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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 97 have been procured through FY2025, including three in FY2025.

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.)

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 75 have been delivered as of October 1, 2025. 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 $2.7 billion each when procured at a rate of two ships per year. The Navy's proposed FY2026 budget requests the procurement of two more DDG-51s in FY2026, and estimates their combined procurement cost at $5,410.8 million (i.e., about $5.4 billion).

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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 97 have been procured through FY2025, including three in FY2025. The Navy's proposed FY2026 budget requests the procurement of two more DDG-51s in FY2026.

Potential issues for Congress for the DDG-51 program in FY2025 include the shipbuilding industrial base's capacity for building DDG-51s, 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 FY2025

As of the end of FY2025, the Navy's LSC force included 84 ships, including 7 Ticonderoga (CG-47) class cruisers,[2] 75 DDG-51s, and two Zumwalt (DDG-1000) class destroyers.

[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 retired in 2004-2005, leaving 22 ships in operation (CGs 52 through 73). The Navy began retiring the remaining 22 ships in FY2022 and wants to retire all 22 by the end of FY2027.

### 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 97 have been procured through FY2025, including three in FY2025. 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 75 have been delivered as of October 1, 2025. The remaining 22 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 some 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 numerous 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]

### FY2026 Procurement Funding Request

DDG-51s currently cost about $2.7 billion each when procured at a rate of two ships per year. The Navy's proposed FY2026 budget requests the procurement of two more DDG-51s in FY2026, and estimates their combined procurement cost at $5,410.8 million (i.e., about $5.4 billion).

## 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.

[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).

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 one 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 the end of 2025.[11] 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.[12]

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

[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] Rich Abott, "Zumwalt To Finish Hypersonic Weapon Tube Install By End Of 2025, DDG-1002 to Start Mod in 2026," *Defense Daily*, January 16, 2025.

[12] 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-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.

U.S. Navy surface combatants. The Navy refers to this as the Zumwalt Enterprise Upgrade Solution (ZEUS).[13]

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. Although DDG-51s have been procured at annual rates of two or three ships per year since FY2016, deliveries of DDG-51s have averaged less than two ship per year,[14] resulting in an increasing backlog of ships that have been procured but not completed. A January 2025 Congressional Budget Office (CBO) report on the Navy's FY2025 30-year shipbuilding plan states that "according to CBO's analysis of the Navy's budget documents, delays in the DDG-51 class destroyers have grown by 18 months over the past two years. From a broader perspective, whereas the shipbuilding industry took 5 to 6 years to build

[13] 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.

[14] Source: Navy information paper on DDG shipbuilding delivery rates, October 1, 2025, provided by navy Office of Legislative Affairs to CRS and CBO on November 25, 2025.

destroyers and submarines in the 2000s, under current schedules, the shipyards now need 8 to 9 years, on average, to build those ships."[15]

## 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 2025 GAO Report

A June 2025 Government Accountability Office (GAO) report—the 2025 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, persistent shipyard performance issues contributed to additional schedule growth. The DDG 51 program office stated that both shipbuilders have made progress but continue to struggle to meet hiring, training, and retention targets needed to stabilize construction schedules. The schedule instability led to additional delivery delays since our last assessment for each of the first 13 follow-on ships. The delivery delays for these ships now range from 8 to 41 months compared with the contract dates provided by the program. These delays undermine Navy efforts to provide timely new capability to counter current and future air and surface threats.
>
> The program office said that it assessed shipyard capacity and workload prior to its 2023 construction contract awards and conducted studies to understand the shipyards' challenges. To address the challenges, the program office said that it is using funding received above the program's request to support shipbuilder infrastructure projects and the supplier base for the program. Further, the program office stated that it is using workforce development contract incentives to help DDG 51 shipbuilders improve their facilities, employee training, and retention and recruitment.
>
> Since our last assessment, the program also delayed the planned start of initial operational test and evaluation by at least 18 months. The program office stated that it added two developmental test periods—one completed in 2024—to reduce overall risk to the initial capability. The revised schedule maintains the program's plan to complete testing in 2027. However, the changes to the operational testing approach delay the Navy's achievement of initial operational capability by roughly 3 years as compared to previous plans. The program office deemed the initial operational capability date as not suitable for public release.
>
> **Program Office Comments**
>
> We provided a draft of this assessment for program office review. The DDG 51 program office provided technical comments, which we incorporated where appropriate. The program office stated that it has delivered 74 ships as one of the Navy's longest-running production lines, with 25 new ships under contract and in various stages of production or pre-construction. The program office added that the first Flight III ship, DDG 125, continues to make progress in achieving the Navy's objective to deliver a fully tested and certified integrated air and missile defense-capable ship in fiscal year 2027.[16]

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

[15] Congressional Budget Office, *An Analysis of the Navy's 2025 Shipbuilding Plan*, January 2025, p. 23.

