a given fiscal year is an internal DOD document that is to guide DOD's preparation of its proposed budget for that fiscal year.

[21] Director, Operational Test & Evaluation, *FY 2023 Annual Report*, January 2024, pp. 155-156.

Legislative Activity for FY2025

Summary of Congressional Action on FY2025 Funding Request

Table 1 summarizes congressional action on the Navy's FY2025 procurement funding requests for the DDG-51 and DDG-1000 programs.

Table 1. Congressional Action on FY2025 Funding Request

Millions of dollars, rounded to nearest tenth

		Authorization			Appropriation		
	Request	HASC	SASC	Enacted	HAC	SAC	Enacted
DDG-51 procurement	4,725.8	4,775.8			4,725.8		
Quantity	*(2)*	*(2)*			*(2)*		
DDG-51 advance procurement (EOQ AP)	41.7	41.7			41.7		
DDG-51 procurement for cost growth on five DDG-51s procured in FY2023-FY2024	1,683.4	1,683.4			1,683.4		
DDG-51 cost to complete for cost growth on five DDG-51 procured in FY2016-FY2018	233.5	233.5			233.5		
DDG-1000 procurement	61.1	61.1			61.1		

Sources: Table prepared by CRS based on Navy's FY2025 budget submission, committee and conference reports, and explanatory statements on FY2025 National Defense Authorization Act and FY2025 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.

FY2025 National Defense Authorization Act (H.R. 8070)

House

The House Armed Services Committee, in its report (H.Rept. 118-125 of June 30, 2023) on H.R. 2670, recommended the funding levels shown in the HASC column of **Table 1**. The recommended increase of $50.0 million in DDG-51 procurement funding is for "Large Surface Combatant Shipyard Infrastructure." (Page 4246)

H.Rept. 118-529 states

> *Large surface combatants*
>
> The committee remains concerned about the ability of the Navy's destroyers to meet future threats, especially as missile technology continues to advance. The committee understands that the Navy is in early phases of developing its requirements for a new large surface combatant, known as DDG(X), to replace the DDG 51 destroyers. At the same time, the Navy is in the process of building the latest iteration of its DDG 51 Arleigh Burke destroyer (Flight III) and testing the DDG 1000 Zumwalt class, its most recent new start large surface combatant program destroyer. The Navy has stated that its new large surface combatant is expected to be a blend of its current destroyer programs, in addition to incorporating some future concepts such as directed energy and improved ship signatures. The committee recognizes that the Navy is leading a world-class design effort for DDG(X) that aims to enhance its capability and capacity to oversee shipbuilding design efforts. The Navy

> expects to invest over $100 billion between 2019 and 2048 building its fleet of new large surface combatant ships. The committee directs the Comptroller General of the United
>
> States to review the following:
>
> (1) the status of the large surface combatant program, including, but not limited to, the Navy's plans for developing requirements, its acquisition strategy, test plans, and concept of operations and comparisons to GAO's leading acquisition practices as appropriate;
>
> (2) the status of DDG 51 Flight III development, construction, and testing; and
>
> (3) the status of the Zumwalt-class program including combat systems development, ship testing, and modifying the ship for its new mission.
>
> The committee directs the Comptroller General to provide a briefing to the House Committee on Armed Services not later than April 1, 2025, with one or more reports to follow. (Pages 24-25)

FY2025 DOD Appropriations Act (H.R. 8774)

House

The House Appropriations Committee, in its report (H.Rept. 118-121 of June 27, 2023) on H.R. 4365, recommended the funding levels shown in the HAC column of **Table 1**.

Appendix. Additional Background Information on DDG-1000 Program

This appendix presents additional background information on the DDG-1000 program.

Overview

The DDG-1000 program was initiated in the early 1990s.[22] DDG-1000s (**Figure A-1**) are multi-mission destroyers with an originally intended emphasis on naval surface fire support (NSFS) and operations in littoral (i.e., near-shore) waters. (NSFS is the use of naval guns to provide fire support for friendly forces operating ashore.)

Figure A-1. DDG-1000 Class Destroyer

Source: U.S. Navy photo 151207-N-ZZ999-435, posted December 8, 2015, with a caption that reads in part: "The future USS Zumwalt (DDG 1000) is underway for the first time conducting at-sea tests and trials in the Atlantic Ocean Dec. 7, 2015."

DDG-1000s were originally intended to replace, in a technologically more modern form, the large-caliber naval gun fire capability that the Navy lost when it retired its Iowa-class battleships in the early 1990s,[23] to improve the Navy's general capabilities for operating in defended littoral waters, and to introduce several new technologies that would be available for use on future Navy

[22] The program was originally designated DD-21, which meant destroyer for the 21st century. In November 2001, the program was restructured and renamed DD(X), meaning a destroyer whose design was in development. In April 2006, the program's name was changed again, to DDG-1000, meaning a guided missile destroyer with the hull number 1000.

