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

**Ronald O'Rourke**
Specialist in Naval Affairs

May 12, 2011

**Congressional Research Service**
7-5700
www.crs.gov
RL32109

**CRS Report for Congress**
*Prepared for Members and Committees of Congress*

# Summary

Procurement of Arleigh Burke (DDG-51) class Aegis destroyers resumed in FY2010 after a four-year hiatus. Congress funded the procurement of one DDG-51 in FY2010, and two more in FY2011. The Navy's FY2012 budget submission calls for procuring one DDG-51 in FY2012, and seven more in FY2013-FY2016.

DDG-51s to be procured through FY2015 are to be of the current Flight IIA design. The Navy wants to begin procuring a new version of the DDG-51 design, called the Flight III design, starting in FY2016. The Flight III design is to feature, among other design changes, a new and more capable radar called the Air and Missile Defense Radar (AMDR). The Navy plans to begin preliminary design work on the Flight III DDG-51 in FY2012, and wants to use a multiyear procurement (MYP) contract for DDG-51s to be procured from FY2013 through FY2017.

The Navy's proposed FY2012 budget requests $1,980.7 million in procurement funding for the DDG-51 planned for procurement in FY2012. This funding, together with $48.0 million in advance procurement funding provided in FY2011, would complete the ship's total estimated procurement cost of $2,028.7 million. The Navy's proposed FY2012 budget also requests $100.7 million in advance procurement funding for two DDG-51s planned for procurement in FY2013, $453.7 million in procurement funding to help complete procurement costs for the three Zumwalt (DDG-1000) class destroyers that were procured in FY2007 and FY2009, and $166.6 million in research and development funding for the AMDR.

FY2012 issues for Congress include the following:

- whether actions—such as adding DDG-51s to the Navy's shipbuilding plan and/or extending the lives of existing Flight I/II DDG-51s beyond current Navy plans—should be taken to mitigate a significant shortfall in cruisers and destroyers that is projected to begin in the 2020s;
- the contract status of the second and third ships in the DDG-1000 program;
- whether to approve, reject, or modify the Navy's proposal to develop the Flight III DDG-51 design and start procuring it in FY2016;
- whether it would be appropriate for the Navy to use a multiyear procurement (MYP) contract in FY2013-FY2017 to procure one or more Flight III DDG-51s;
- the development status of the AMDR;
- whether Flight III DDG-51s should be procured to a lengthened configuration that includes an additional 32 vertical launch system (VLS) missile cells in the forward part of the ship; and
- whether to procure, in addition to DDG-51s, one or more adjunct radar ships to further strengthen Navy air and missile defense capabilities.

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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. Decisions that Congress makes concerning these programs could substantially affect Navy capabilities and funding requirements, and the U.S. shipbuilding industrial base.

# Background

## DDG-51 Program

### General

The DDG-51 program was initiated in the late 1970s.[1] The DDG-51 is a multi-mission destroyer with an emphasis on air defense (which the Navy refers as anti-air warfare, or AAW) and blue-water (mid-ocean) operations. DDG-51s, like the Navy's 22 Ticonderoga (CG-47) class cruisers,[2] 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. All DDG-51s (and also some CG-47s) are being modified to receive an additional capability for ballistic missile defense (BMD) operations.[3]

The first DDG-51 was procured in FY1985. A total of 65 have been procured through FY2011, including 62 in FY1985-FY2005, none during the four-year period FY2006-FY2009, the 63rd in FY2010, and the 64th and 65th in FY2011. The first DDG-51 entered service in 1991, and a total of 59 were in service as of the end of FY2010. Of the 65 DDG-51s procured through FY2011, General Dynamics Bath Iron Works (GD/BIW) of Bath, ME, is the builder of 35, and the Ingalls shipyard of Pascagoula, MS, which is currently owned by Northrop Grumman, is the builder of 30.

The DDG-51 design has been modified over time. The first 28 DDG-51s (i.e., DDGs 51 through 78) are called Flight I/II DDG-51s. Subsequent ships in the class (i.e., DDGs 79 and higher) are referred to as Flight IIA DDG-51s. The Flight IIA design, first procured in FY1994, implemented a significant design change that included, among other things, the addition of a helicopter hangar.