[16] Government Accountability Office, *Weapon Systems Annual Assessment[:] DOD Leaders Should Ensure That Newer Programs Are Structured for Speed and Innovation*, GAO-25-107569, June 2025, p. 123.

**Current Status**

Due to shipbuilding delays, radar production continues to outpace ship production of DDG 51 Flight III and other ships. This production mismatch has required the Navy to store some delivered radars as the AMDR program waits for ships to become available for installation. To mitigate the costs of storage, AMDR officials stated, the program is establishing a government secure storage facility. Additionally, AMDR program officials told us that it remains cost effective and efficient to maintain continuous production of the AMDR family of radars to complete and deliver equipment at a predictable pace.

Program officials reported that the first radar variant is currently in development testing and that deficiencies found under certain testing conditions for the inverter modules have been addressed and modules in production are being delivered with the updates. However, program officials told us that they conducted a root cause analysis and software fixes and are addressing integration issues with the radar to support upcoming test events. The program received its first software to address this risk in spring 2024.

Last year the program reported the initial capability date as August 2024. However, program officials explained that the AMDR program adjusted this date to September 2027 to align with the DDG 51 Flight III initial operational testing plan and fleet needs. The Navy does not plan to certify radars until fiscal year 2026. We previously reported on the potential for discovery of additional deficiencies during ongoing testing that could result in costly, time-intensive revisions, particularly if rework is required for installed radars. Program officials acknowledged this risk, and the Navy continues to try to mitigate these issues.

**Program Office Comments**

We provided a draft of this assessment to the program office for review and comment. It stated that it is on track to support combat systems for all variants, and that the secure storage facility's first intake is scheduled for April 2025. It noted that new builds of radar and combat system software for continuing DDG 125 at-sea testing match those planned for operational testing. In April 2025, the office of DOD's Director, Operational Test and Evaluation provided comments stating that AMDR's operational testing date should be reflected as the fourth quarter of fiscal year 2029. The Navy's comments did not provide a revision to this date.[17]

## January 2025 DOT&E Report

A January 2025 report from DOD's Director, Operational Test and Evaluation (DOT&E)—DOT&E's annual report for FY2024—stated the following regarding the DDG-51 Flight III destroyer:

**TEST ADEQUACY**

In March 2024, USS Jack H. Lucas (DDG 125) participated in FTM-32, an integrated test to demonstrate the capability to detect, track, engage, and intercept a medium-range ballistic missile target utilizing a simulated Standard Missile-6 (SM-6). This event is detailed in the classified DOT&E FY24 Missile Defense System Annual Assessment, that will be published in 2QFY25. Significant intended data collection on DDG 51 Flight III's performance were not attained during test execution due to challenges with the ship's ACS [Aegis Combat System) and AN/SPY-6(V)1 during test execution. As a result, insufficient data are available to assess DDG 51 Flight III operational effectiveness from this flight test.

[17] Government Accountability Office, *Weapon Systems Annual Assessment[:] DOD Leaders Should Ensure That Newer Programs Are Structured for Speed and Innovation*, GAO-25-107569, June 2025, p. 118.

> Evaluation of DDG 51 Flight III capability to defeat incoming threat anti-ship cruise missiles is constrained by available aerial test targets, or threat surrogates, that do not fully emulate the most stressing threats. Aerial targets provide demonstration of warship capability in the represented scenario and provide validation data to accredit M&S and estimate capability beyond the limited live test scenarios.
>
> In October 2023, the Navy commenced blast fragility testing at Aberdeen Proving Ground in Aberdeen, Maryland. Testing was completed in accordance with the DOT&E-approved test plan and observed by DOT&E. The first series of tests evaluated the blast resistance of representative electrical equipment and provided data to set equipment fragility thresholds within survivability M&S [modeling and simulation]. The Navy expects the second series of test to evaluate the blast resistance of Navy Standard doors and hatches to complete in FY25 and enable the setting of their thresholds with survivability M&S.
>
> **PERFORMANCE**
>
> **EFFECTIVENESS, SUITABILITY, AND SURVIVABILITY**
>
> No data are available to determine DDG 51 Flight III operational effectiveness, suitability, and survivability. DOT&E will report on the operational effectiveness, suitability, and survivability of DDG 51 Flight III after IOT&E [Initial Operational Test and Evaluation] and LFT&E [Live Fire Test and Evaluation] are complete, currently expected by the Navy to be FY28.
>
> **RECOMMENDATIONS**
>
> The Navy should:
>
> 1. Fund development and procure aerial anti-ship cruise missile targets that emulate advanced and stressing threat ASCMs [anti-ship cruise missiles].
>
> 2. Determine and correct issues that limited evaluation of DDG 51 Flight III performance in FTM-32.[18]