[23] The Navy in the 1980s reactivated and modernized four Iowa (BB-61) class battleships that were originally built during World War II. The ships reentered service between 1982 and 1988 and were removed from service between 1990 and 1992.

ships. The DDG-1000 was also intended to serve as the basis for a planned cruiser called CG(X) that was subsequently canceled.[24]

DDG-1000s are to have reduced-size crews of 175 sailors (147 to operate the ship, plus a 28-person aviation detachment), compared to roughly 300 on the Navy's Aegis destroyers and cruisers, so as to reduce its operating and support (O&S) costs. The DDG-1000 design incorporates a significant number of new technologies, including an integrated electric-drive propulsion system[25] and automation technologies enabling its reduced-sized crew.

With an estimated full load displacement of 15,656 tons, the DDG-1000 design is substantially larger than the Navy's Aegis cruisers and destroyers, which have displacements of up to about 9,700 tons, and are larger than any Navy destroyer or cruiser since the nuclear-powered cruiser *Long Beach* (CGN-9), which was procured in FY1957.

The first two DDG-1000s were procured in FY2007 and split-funded (i.e., funded with two-year incremental funding) in FY2007-FY2008; the Navy's FY2024 budget submission estimates their combined procurement cost at $9,450.8 million. The third DDG-1000 was procured in FY2009 and split-funded in FY2009-FY2010; the Navy's FY2024 budget submission estimates its procurement cost at $4,342.4 million.

The first DDG-1000 was commissioned into service on September 7, 2016. Its delivery date was revised multiple times and reportedly was April 2020.[26] This created an unusual situation in which a ship was commissioned into service more than three years prior to its delivery date. The delivery dates for the second and third ships have also been revised multiple times.[27] In the Navy's FY2024 budget submission, the delivery dates for the two ships are listed as October 2023 and December 2026, respectively.

Program Origin

The program known today as the DDG-1000 program was announced on November 1, 2001, when the Navy stated that it was replacing a destroyer-development effort called the DD-21 program, which the Navy had initiated in the mid-1990s, with a new Future Surface Combatant Program aimed at developing and acquiring a family of three new classes of surface combatants:[28]

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[24] For more on the CG(X) program, see CRS Report RL34179, *Navy CG(X) Cruiser Program: Background for Congress*, by Ronald O'Rourke.

[25] For more on integrated electric-drive technology, see CRS Report RL30622, *Electric-Drive Propulsion for U.S. Navy Ships: Background and Issues for Congress*, by Ronald O'Rourke.

[26] See Aidan Quigley, "Final Delivery of Zumwalt-class Destroyer Monsoor Delayed," *Inside Defense*, January 21, 2021.

[27] The revised delivery dates for the three ships reflect Section 121 of the FY2017 National Defense Authorization Act (S. 2943/P.L. 114-328 of December 23, 2016), a provision that establishes standards for determining vessel delivery dates and which also required the Secretary of the Navy to certify that the delivery dates for certain ships, including the three DDG-1000s, had been adjusted in accordance with the provision. The Navy's original plan for the DDG-1000 program was to install certain elements of each DDG-1000's combat system after delivering the ship and commissioning it into service. Section 121 of P.L. 114-328 in effect requires the Navy to defer the delivery date of a DDG-1000 until those elements of the combat system are installed. By the time P.L. 114-328 was enacted, DDG-1000, per the Navy's original plan, had already been commissioned into service without those elements of its combat system.

[28] The DD-21 program was part of a Navy surface combatant acquisition effort begun in the mid-1990s and called the SC-21 (Surface Combatant for the 21st Century) program. The SC-21 program envisaged a new destroyer called DD-21 and a new cruiser called CG-21. When the Navy announced the Future Surface Combatant Program in 2001, development work on the DD-21 had been underway for several years, while the start of development work on the CG-
(continued...)

- **a destroyer called DD(X)** for the precision long-range strike and naval gunfire mission;
- **a cruiser called CG(X)** for the air defense and ballistic missile mission; and
- **a smaller combatant called the Littoral Combat Ship (LCS)** to counter submarines, small surface attack craft (also called "swarm boats"), and mines in heavily contested littoral (near-shore) areas.[29]

On April 7, 2006, the Navy announced that it had redesignated the DD(X) program as the DDG-1000 program. The Navy also confirmed in that announcement that the first ship in the class, DDG-1000, would be named *Zumwalt*, in honor of Admiral Elmo R. Zumwalt, the Chief of Naval operations from 1970 to 1974. The decision to name the first ship after Zumwalt was made by the Clinton Administration in July 2000, when the program was still called the DD-21 program.[30]

New Technologies

The DDG-1000 incorporates a significant number of new technologies, including a wave-piercing, tumblehome hull design for reduced detectability,[31] a superstructure on the first two ships (but not the third) that is made partly of large sections of composite (i.e., fiberglass-like) materials rather than steel or aluminum, an integrated electric-drive propulsion system,[32] a total-ship computing system for moving information about the ship, automation technologies enabling its reduced-sized crew, a dual-band radar (that was later changed to a single-band radar), a new kind of vertical launch system (VLS) for storing and firing missiles, and two copies of a new 155mm gun called the Advanced Gun System (AGS).