[1] 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.

[2] A total of 27 CG-47s were procured for the Navy between FY1978 and FY1988; the ships entered service between 1983 and 1994. The first five, which were built to an earlier technical standard, were judged by the Navy to be too expensive to modernize and were removed from service in 2004-2005.

[3] The modification for BMD operations includes, among other things, the addition of a new software program for the Aegis combat system and the arming of the ship with the SM-3, a version of the Navy's Standard Missile that is designed for BMD operations. For more on Navy BMD programs, CRS Report RL33745, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*, by Ronald O'Rourke.

The Flight IIA design has a full load displacement of about 9,500 tons, which is similar to that of the CG-47.

DDG-51s were originally built with 35-year expected service lives. The Navy's February 2010 report on its FY2011 30-year (FY2011-FY2040) shipbuilding plan stated that the Navy intends to extend the service lives of Flight IIA DDG-51s to 40 years.[4] The Navy is implementing a program for modernizing all DDG-51s (and CG-47s) so as maintain their mission and cost effectiveness out to the end of their projected service lives.[5]

Older CRS reports provide additional historical and background information on the DDG-51 program.[6]

**Figure 1. DDG-51 Flight IIA Destroyer**


**Source:** U.S. Navy file photo accessed by CRS on January 13, 2010, at http://www.navy.mil/management/photodb/photos/110110-N-7981E-938.jpg.

[4] U.S. Navy, *Report to Congress on Annual Long-Range Plan for Construction of Naval Vessels for FY 2011*, February 2010, p. 21.

[5] For more on this program, see CRS Report RS22595, *Navy Aegis Cruiser and Destroyer Modernization: Background and Issues for Congress*, by Ronald O'Rourke.

[6] 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 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 directly from the author).

## Resumption of Flight IIA DDG-51 Procurement in FY2010

The Navy in July 2008 announced that it wanted to end procurement of DDG-100 destroyers (see "DDG-1000 Program" below) and resume procurement of Flight IIA DDG-51s. The announcement represented a major change in Navy planning: prior to the announcement, the Navy for years had strongly supported ending DDG-51 procurement permanently in FY2005 and proceeding with procurement of DDG-1000 destroyers.[7] The Navy's FY2010 budget, submitted in May 2009, reflected the Navy's July 2008 change in plans: the budget proposed truncating DDG-1000 procurement to the three ships that had been procured in FY2007 and FY2009, and resuming procurement of Flight IIA DDG-51s. Congress, as part of its action on the FY2010 defense budget, supported the proposal.[8]

## Procurement of Flight III DDG-51 Planned For FY2016

The Navy's FY2011 budget, submitted in February 2010, proposed another major change in Navy plans—terminating a planned cruiser called the CG(X) in favor of procuring an improved version of the DDG-51 called the Flight III version.[9] The Flight III design is to feature, among other design changes, a new and more capable radar called the Air and Missile Defense Radar (AMDR). Rather than starting to procure CG(X)s around FY2017, as the Navy had previously envisaged, the Navy stated that it wanted to begin procuring Flight III DDG-51s in FY2016. Navy plans thus call for procuring the Flight IIA DDG-51s through FY2015, followed by procurement of Flight III DDG-51s starting in FY2016. Navy plans call for procuring 24 Flight III DDG-51s between FY2016 and FY2031.[10]

The Flight III DDG-51 is to carry a version of the AMDR that is smaller and less powerful than the one that was envisaged for the CG(X). The Flight III DDG-51's AMDR is to have a diameter of about 14 feet, while the AMDR envisaged for the CG(X) might have had a diameter of about 22 feet.[11] In addition to improving the DDG-51's AAW and BMD capability through the

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[7] The Navy announced this change in its plans at a July 31, 2008, hearing before the Seapower and Expeditionary Forces subcommittee of the House Armed Services Committee. In explaining their proposed change in plans, Navy officials cited a reassessment of threats that Navy forces are likely to face in coming years. As a result of this reassessment, Navy officials stated, the service decided that destroyer procurement over the next several years should emphasize three mission capabilities—area-defense AAW, BMD, and open-ocean ASW. Navy officials also stated that they want to maximize the number of destroyers that can be procured over the next several years within budget constraints. Navy officials stated that DDG-51s can provide the area-defense AAW, BMD, and open-ocean ASW capabilities that the Navy wants to emphasize, and that while the DDG-1000 design could also be configured to provide these capabilities, the Navy could procure more DDG-51s than reconfigured DDG-1000s over the next several years for the same total amount of funding. In addition, the Navy by 2008-2009 no longer appeared committed to the idea of reusing the DDG-1000 hull as the basis for the Navy's planned CG(X) cruiser. If the Navy had remained committed to that idea, it might have served as a reason for continuing DDG-1000 procurement.