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

> **TEST ADEQUACY**
>
> In March 2024, DOT&E published a classified AMDR / AN/SPY-6(V)1 OA report. OPTEVFOR conducted the OA of AN/SPY-6(V)1 in FY23 at the ARDEL on PMRF, in Kauai, Hawaii, as detailed in the FY23 Annual Report. The OA evaluated capability of AN/SPY-6(V)1 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. The OA provided early evaluation of the AN/SPY-6(V)1 radar performance in its AW and surface warfare missions in clear and electromagnetic contested environments and demonstrated the Navy's test method for assessing AN/SPY-6(V)1's classified electromagnetic protection waveforms. The OA additionally informed planning of IOT&E 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 that will not be used by the delivered system. The AMDR Program Office did not evaluate cyber survivability due to differences between the delivered AMDR and the EDM version of AMDR at ARDEL.
>
> In March 2024, the MDA, in collaboration with OPTEVFOR, conducted the Flight Test Aegis Weapon System (FTM-32) as an integrated test to demonstrate the capability to detect, track, engage, and intercept a medium-range ballistic missile target utilizing a simulated Standard Missile-6 (SM-6). USS Jack H. Lucas (DDG 125), equipped with AWS

[18] Director, Operational Test & Evaluation, *FY 2024 Annual Report*, January 2025, pp. 222-223.

Baseline 10 and AN/SPY-6(V)1 radar, participated in FTM-32 as part of IOT&E. Significant intended data collection on AN/SPY-6(V)1 performance was not attained due to system challenges during test execution. As a result, insufficient data are available to assess AMDR operational effectiveness from this flight test. This event is detailed in the classified DOT&E FY24 Missile Defense System Annual Assessment, to be published in February 2025.

As identified in the FY23 Annual Report and the AN/SPY-6(V)1 OA Report, assessment of the resident AN/SPY-6(V)1 at ARDEL was limited by the following:

• AMDR EDM was not operationally representative. The AMDR program plans to install a low-rate initial production (LRIP) AMDR unit in FY26.

• The current aerial anti-ship cruise missile targets do not emulate more stressing threats, including advanced electromagnetic attack capabilities.

• System setup and software configuration of the AMDR EDM could not evaluate performance of all capabilities that are prohibited from testing in an open-air environment due to security reasons. An anechoic chamber would provide the ability to test these capabilities.

**PERFORMANCE**

**EFFECTIVENESS**

The AN/SPY-6(V)1 OA demonstrated radar performance in a limited set of scenarios. DOT&E provided performance results and risks to IOT&E in the classified AN/SPY-6(V)1 OA report in March 2024.

AMDR performance cannot be fully evaluated from the flight test event, FTM-32, due to unavailable data resulting from system challenges during test execution. DOT&E will report on operational effectiveness of AMDR after OT&E completes, currently expected by the Navy to be FY28.

**SUITABILITY AND SURVIVABILITY**

No observations on suitability and survivability can be made due to differences in the AMDR EDM used in the OA to the AMDR being delivered to the fleet. The flight test event, FTM-32, identified concerns that could degrade AMDR reliability if not addressed. DOT&E will report on operational suitability and survivability of AMDR after IOT&E that the Navy expects to complete in FY28.

**RECOMMENDATIONS**

The Navy should:

1. As stated in the FY23 DOT&E Annual Report and the AN/SPY-6(V)1 OA Report, replace the radar system at ARDEL with a production-representative AN/SPY-6(V)1 in FY26 to enable use in integrated and operational test of capabilities.

2. Develop an AN/SPY-6 test environment, such as an anechoic chamber, to effectively assess critical AN/SPY-6 capabilities that are restricted from evaluation in open-air test environments.

3. Evaluate AN/SPY-6(V)1 during large fleet exercises that provide representative complex electromagnetic spectrum environments.

4. Fund development and procure aerial anti-ship cruise missile targets that emulate modern and stressing threats, including advanced electromagnetic attack, to support AMDR IOT&E.