Shipbuilders and Combat System Prime Contractor

GD/BIW is the builder for all three DDG-1000s, with some portions of each ship being built by HII/Ingalls for delivery to GD/BIW. Raytheon is the prime contractor for the DDG-1000's combat system (its collection of sensors, computers, related software, displays, and weapon launchers).

Under a DDG-1000 acquisition strategy approved by the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD AT&L) on February 24, 2004, the first DDG-1000 was to have been built by HII/Ingalls, the second ship was to have been built by GD/BIW, and contracts for building the first six were to have been equally divided between HII/Ingalls[33] and GD/BIW.

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21 was still years in the future. The current DDG-1000 destroyer CG(X) cruiser programs can be viewed as the descendants, respectively, of the DD-21 and CG-21. The acronym SC-21 is still used in the Navy's research and development account to designate the line item (i.e., program element) that funds development work on both the DDG-1000 and CG(X).

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

[30] For more on Navy ship names, see CRS Report RS22478, *Navy Ship Names: Background for Congress*, by Ronald O'Rourke.

[31] A tumblehome hull slopes inward, toward the ship's centerline, as it rises up from the waterline, in contrast to a conventional flared hull, which slopes outward as it rises up from the waterline.

[32] For more on integrated electric-drive technology, see CRS Report RL30622, *Electric-Drive Propulsion for U.S. Navy Ships: Background and Issues for Congress*, by Ronald O'Rourke.

[33] At the time of the events described in this section, HII was owned by Northrop Grumman and was called Northrop Grumman Shipbuilding (NGSB).

In February 2005, Navy officials announced that they would seek approval from USD AT&L to instead hold a one-time, winner-take-all competition between HII/Ingalls and GD/BIW to build all DDG-1000s. On April 20, 2005, the USD AT&L issued a decision memorandum deferring this proposal, stating in part, "at this time, I consider it premature to change the shipbuilder portion of the acquisition strategy which I approved on February 24, 2004."

Several Members of Congress also expressed opposition to the Navy's proposal for a winner-take-all competition. Congress included a provision (§1019) in the Emergency Supplemental Appropriations Act for 2005 (H.R. 1268/P.L. 109-13 of May 11, 2005) prohibiting a winner-take-all competition. The provision effectively required the participation of at least one additional shipyard in the program but did not specify the share of the program that is to go to the additional shipyard.

On May 25, 2005, the Navy announced that, in light of Section 1019 of P.L. 109-13, it wanted to shift to a "dual-lead-ship" acquisition strategy, under which two DDG-1000s would be procured in FY2007, with one to be designed and built by HII/Ingalls and the other by GD/BIW.

Section 125 of the FY2006 defense authorization act (H.R. 1815/P.L. 109-163) again prohibited the Navy from using a winner-take-all acquisition strategy for procuring its next-generation destroyer. The provision again effectively requires the participation of at least one additional shipyard in the program but does not specify the share of the program that is to go to the additional shipyard.

On November 23, 2005, the USD AT&L granted Milestone B approval for the DDG-1000, permitting the program to enter the System Development and Demonstration (SDD) phase. As part of this decision, the USD AT&L approved the Navy's proposed dual-lead-ship acquisition strategy and a low rate initial production quantity of eight ships (one more than the Navy subsequently planned to procure).

On February 14, 2008, the Navy awarded contract modifications to GD/BIW and HII/Ingalls for the construction of the two lead ships. The awards were modifications to existing contracts that the Navy has with GD/BIW and HII/Ingalls for detailed design and construction of the two lead ships. Under the modified contracts, the line item for the construction of the dual lead ships is treated as a cost plus incentive fee (CPIF) item.

Until July 2007, it was expected that HII/Ingalls would be the final-assembly yard for the first DDG-1000 and that GD/BIW would be the final-assembly yard for the second. On September 25, 2007, the Navy announced that it had decided to build the first DDG-1000 at GD/BIW, and the second at HII/Ingalls.

On January 12, 2009, it was reported that the Navy, HII/Ingalls, and GD/BIW in the fall of 2008 began holding discussions on the idea of having GD/BIW build both the first and second DDG-1000s, in exchange for HII/Ingalls receiving a greater share of the new DDG-51s that would be procured under the Navy's July 2008 proposal to stop DDG-1000 procurement and restart DDG-51 procurement.[34]

On April 8, 2009, it was reported that the Navy had reached an agreement with HII/Ingalls and GD/BIW to shift the second DDG-1000 to GD/BIW, and to have GD/BIW build all three ships. HII/Iingalls will continue to make certain parts of the three ships, notably their composite deckhouses. The agreement to have all three DDG-1000s built at GD/BIW was a condition that Secretary of Defense Robert Gates set forth in an April 6, 2009, news conference on the FY2010

[34] Christopher P. Cavas, "Will Bath Build Second DDG 1000?" *Defense News*, January 12, 2009: 1, 6.

defense budget for his support for continuing with the construction of all three DDG-1000s (rather than proposing the cancellation of the second and third).