[8] The FY2010 budget funded the procurement of one DDG-51, provided advance procurement funding for two DDG-51s the Navy wants to procure in FY2011, completed the procurement funding for the third DDG-1000 (which was authorized but only partially funded in FY2009), and provided no funding for procuring additional DDG-1000s.

[9] The Navy stated that its desire to terminate the CG(X) program was "driven by affordability considerations." (Department of the Navy, Office of Budget, *Highlights of the Department of the Navy FY 2011 Budget*, February 2010, p. 5-7.) For more on the CG(X) program and its termination in favor of procuring Flight III DDG-51s, see **Appendix C**.

[10] Source: Supplementary data on 30-year shipbuilding plan provided to CRS and the Congressional Budget Office (CBO) by the Navy on February 18, 2010.

[11] Sources for 14-foot and 22-foot figures: Zachary M. Peterson, "DDG-51 With Enhanced Radar in FY-16, Design Work To Begin Soon," *Inside the Navy*, February 8, 2010; Amy Butler, "STSS Prompts Shift in CG(X) Plans," (continued...)

installation of the AMDR, the Navy is also studying options for modifying the DDG-51 design in other ways for purposes of reducing crew size, achieving energy efficiency and improved power generation, improving effectiveness in warfare areas other than AAW and BMD, and reducing total ownership cost.[12] The Navy plans to begin preliminary design work on the Flight III DDG-51 in FY2012.

### Plan for Multiyear Procurement (MYP) in FY2013-FY2017

The Navy wants to use a multiyear procurement (MYP) contract for DDG-51s to be procured in FY2013-FY2017.

## DDG-1000 Program

The DDG-1000 program was initiated in the early 1990s.[13] The DDG-1000 is a multi-mission destroyer with an emphasis on naval surface fire support (NSFS) and operations in littoral (i.e., near-shore) waters. The DDG-1000 is 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,[14] 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 ships. The DDG-100 was also intended to serve as the basis for the Navy's now-canceled CG(X) cruiser.

The DDG-1000 is to have a reduced-size crew of 142 sailors (compared to roughly 300 on the Navy's Aegis destroyers and cruisers) so as to reduce its operating and support (O&S) costs. The ship incorporates a significant number of new technologies, including an integrated electric-drive propulsion system[15] and automation technologies enabling its reduced-sized crew.

With an estimated full load displacement of 15,482 tons, the DDG-1000 design is roughly 63% larger than the Navy's current 9,500-ton Aegis cruisers and destroyers, and larger than any Navy destroyer or cruiser since the nuclear-powered cruiser *Long Beach* (CGN-9), which was procured in FY1957.

(...continued)

*Aerospace Daily & Defense Report*, December 11, 2010: 1-2; "[Interview With] Vice Adm. Barry McCullough," *Defense News*, November 9, 2009: 38.

[12] Source: Memorandum dated February 2, 2010, from Director, Surface Warfare Division (N86) to Commander, Naval Sea Systems Command (SEA 05) on the subject "Technical Study In Support Of DDG 51 Class Resource Planning And Requirements Analysis," posted on InsideDefense.com (subscription required) February 19, 2009. See also Zachary M. Peterson, "Navy To Launch Technical Study And Cost Analysis For New DDG-51s," *Inside the Navy*, February 19, 2010.)

[13] 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.

[14] 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.

[15] 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.

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 FY2012 budget submission estimates their combined procurement cost at $7,856.3 million. The third DDG-1000 was procured in FY2009 and split-funded in FY2009-FY2010; the Navy's FY2012 budget submission estimates its procurement cost at $3,452.5 million. All three ships are to be built at GD/BIW, with some portions of each ship being built by the Ingalls shipyard 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).