> 5. 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 FY25.[19]

## 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.[20] 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.[21]

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.
>
> "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.[22]

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.

[19] Director, Operational Test & Evaluation, *FY 2024 Annual Report*, January 2025, pp. 191-192.

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

[21] 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.

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

# 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.[23] 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,[24] 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

[23] 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.

[24] 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.[25]

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[26] 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.[27] 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.[28] 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:[29]

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

[26] 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.

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

[28] 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.

[29] 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.[30]

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.[31]

## New Technologies

The DDG-1000 incorporates a significant number of new technologies, including a wave-piercing, tumblehome hull design for reduced detectability,[32] 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,[33] 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[34] 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).

[30] 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.

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

[32] 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.

[33] 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.

[34] 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.[35]

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

[35] 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).[36]

## 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 $4,879.8 million (i.e., about $4.9 billion), or 54.4%, since the FY2009 budget (i.e., the budget for the fiscal year in which the third DDG-1000 was procured).

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.

[36] 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.

**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%) |
| FY26 | 13,856.9 | +26.0 (+0.2%) | +4,879.8 (+54.4%) |

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

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

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

hypersonic Conventional Prompt Strike (CPS) missile.[38] (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 2025 GAO Report

A June 2024 GAO report—the 2025 edition of GAO's annual report surveying DOD major acquisition programs—stated the following in its assessment of the DDG-1000 program:

> **Current Status**
>
> Since last year's assessment, the DDG 1000 program made progress with its installation of the CPS hypersonic weapon system on the lead ship and accepted final delivery of DDG 1001. The Navy also continued DDG 1002 combat systems testing in the lead up to CPS installation, builder's trials, and acceptance trials, intended to support ship delivery in late 2026.
>
> After years of delays, program officials stated that they plan to complete initial operational test and evaluation in fiscal year 2025. Following live fire testing of the Tomahawk missile systems on the DDG 1001 in January 2025, the Navy deployed DDG 1001 before the ship enters a planned modernization period for CPS installation in mid-2026.
>
> According to DDG 1000 officials, CPS program challenges resulted in a roughly 24-month delay to the DDG 1000 live fire demonstration of the weapon system, which was previously scheduled for 2025. DDG 1000 program officials stated that these developmental challenges do not affect their current installation of the Large Missile Vertical Launch System for CPS on the lead ship. This is because the CPS program is responsible for ensuring that the hypersonic missile launches from the shipboard system. Still, key CPS technologies—including the missile canister and system to eject the missile—remain immature. Such immaturity poses design, cost, and schedule risks to achieving the DDG 1000 program's hypersonic strike capability as planned.
>
> DDG 1000 officials noted that risk remains for CPS software and integration. They said that the DDG 1000 program will use testing to assess integration risk involving software interfaces once the CPS program delivers a developmental version of the advanced payload module that will hold the hypersonic missile and cannister. Delivery of this module is scheduled for spring 2025.
>
> Program Office Comments
>
> We provided a draft of this assessment for program office review and comment. It provided technical comments, which we incorporated where appropriate. The program office stated that it has made significant progress in the testing and modernization of Zumwalt class ships and noted that CPS installation efforts are in various stages on DDG 1000 and DDG 1002. It also stated that the Zumwalt class is on track to field CPS' capability. In May 2025, after our cutoff date for new information, program officials told us that they have yet to achieve initial operational capability as planned, but they expect to do so in fiscal year 2025.[39]

[38] 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.

[39] Government Accountability Office, *Weapon Systems Annual Assessment[:] DOD Leaders Should Ensure That Newer Programs Are Structured for Speed and Innovation*, GAO-25-107569, June 2025, p. 122.

## January 2025 DOT&E Report

A January 2025 report from DOD's Director, Operational Test and Evaluation (DOT&E)—DOT&E's annual report for FY2024—stated the following regarding the DDG-1000 program:

> **TEST ADEQUACY**
>
> In FY23, 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, were in accordance with the DOT&E-approved test plan, and were observed by DOT&E.
>
> In FY24, OPTEVFOR [the Navy's Operational Test and Evaluation Force] continued operational test of the Zumwalt-class in accordance with DOT&E-approved test plans and DOT&E observation. The Navy conducted four live fire anti-air warfare tests in December 2023. Data collected from these tests were adequate to demonstrate the Zumwalt-class's ability to defeat ASCM [anti-ship cruise missile] raids in representative scenarios.
>
> In FY24, OPTEVFOR continued Probability of Raid Annihilation M&S [modeling and simulation] testbed runs with completion expected in FY25. These M&S runs are intended to predict the Zumwalt-class's probability of defeating inbound ASCMs and aircraft across an expanded set of scenarios from the previously identified live fire test events. The Navy expects to complete validation of the testbed in FY25 and expects to accredit it for this use. DOT&E continues to work with OPTEVFOR to ensure appropriate use of the M&S testbed for the determined uncertainties from the validation process.
>
> The Navy plans to evaluate the Zumwalt-class primary mission of offensive surface strike with a Tomahawk missile launch in FY25, including shipborne strike planning events. Evaluation of Zumwalt-class employment of CPS will occur during FOT&E [Follow-on Operational Test and Evaluation], in conjunction with CPS program testing, in FY27.
>
> Torpedo defense testing, conducted with DDG 1000 in October 2021, provided data on the class's ability to evade torpedoes. However, full evaluation of the class's effectiveness against undersea threats has not been completed.
>
> The Navy has yet to fund or schedule an FSST [Full Ship Shock Trials] for the Zumwalt-class. As previously identified in the FY22 and FY23 Annual Reports, this test is required to adequately assess ship survivability against underwater threat weapons and determine residual mission capability following such an occurrence.
>
> The Navy reports that budget and schedule shortfalls preclude updates to vulnerability and recoverability M&S to reflect the as-built Zumwalt-class or inclusion of CPS when installed. The Navy intends to complete a Final Survivability Assessment Report in FY25 that includes survivability findings related to earlier ship design. DOT&E will not be able to provide a complete assessment of the Zumwalt-class's vulnerability to threat weapons until M&S reflects the as-built ship and FSST is complete.
>
> **EFFECTIVENESS**
>
> Insufficient data are available to determine Zumwalt-class operational effectiveness or change the preliminary assessment provided in DOT&E's classified early fielding report from November 2022. DOT&E will publish an IOT&E [Initial Operational Test and Evaluation] report of the Zumwalt-class operational effectiveness after completion of operational test that the Navy expects to occur in FY25. DOT&E will publish an update to this report after test of the Zumwalt-class employment of CPS that the Navy expects to occur in FY27.
>
> **SUITABILITY**

Insufficient data are available to determine Zumwalt-class operational suitability or change the preliminary assessment provided in DOT&E's classified early fielding report from November 2022. DOT&E will publish an IOT&E report of the Zumwalt-class operational suitability after completion of operational test that the Navy expects to occur in FY25. DOT&E will publish an update to this report after test of the Zumwalt-class employment of CPS, as well as evaluation of the technological refresh of the class's Command, Control, Communication, Computer, Cyber and Intelligence systems, that the Navy expects to occur in FY27.

**SURVIVABILITY**

Assessment of Zumwalt-class cyber survivability is classified. DOT&E will publish a classified report of the Zumwalt-class cyber survivability after completion of IOT&E that the Navy expects to occur in FY25.

Due to vulnerability and recoverability M&S not yet being validated, and not reflecting the ship as-built, data remain insufficient to determine 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 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 [Live Fire Test and Evaluation] 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.

**RECOMMENDATIONS**

The Navy should:

1. Complete remaining IOT&E events as recommended in the FY23 Annual Report.

2. Submit for DOT&E approval a revision of the TEMP [Test and Evaluation Master Plan] for modifications to the operational requirements and employment of the Zumwalt-class to include installation of CPS.

3. Submit for DOT&E approval an update to the LFT&E Strategy that includes FSST and evaluation of the as-built Zumwalt-class following the installation of CPS.

4. Fund and schedule an FSST prior to the first deployment of a Zumwalt-class ship with CPS installed as recommended in the FY23 Annual Report.

5. As noted in the FY22 and FY23 Annual Reports, document the risk to the warfighter associated with incomplete component shock qualification and lack of an FSST, prior to deployment.

6. As recommended in the FY22 and FY23 Annual Reports, sufficiently fund modernization and sustainment of the DDG 1000 class to include improvements determined from failure and recoverability mode testing as documented in the Navy's report on the event.[40]

## 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

[40] Director, Operational Test & Evaluation, *FY 2024 Annual Report*, January 2025, pp. 218-220.

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 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.[41]

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.[42] 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[43]—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.[44] 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-

[41] 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.

[42] 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.

[43] 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.

[44] 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.

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....
>
> 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.[45]

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.[46] 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."[47]

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

[45] 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.

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

[47] 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.

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 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.[48]

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

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