Reduction in Procurement to Three Ships

Navy plans for many years called for ending DDG-51 procurement in FY2005, to be followed by procurement of up to 32 DDG-1000s and some number of CG(X)s. In subsequent years, the planned total number of DDG-1000s was reduced to 16 to 24, then to 7, and finally to 3.

At the end of July 2008, in a major reversal of its destroyer procurement plans, the Navy announced that it wanted to end procurement of DDG-1000s and resume procurement of DDG-51s. In explaining this reversal, which came after two DDG-1000s had been procured, the Navy stated that it had reevaluated the future operating environment and determined that its destroyer procurement now needed to emphasize three missions: open-ocean antisubmarine warfare (ASW), countering anti-ship cruise missiles (ASCMs), and countering ballistic missiles. Although the DDG-1000 could perform the first two of these missions and could be modified to perform the third, the Navy concluded that the DDG-51 design could perform these three missions adequately and would be less expensive to procure than the DDG-1000 design.

The Navy's proposal to stop procuring DDG-1000s and resume procuring DDG-51s was presented in the Navy's proposed FY2010 budget, which was submitted to Congress in 2009. Congress, in acting on the Navy's FY2010 budget, approved the idea of ending DDG-1000 procurement and restarting DDG-51 procurement, and procured a third DDG-1000 as the final ship in the class.

In retrospect, the Navy's 2008 reversal in its destroyer procurement plans can be viewed as an early indication of the ending of the post-Cold War era (during which the Navy focused its planning on operating in littoral waters against the land- and sea-based forces of countries such as Iran and North Korea) and the shift in the international security environment to renewed great power competition (during which the Navy is now focusing its planning more on being able to operate in mid-ocean waters against capable naval forces from near-peer competitors such as China and Russia).[35]

Increase in Estimated Procurement Cost

As shown in **Table A-1** below, the estimated combined procurement cost for all three DDG-1000s, as reflected in the Navy's annual budget submissions, has grown by $4,816.1 million (i.e., about $4.8 billion), or 53.6%, since the FY2009 budget (i.e., the budget for the fiscal year in which the third DDG-1000 was procured). Within the increase from the FY2023 figure to the FY2024 figure, the Navy's FY2024 budget submission states $234 million is for modifying the third ship in the program (DDG-1002) during its construction to include large-diameter vertical launch tubes capable of storing and firing the Navy's new hypersonic Conventional Prompt Strike (CPS) missile.[36] (Costs to modify the first two DDG-1000 class ships—DDG-1000 and DDG-1001—for the CPS are budgeted in the Other Procurement, Navy [OPN] appropriation account.)

[35] For additional discussion, see CRS Report R43838, *Great Power Competition: Implications for Defense—Issues for Congress*, by Ronald O'Rourke, and CRS Report RL33153, *China Naval Modernization: Implications for U.S. Navy Capabilities—Background and Issues for Congress*, by Ronald O'Rourke.

[36] Department of Defense, Fiscal Year (FY) 2024 Budget Estimates, Navy Justification Book Volume 1 of 1, Shipbuilding and Conversion, Navy, March 2023, pp. 178-179.

Table A-1. Estimated Combined Procurement Cost of DDGs 1000, 1001, and 1002

In millions, rounded to nearest tenth, as shown in annual Navy budget submissions

Budget submission	Estimated combined procurement cost (millions of dollars)	Change from prior year's budget submission	Cumulative change from FY2009 budget submission
FY09	8,977.1	—	—
FY10	9,372.5	+395.4 (+4.4%)	+395.4 (+4.4%)
FY11	9,993.3	+620.8 (+6.6%)	+1,016.2 (+11.3%)
FY12	11,308.8	+1,315.5 (+13.2%)	+2,331.7 (+26.0%)
FY13	11,470.1	+161.3 (+1.4%)	+2,493.0 (+27.8%)
FY14	11,618.4	+148.3 (+1.3%)	+2,641.3 (+29.4%)
FY15	12,069.4	+451.0 (+3.9%)	+3,092.3 (+34.4%)
FY16	12,288.7	+219.3 (+1.8%)	+3,311.6 (+36.9%)
FY17	12,738.2	+449.5 (+3.7%)	+3,761.1 (+41.9%)
FY18	12,882.0	+143.8 (+1.1%)	+3,904.0 (+43.5%)
FY19	13,032.2	+150.2 (+1.2%)	+4,055.1 (+45.1%)
FY20	13,195.5	+163.3 (+1.3%)	+4,218.4 (+47.0%)
FY21	13,275.6	+80.1 (+ 0.6%)	+4,298.5 (+47.9%)
FY22	13,305.9	+30.3 (+0.2+%)	+4,328.8 (+48.2%)
FY23	13,378.7	+72.8 (+0.5%)	+4,401.6 (+49.0%)
FY24	13,793.2	+414.5 (+3.1%)	+4,816.1 (+53.6%)
FY25	13,830.9	+37.7 (+0.3%)	+4,853.8 (+54.1%)

Source: Table prepared by CRS based on data in annual Navy budget submissions.

Some of the cost growth in the earlier years in the table was caused by the truncation of the DDG-1000 program from seven ships to three, which caused some class-wide procurement-rated costs that had been allocated to the fourth through seventh ships in the program to be reallocated to the three remaining ships.