Construction of the first DDG-1000 is well underway. Some early construction activities have taken place on the second DDG-1000. Although the Navy has issued limited bridging contracts to support early construction activities on the second DDG-1000, the Navy as of early May 2011 had not yet signed overall construction contracts for the second or third ships in the program.

For additional background information on the DDG-1000 program—including developments in 2010 relating to the program's Nunn-McCurdy critical cost breach and subsequent restructuring and milestone recertification—see **Appendix B**.

## Projected Shortfall in Cruisers and Destroyers

As discussed in another CRS report, the Navy's planned fleet of more than 300 ships includes, among other things, a requirement for a maintaining a force of 94 cruisers and destroyers.[16] (The requirement since early 2006 had been 88 ships; it was increased to 94 ships in an April 2011 Navy report to Congress on naval force structure and ballistic missile defense.[17])

The 30-year (FY2011-FY2040) shipbuilding plan submitted by the Navy in February 2010, in conjunction with the FY2011 budget, does not contain enough destroyers to maintain a force of 94 cruisers and destroyers consistently over the long run. As shown in **Table 1**, the Navy projects that implementing the 30-year shipbuilding plan would result in a cruiser-destroyer force that drops below 94 ships in FY2025, reaches a minimum of 67 ships (i.e., 27 ships, or about 29%, below the required figure of 94 ships) in FY2034, and remains 18 or more ships below the 94-ship figure through the end of the 30-year period. The projected cruiser-destroyer shortfall is the largest projected shortfall of any ship category in the Navy's 30-year shipbuilding plan.

[16] CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

[17] U.S. Navy, Office of the Chief of Naval Operations, Director of Strategy and Policy (N51), *Report to Congress On Naval Force Structure and Missile Defense,* April 2011, 12 pp.

**Table 1. Projected Cruiser-Destroyer Shortfall**

As shown in Navy's FY2011-FY2040 30-year Shipbuilding Plan

| Fiscal year | Projected number of cruisers and destroyers | Shortfall relative to 94-ship goal (number of ships, shown as a negative) | Shortfall relative to 94-ship goal (percent of 94-ship goal, rounded to nearest percent, shown as a negative) |
|---|---|---|---|
| 11 | 84 | -10 | -11% |
| 12 | 84 | -10 | -11% |
| 13 | 85 | -9 | -10% |
| 14 | 86 | -8 | -9% |
| 15 | 88 | -6 | -6% |
| 16 | 90 | -4 | -4% |
| 17 | 91 | -3 | -3% |
| 18 | 93 | -1 | -1% |
| 19 | 94 | | |
| 20 | 96 | | |
| 21 | 96 | | |
| 22 | 95 | | |
| 23 | 94 | | |
| 24 | 94 | | |
| 25 | 92 | -2 | -2% |
| 26 | 89 | -5 | -5% |
| 27 | 87 | -7 | -7% |
| 28 | 85 | -9 | -10% |
| 29 | 81 | -13 | -14% |
| 30 | 77 | -17 | -18% |
| 31 | 73 | -21 | -22% |
| 32 | 71 | -23 | -24% |
| 33 | 69 | -25 | -27% |
| 34 | 67 | -27 | -29% |
| 35 | 68 | -26 | -28% |
| 36 | 70 | -24 | -26% |
| 37 | 72 | -22 | -23% |
| 38 | 74 | -20 | -21% |
| 39 | 76 | -18 | -19% |
| 40 | 76 | -18 | -19% |

**Source:** Table prepared by CRS based on Navy's FY2011-FY2040 30-year shipbuilding plan.

# Surface Combatant Construction Industrial Base

## Shipyards

All cruisers, destroyers, and frigates procured since FY1985 have been built at General Dynamics' Bath Iron Works (GD/BIW) shipyard of Bath, ME, and the Ingalls shipyard in Pascagoula, MS, that forms part of Huntington Ingalls Industries (HII). (HII was previously owned by Northrop Grumman, during which time it was known as Northrop Grumman Shipbuilding.) Both yards 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 Ingalls' ship-construction work. (Ingalls also builds amphibious ships for the Navy.) Navy surface combatants are overhauled, repaired, and modernized at GD/BIW, Ingalls, other private-sector U.S. shipyards, and government-operated naval shipyards (NSYs).

## Combat System Manufacturers

Lockheed Martin and Raytheon are generally considered the two leading Navy surface combatant radar makers and combat system integrators. Northrop Grumman is a third potential maker of Navy surface combatant radars. 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-100 combat system, and Raytheon has a share of the DDG-51 combat system. Lockheed, Raytheon, and Northrop are competing to be the maker of the AMDR to be carried by the Flight III DDG-51.

## Supplier Firms

The surface combatant industrial base also includes hundreds of additional firms that supply materials and components. The financial health of Navy shipbuilding supplier firms has been a matter of concern in recent years, particularly since some of them are the sole sources for what they make for Navy surface combatants.

# FY2012 Funding Request

The Navy's proposed FY2012 budget requests $1,980.7 million in procurement funding for the DDG-51 planned for procurement in FY2012. This funding, together with $48.0 million in advance procurement funding provided in FY2011, would complete the ship's total estimated procurement cost of $2,028.7 million. The Navy's proposed FY2012 budget also requests $100.7 million in advance procurement funding for two DDG-51s planned for procurement in FY2013, $453.7 million in procurement funding to help complete DDG-1000 procurement costs, and $166.6 million in research and development funding for the AMDR. The funding request for the AMDR is contained in the Navy's research and development account in Project 3186 ("Air and Missile Defense Radar") of Program Element (PE) 0604501N ("Advanced Above Water Sensors").

# Issues for Congress

FY2012 issues for Congress include the following:

- whether actions—such as adding DDG-51s to the Navy's shipbuilding plan and/or extending the lives of existing Flight I/II DDG-51s beyond current Navy plans—should be taken to mitigate the significant shortfall in cruisers and destroyers that is projected to begin in the 2020s;
- the contract status of the second and third ships in the DDG-1000 program;
- whether to approve, reject, or modify the Navy's proposal to develop the Flight III DDG-51 design and start procuring it in FY2016;
- whether it would be appropriate for the Navy to use a multiyear procurement (MYP) contract in FY2013-FY2017 to procure one or more Flight III DDG-51s;
- the development status of the AMDR;
- whether Flight III DDG-51s should be built to a lengthened configuration that includes an additional 32 vertical launch system (VLS) missile cells in the forward part of the ship; and
- whether to procure, in addition to DDG-51s, one or more adjunct radar ships to further strengthen Navy air and missile defense capabilities.

Each of these issues is discussed below. These issues could influence congressional consideration of whether to approve, reject, or modify the Navy's FY2012 funding request for procurement of DDG-51s, for completing DDG-1000 procurement costs, and for research and development work on the AMDR.

## Mitigating Projected Cruiser-Destroyer Shortfall

One issue for Congress is whether actions should be taken to mitigate the significant projected shortfall in cruisers and destroyers shown in **Table 1**. Options for mitigating this projected shortfall include the following:

- adding DDG-51s to the Navy's shipbuilding plan and
- extending the lives of Flight I/II DDG-51s to about 45 years (i.e., about 10 years beyond their currently planned 35-year service lives).

### Adding DDG-51s to Shipbuilding Plan

Substantially mitigating the projected cruiser-destroyer shortfall primarily through the first of these two options could involve adding at least 15, and possibly more than 20, additional DDG-51s to the Navy's shipbuilding plan. (Ensuring that the cruiser-destroyer force does not drop below 90% of the 94-ship requirement would require adding 18 ships to the plan; ensuring that the cruiser-destroyer force does not drop below 95% of the requirement would require adding 23 ships to the plan.)

The Navy's FY2011 five-year shipbuilding plan included one DDG-51 in FY2014; the Navy's new FY2012 five-year shipbuilding plan includes two. The second DDG-51 now planned for FY2014 could be considered the first such additional DDG-51.

Given funding pressures that could be placed on the Navy's shipbuilding budget during the period FY2019-FY2033 by the Navy's program to procure 12 new SSBN(X) ballistic missile submarines,[18] one option would be to add at least some, if not most or all, of these additional DDG-51s to the shipbuilding plan in fiscal years that are prior to FY2019. This could make the question of whether to add DDG-51s to the shipbuilding plan a potentially near-term issue for policymakers.