The Navy stated in 2014 that the cost growth shown through FY2015 in the table reflects, among other things, a series of incremental, year-by-year movements away from an earlier Navy cost estimate for the program, and toward a higher estimate developed by the Cost Assessment and Program Evaluation (CAPE) office within the Office of the Secretary of Defense (OSD). As one consequence of a Nunn-McCurdy cost breach experienced by the DDG-1000 program in 2010 (see discussion below), the Navy was directed to fund the DDG-1000 program to CAPE's higher cost estimate for the period FY2011-FY2015, and to the Navy's cost estimate for FY2016 and beyond. The Navy states that it implemented this directive in a year-by-year fashion with each budget submission from FY2010 through FY2015, moving incrementally closer each year through FY2015 to CAPE's higher estimate. The Navy stated in 2014 that even with the cost growth shown in the table, the DDG-1000 program as of the FY2015 budget submission was still

about 3% below the program's rebaselined starting point for calculating any new Nunn-McCurdy cost breach on the program.[37]

The Navy's FY2024 budget submission stated that $234 million of the increase shown for FY2024 is for modifying the third ship in the program (DDG-1002) during its construction to include large-diameter vertical launch tubes capable of storing and firing the Navy's new hypersonic Conventional Prompt Strike (CPS) missile. (Costs to modify the first two DDG-1000 class ships—DDG-1000 and DDG-1001—for the CPS are budgeted in the Other Procurement, Navy [OPN] appropriation account.)

Technical Risk and Test and Evaluation Issues

June 2024 GAO Report

A June 2024 GAO report—the 2024 edition of GAO's annual report surveying DOD major acquisition programs—stated the following in its assessment of the DDG-1000 program:

> **Technology Maturity, Design Stability, and Production Readiness**
>
> The DDG 1000 program has yet to mature a total of four critical technologies despite completing construction for all three ships in the class. According to the program, the Navy intends to demonstrate full maturity for three of these technologies—which involve the ships' signature, computing, and radar capabilities—during operational testing.
>
> However, the program experienced recent testing delays. For example, the program office noted that DDG 1001 did not complete its final contract trial in September 2023 as planned to support the ship's delivery to the Navy. The program also did not complete initial operational test and evaluation in January 2024 as planned. The program office reported that the dates for completing that testing and achieving initial operational capability are under review by the program. The program office added that it continues testing to support initial operational capability at some point in 2024—capability that is already delayed more than 7 years from the approved acquisition program baseline date.
>
> The program's fourth immature critical technology—an intelligence system—is part of surface strike capabilities that were added to the program's requirements. As we reported in last year's assessment, installation of this intelligence system and one other surface strike critical technology was delayed at the direction of the Chief of Naval Operations. The program office stated that installation of these two technologies continues to be deferred because the Navy prioritized integrating the CPS hypersonic weapons system on the ships. Two other mature critical technologies for surface strike were previously added to provide enhanced missile capabilities. For these technologies, the program is preparing DDG 1001 to conduct testing and demonstration events in fiscal year 2024.
>
> **Other Program Issues**
>
> Since our last assessment, DDG 1000 conducted a multinational fleet training exercise focused on fostering joint interoperability and improved combat readiness. The Navy also awarded a contract modification in August 2023, increasing the contract value by approximately $157 million to support a modernization period for DDG 1000. The primary purpose of the ship's modernization period—planned through mid-2025—is to install the CPS hypersonic weapon system. Adding CPS involves removing the advanced gun system from Zumwalt class ships and a major structural change to enable installation and integration of a large missile vertical launch system. According to the program office, DDG

[37] Source: Navy briefing for CRS and the Congressional Budget Office (CBO) on the DDG-1000 program, April 30, 2014.

1000 will be the first ship to deliver CPS capability, with a live demonstration scheduled for 2025.

DDG 1000 program officials noted that CPS installation in the Zumwalt class destroyers is a top priority for the Chief of Naval Operations. Since last year's assessment, the Navy developed an integrated acquisition strategy for the DDG 1000 program reflecting the prioritization of CPS installation. Specifically, the new strategy reorders the CPS installation schedule, with DDG 1000 receiving the system first, followed by installation beginning in early 2025 for DDG 1002 and in summer 2026 for DDG 1001.

Program officials stated that the decision to install the CPS weapon system on DDG 1001 last creates efficiencies for the Navy. They noted that the previous installation plan would have negatively affected sailors by creating a schedule where DDG 1001 embarked for a limited period at sea after ship delivery before returning to the shipyard for the installation. The revised schedule also delays final delivery of DDG 1002 by 26 months to the end of 2026. This delay allows the ship—already at the shipyard in Mississippi for its combat systems installation and activation—to remain at the yard to complete CPS installation. Finally, DDG 1000 program officials stated that the new CPS installation strategy allows the Navy to maintain operational availability of at least one Zumwalt class ship throughout the program's overall installation period.

Despite these efforts to achieve efficiencies, CPS continues to present risks to DDG 1000's installation schedule. Program officials stated that remaining technical risks and the need to demonstrate CPS capability through successful testing make upholding the DDG 1000 installation schedule the biggest challenge. They noted that they are managing the risk through regular communication with the CPS program.

In addition to installing CPS, the Navy plans to address several design deficiencies during the DDG 1000 modernization period. For example, Navy officials stated that the ship experienced significant biofouling during its first deployment. Biofouling—which occurs when sea life is ingested through the seawater cooling system and continues to thrive inside the ship—contributes to clogged filters, valves, and pipes. According to Navy officials, the program is also addressing an issue with the ship ingesting its own engine exhaust.

Program Office Comments

We provided a draft of this assessment for program office review and comment. The program office provided technical comments, which we incorporated where appropriate. According to the program, it has made significant progress in testing and modernization on DDG 1000 and DDG 1001 while completing combat system activation on DDG 1002. The program office also stated that since 2020, DDG 1000 and DDG 1001 supported significant testing and certain fleet exercises and operations. The program office added that the Navy accelerated modernization efforts to support fielding a long-range precision hypersonic capability on Zumwalt class destroyers and is on track to field the capability in 2025.[38]

January 2024 DOT&E Report

A January 2024 report from DOD's Director, Operational Test and Evaluation (DOT&E)—DOT&E's annual report for FY2023—stated the following regarding the DDG-1000 program:

TEST ADEQUACY

Zumwalt-class testing to date was conducted in accordance with the DOT&E-approved test plans and observed by DOT&E. The Navy began modeling and simulation (M&S) Probability of Raid Annihilation testbed runs in July FY23 and expects to complete in

[38] Government Accountability Office, *Weapon Systems Annual Assessment[:] DOD Is Not Yet Well-Positioned to Field Systems with Speed*, GAO-24-106831, June 2024, p. 134.

FY24. These runs will evaluate the Zumwalt class's probability of defeating inbound anti-ship cruise missiles (ASCMs) as part of Zumwalt class's antiair warfare mission. Additional live fire testing against ASCM surrogates is scheduled aboard DDG 1001 in December 2023, however there is currently no plan to rerun M&S with updated data from the live fire testing.

The Navy completed a cyber cooperative vulnerability and penetration assessment and an adversarial assessment between November 2022 and March 2023. Testing encompassed Internet Protocol (IP) networks aboard the ship along with industrial control systems associated with its hull, mechanical, and electrical systems. These tests were adequate to assess cyber survivability of the class, in accordance with the DOT&E-approved test plan, and observed by DOT&E.

As noted in the FY22 Annual Report, the Navy has not yet funded or planned an adequate ship survivability assessment against underwater threat weapons, to include a demonstration of residual mission capability after such engagements, through a full ship shock trial. The Navy is currently evaluating options for completion of the equipment shock qualification program and conduct of an alternative to shock trial that would sufficiently assess the risk to the warfighter from associated weapon events.

The Navy has not yet updated vulnerability and recoverability M&S meant to support the LFT&E [Live Fire Test and Evaluation] survivability assessment of the Zumwalt class to reflect the ship as built. In the FY22 Annual Report, DOT&E recommended that the Navy work to develop an updated M&S strategy that would include survivability model updates, but currently the Navy does not intend to update, validate, or accredit LFT&E survivability assessments prior to completing their LFT&E program in FY24, previously expected to be completed in FY23. DOT&E will not be able to provide an assessment of the Zumwalt class's vulnerability to threat weapons without the results from validated survivability M&S that models the ship design as built.

PERFORMANCE

EFFECTIVENESS

Not enough data are yet available to determine Zumwalt-class operational effectiveness. Simulation runs for AAW remain in progress and no update in the determination of AAW [anti-air warfare, i.e., air defense] performance can be made from the preliminary assessment provided in DOT&E's classified early fielding report of November 2022. Similarly, torpedo defense testing conducted with DDG 1000 in October 2021 provided data on the class's ability to evade torpedoes, but the postponement and proposed cancellation of other undersea warfare test events prevents further assessment of the class's effectiveness against undersea threats. Final assessment of Zumwalt-class offensive surface strike effectiveness will be reported in a classified report following the completion of the live missile events in FY27.

SUITABILITY

Not enough data are yet available to provide an assessment of Zumwalt-class operational suitability. DOT&E will report operational suitability after changes to hardware and software baselines associated with the install of CPS and the technological refresh of the class's Command, Control, Communication, Computer, Cyber and Intelligence (C5I) systems.

SURVIVABILITY

Due to vulnerability and recoverability M&S not yet being validated or reflecting the ship as built, data are insufficient to assess Zumwalt-class survivability against threat weapons. DOT&E will require that the survivability M&S be updated and validated as part of the upcoming TEMP [Test and Evaluation Master Plan] revision.

Failure and recoverability mode testing aboard DDG 1001 conducted in 2022 provided insight into the recoverability of the class after damage. However, testing was not sufficient to resolve associated LFT&E critical issues due to limitations on the systems under test. DOT&E will address the strategy for completing the LFT&E assessment of the Zumwalt class's mission system recoverability as part of the upcoming TEMP revision.