### Extending Service Lives of Flight I/II DDG-51s

A second potential option for substantially mitigating the project cruiser-destroyer would be to extend the lives of most or all of the Navy's 28 Flight I/II DDG-51s to about 45 years (i.e., about 10 years beyond their currently planned 35-year service lives). If feasible, this option could be much less expensive on a per-hull basis than adding DDG-51s to the shipbuilding plan. The life-extended Flight I/II DDG-51s, however, might be less capable than new DDG-51s added to the shipbuilding plan, making the calculation of the relative cost effectiveness of these two options more complex.

Extending the service lives of Flight I/II DDG-51s could require increasing, perhaps soon, funding levels for the maintenance of these ships, to help ensure they will remain in good enough shape to eventually have their lives extended for another 10 years. This additional maintenance funding would be on top of funding that the Navy has already programmed to help ensure that these ships can remain in service to the end of their currently planned 35-year lives. The potential need to increase maintenance funding soon could make the question of whether to extend the lives of these ships a potentially near-term issue for policymakers.

The options of adding DDG-51s to the shipbuilding plan and extending the lives of Flight I/II DDG-51s are not mutually exclusive; a combination of both options could be employed to mitigate the projected cruiser-destroyer shortfall.

## Contract Status of Second and Third DDG-1000s

Another potential issue for Congress concerns the contract status of the second and third ships in the DDG-1000 program. As mentioned earlier (see "DDG-1000 Program" in "Background"), although the Navy has issued limited bridging contracts to support early construction activities on the second DDG-1000, the Navy as of mid-March 2011 had not yet signed overall construction contracts for the second or third ships in the DDG-1000 program.

The signing of contracts for these two ships was delayed during 2010 by the need for the DDG-1000 program to go back through the DOD acquisition milestone certification process following the determination that the program had experienced a critical cost breach under the Nunn-

[18] For more on this program, see CRS Report R41129, *Navy SSBN(X) Ballistic Missile Submarine Program: Background and Issues for Congress*, by Ronald O'Rourke.

McCurdy provision.[19] That milestone certification process was completed late last year. A March 2011 Government Accountability Office (GAO) report states that "construction has begun on the first and second ships, and the Navy anticipates awarding a construction contract for the third ship in the second quarter of fiscal year 2011."[20]

## Navy Proposal to Develop and Procure Flight III DDG-51s

Another potential issue for Congress concerns the Navy's proposal to develop and procure the Flight III DDG-51. Although the first Flight III ship would not be procured under Navy plans until FY2016, the Navy plans to begin preliminary design work on the Flight III DDG-51 in FY2012. An alternative to the Flight III DDG-51 that Congress may wish to consider would be a new-design destroyer that would be more capable in certain respects than the Flight III DDG-51, but more affordable than the CG(X). If development of a new-design destroyer were begun in FY2012, the first ship might be ready for procurement as early as FY2018.

In considering whether to approve, reject, or modify the Navy's proposal to develop and procure Flight III DDG-51s, potential questions for Congress to consider include the following:

- Is there an adequate analytical basis for procuring Flight III DDG-51s in lieu of CG(X)s? Should an analysis of alternatives (AOA) or the equivalent of an AOA be performed before committing to the development and procurement of Flight III DDG-51s?
- Would a Flight III DDG-51 have sufficient AAW and BMD capability to perform projected AAW and BMD missions?
- Would a Flight III DDG-51 have sufficient growth margin for a projected 35- or 40-year service life?
- Would a Flight III DDG-51 have sufficiently low life-cycle ownership costs?
- How would a new-design destroyer compare to a Flight III DDG-51 in terms of capabilities, costs, and risks?
- What would be the potential industrial-base consequences of developing and procuring a new-design destroyer instead of the Flight III DDG-51?

Each of these questions is discussed below.

### Analytical Basis

*Is there an adequate analytical basis for procuring Flight III DDG-51s in lieu of CG(X)s? Should an analysis of alternatives (AOA) or the equivalent of an AOA be performed before committing to the development and procurement of Flight III DDG-51s?*[21]

[19] For more on this, see **Appendix B** to this CRS report, and also and CRS Report R41293, *The Nunn-McCurdy Act: Background, Analysis, and Issues for Congress* , by Moshe Schwartz.