Results from cyber survivability testing aboard DDG 1000 conducted between November 2022 and March 2023 will be included in a classified report upon completion of IOT&E [Initial Operational Test and Evaluation] , currently expected in FY24.

RECOMMENDATIONS

The Navy should:

1. Complete remaining IOT&E events in accordance with the DOT&E-approved test plans.

2. Complete revision of the TEMP that includes completion of existing IOT&E requirements and an adequate test strategy for the as-delivered mission capabilities after installation of CPS.

3. Complete development and validation of the combat system M&S testbed, to include debris, missile, radar, and electronic warfare models.

4. As noted in the FY22 Annual Report, document the risk to the warfighter associated with incomplete component shock qualification and lack of full-ship shock trial prior to deployment.

5. Update the LFT&E strategy to include evaluation of the as-built survivability of the Zumwalt class and submit it for DOT&E approval with the TEMP update.

6. Plan and resource within the TEMP update a full ship shock trial of the first available Zumwalt-class ship with CPS [Conventional Prompt Strike missile] installation.

7. As recommended in the FY22 Annual Report, sufficiently fund modernization and sustainment of the DDG 1000 class to include improvements determined from Failure and Recoverability Mode testing, which will be documented in the final survivability assessment report.[39]

Procurement Cost Cap

Section 123 of the FY2006 defense authorization act (H.R. 1815/P.L. 109-163 of January 6, 2006) limited the procurement cost of the fifth DDG-1000 to $2.3 billion, plus adjustments for inflation and other factors. Given the truncation of the DDG-1000 program to three ships, this unit procurement cost cap appears moot.

2010 Nunn-McCurdy Breach, Program Restructuring, and Milestone Recertification

On February 1, 2010, the Navy notified Congress that the DDG-1000 program had experienced a critical cost breach under the Nunn-McCurdy provision. The Nunn-McCurdy provision (10 U.S.C. 2433a) requires certain actions to be taken if a major defense acquisition program exceeds (i.e., breaches) certain cost-growth thresholds and is not terminated. Among other things, a program that experiences a cost breach large enough to qualify under the provision as a critical cost breach has its previous acquisition system milestone certification revoked. (In the case of the

[39] Director, Operational Test & Evaluation, *FY 2023 Annual Report*, January 2024, pp. 184-185.

DDG-1000 program, this was Milestone B.) In addition, for the program to proceed rather than be terminated, DOD must certify certain things, including that the program is essential to national security and that there are no alternatives to the program that will provide acceptable capability to meet the joint military requirement at less cost.[40]

The Navy stated in its February 1, 2010, notification letter that the DDG-1000 program's critical cost breach was a mathematical consequence of the program's truncation to three ships.[41] Since the DDG-1000 program has roughly $9.3 billion in research and development costs, truncating the program to three ships increased to roughly $3.1 billion the average amount of research and development costs that are included in the average acquisition cost (i.e., average research and development cost plus procurement cost) of each DDG-1000. The resulting increase in program acquisition unit cost (PAUC)—one of two measures used under the Nunn-McCurdy provision for measuring cost growth[42]—was enough to cause a Nunn-McCurdy critical cost breach.

In a June 1, 2010, letter (with attachment) to Congress, Ashton Carter, the DOD acquisition executive (i.e., the Under Secretary of Defense for Acquisition, Technology and Logistics), stated that he had restructured the DDG-1000 program and that he was issuing the certifications required under the Nunn-McCurdy provision for the restructured DDG-1000 program to proceed.[43] The letter stated that the restructuring of the DDG-1000 program included the following:

- A change to the DDG-1000's design affecting its primary radar.
- A change in the program's Initial Operational Capability (IOC) from FY2015 to FY2016.
- A revision to the program's testing and evaluation requirements.

Regarding the change to the ship's design affecting its primary radar, the DDG-1000 originally was to have been equipped with a dual-band radar (DBR) consisting of the Raytheon-built X-band SPY-3 multifunction radar (MFR) and the Lockheed-built S-band SPY-4 Volume Search Radar (VSR). (Raytheon is the prime contractor for the overall DBR.) Both parts of the DBR have been in development for the past several years. An attachment to the June 1, 2010, letter stated that, as a result of the program's restructuring, the ship is now to be equipped with "an upgraded multifunction radar [MFR] and no volume search radar [VSR]." The change eliminates the Lockheed-built S-band SPY-4 VSR from the ship's design. The ship might retain a space and weight reservation that would permit the VSR to be backfitted to the ship at a later point. The Navy states that

> As part of the Nunn-McCurdy certification process, the Volume Search Radar (VSR) hardware was identified as an acceptable opportunity to reduce cost in the program and thus was removed from the current baseline design....

[40] For more on the Nunn-McCurdy provision, see CRS Report R41293, *The Nunn-McCurdy Act: Background, Analysis, and Issues for Congress*, by Moshe Schwartz and Charles V. O'Connor.

[41] Source: Letter to congressional offices dated February 1, 2010, from Robert O. Work, Acting Secretary of the Navy, to Representative Ike Skelton, provided to CRS by Navy Office of Legislative Affairs on February 24, 2010.

[42] PAUC is the sum of the program's research and development cost and procurement cost divided by the number of units in the program. The other measure used under the Nunn-McCurdy provision to measure cost growth is average program unit cost (APUC), which is the program's total procurement cost divided by the number of units in the program.

[43] Letter dated June 1, 2010, from Ashton Carter, Under Secretary of Defense (Acquisition, Technology and Logistics) to the Honorable Ike Skelton, with attachment. The letter and attachment were posted on InsideDefense.com (subscription required) on June 2, 2010.

> Modifications will be made to the SPY-3 Multi-Function Radar (MFR) with the focus of meeting ship Key Performance Parameters. The MFR modifications will involve software changes to perform a volume search functionality. Shipboard operators will be able to optimize the SPY-3 MFR for either horizon search or volume search. While optimized for volume search, the horizon search capability is limited. Without the VSR, DDG 1000 is still expected to perform local area air defense....
>
> The removal of the VSR will result in an estimated $300 million net total cost savings for the three-ship class. These savings will be used to offset the program cost increase as a result of the truncation of the program to three ships. The estimated cost of the MFR software modification to provide the volume search capability will be significantly less than the estimated procurement costs for the VSR.[44]

Regarding the figure of $300 million net total cost savings in the above passage, the Navy during 2011 determined that eliminating the SPY-4 VSR from the DDG-1000 increased by $54 million the cost to integrate the dual-band radar into the Navy's new Gerald R. Ford (CVN-78) class aircraft carriers.[45] Subtracting this $54 million cost from the above $300 million savings figure would bring the net total cost savings to about $246 million on a Navy-wide basis.

A July 26, 2010, press report quotes Captain James Syring, the DDG-1000 program manager, as stating the following: "We don't need the S-band radar to meet our requirements [for the DDG-1000]," and "You can meet [the DDG-1000's operational] requirements with [the] X-band [radar] with software modifications."[46]

An attachment to the June 1, 2010, letter stated that the PAUC for the DDG-1000 program had increased 86%, triggering the Nunn-McCurdy critical cost breach, and that the truncation of the program to three ships was responsible for 79 of the 86 percentage points of increase. (The attachment stated that the other seven percentage points of increase are from increases in development costs that are primarily due to increased research and development work content for the program.)

Carter also stated in his June 1, 2010, letter that he had directed that the DDG-1000 program be funded, for the period FY2011-FY2015, to the cost estimate for the program provided by the Cost Assessment and Program Evaluation (CAPE) office (which is a part of the Office of the Secretary of Defense [OSD]), and, for FY2016 and beyond, to the Navy's cost estimate for the program. The program was previously funded to the Navy's cost estimate for all years. Since CAPE's cost estimate for the program is higher than the Navy's cost estimate, funding the program to the CAPE estimate for the period FY2011-FY2015 will increase the cost of the program as it appears in the budget for those years. The letter states that DOD "intends to address the [resulting] FY2011 [funding] shortfall [for the DDG-1000 program] through reprogramming actions."

An attachment to the letter stated that the CAPE in May 2010 estimated the PAUC of the DDG-1000 program (i.e., the sum of the program's research and development costs and procurement costs, divided by the three ships in the program) as $7.4 billion per ship in then-year dollars ($22.1 billion in then-year dollars for all three ships), and the program's average procurement unit cost (APUC), which is the program's total procurement cost divided by the three ships in the program, as $4.3 billion per ship in then-year dollars ($12.8 billion in then-year dollars for all

[44] Source: Undated Navy information paper on DDG-51 program restructuring provided to CRS and CBO by Navy Office of Legislative Affairs on July 19, 2010.

[45] Source: Undated Navy information paper on CVN-78 cost issues, provided by Navy Office of Legislative Affairs to CRS on March 19, 2012.

[46] Cid Standifer, "Volume Radar Contracted For DDG-1000 Could Be Shifted To CVN-79," *Inside the Navy*, July 26, 2010. See also Joseph Trevithick and Tyler Rogoway, "Navy's Troubled Stealth Destroyers May Have Radars Replaced Before Ever Sailing On A Mission," *The Drive*, October 15, 2020.

three ships). The attachment stated that these estimates are at a confidence level of about 50%, meaning that the CAPE believes there is a roughly 50% chance that the program can be completed at or under these cost estimates, and a roughly 50% chance that the program will exceed these cost estimates.

An attachment to the letter directed the Navy to "return for a Defense Acquisition Board (DAB) review in the fall 2010 timeframe when the program is ready to seek approval of the new Milestone B and authorization for production of the DDG-1002 [i.e., the third ship in the program]."

On October 8, 2010, DOD reinstated the DDG-1000 program's Milestone B certification and authorized the Navy to continue production of the first and second DDG-1000s and commence production of the third DDG-1000.[47]

[47] Christopher J. Castelli, "Pentagon Approves Key Milestone For Multibillion-Dollar Destroyer," *Inside the Navy*, November 22, 2010.

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