[20] Government Accountability Office, Defense Acquisitions[:] Assessments of Selected Weapon Programs, GAO-11-233SP, March 2011, p. 57.

[21] The issue of whether there is an adequate analytical basis for canceling the CG(X) and instead procuring Flight III DDG-51s is somewhat similar to an issue raised by CRS several years ago as to whether there was an adequate (continued...)

Those who believe there is an adequate analytical basis for canceling the CG(X) and instead procuring Flight III DDG-51s could argue the following:

- Shifting to procurement of Flight III DDG-51s in FY2016, like shifting to procurement of Flight IIA DDG-51s in FY1994, would simply extend the DDG-51 production effort, and therefore would not amount to the initiation of a new shipbuilding program that would require an AOA or the equivalent of an AOA.
- The Navy's proposal to cancel the CG(X) and instead procure Flight III DDG-51s reflects substantial analytical work in the form of the CG(X) AOA, additional Navy studies that were done to support the 2008-2009 proposal to end DDG-1000 procurement and restart DDG-51 procurement, and the 2009 Navy destroyer hull/radar study that examined options for improving the AAW and BMD capabilities of the DDG-51 and DDG-1000 destroyer designs through the installation of an improved radar and combat system modifications.

Those who question whether there is an adequate analytical basis for canceling the CG(X) and instead procuring Flight III DDG-51s could argue the following:

- Procuring Flight III DDG-51s starting in FY2016 represents a significant change from the previous plan to procure CG(X)s starting around FY2017. Given the scope of the design modifications incorporated into the Flight III DDG-51 and the number of years that the design would be procured, the Navy's plan amounts to the equivalent of a new shipbuilding program whose initiation would require an AOA or the equivalent of an AOA.
- The CG(X) AOA focused mainly on examining radar and hull-design options for a cruiser with a large and powerful version of the AMDR, rather than radar- and hull-design options for a smaller destroyer with a smaller and less powerful version of the AMDR. The Navy's 2009 destroyer hull/radar study was focused on answering a somewhat narrowly defined question: what would be the lowest-cost option for improving the AAW and BMD performance of a DDG-51 or DDG-1000 by a certain amount through the installation of an improved radar and an associated modified combat system? An adequate analytical basis for a

(...continued)

analytical basis for the Navy's decision that a ship like the LCS—a small, fast ship with modular payload packages—would be the best or most cost-effective way to fill gaps the Navy had identified in its capabilities for countering submarines, small surface attack craft, and mines in heavily contested littoral areas. (See, for example, the September 5, 2002, update of CRS Report RS21305, *Navy Littoral Combat Ship (LCS): Background and Issues for Congress*, by Ronald O'Rourke, or the October 28, 2004, and the October 28, 2004, update of CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke.)

The Navy eventually acknowledged that, on the question of what would be the best approach to fill these capability gaps, "the more rigorous analysis occurred after the decision to move to LCS." (Spoken testimony of Vice Admiral John Nathman, Deputy Chief of Naval Operations (Warfare Requirements and Programs), at an April 3, 2003, hearing on Navy programs before the Projection Forces subcommittee of the House Armed Services Committee. At this hearing, the chairman of the subcommittee, Representative Roscoe Bartlett, asked the Navy witnesses about the Navy's analytical basis for the LCS program. The witnesses defended the analytical basis of the LCS program but acknowledged that "The more rigorous analysis occurred after the decision to move to LCS." (See U.S. Congress, House Committee on Armed Services, Subcommittee on Projection Forces, *Hearing on National Defense Authorization Act for Fiscal Year 2004—H.R. 1588, and Oversight of Previously Authorized Programs*. 108th Cong., 1st sess., Mar. 27, and Apr. 3, 2003, (Washington: GPO, 2003), p. 126. For an article discussing the exchange, see Jason Ma, "Admiral: Most LCS Requirement Analysis Done After Decision To Build," *Inside the Navy*, Apr. 14, 2003.)

proposed program change of this magnitude would require an AOA or equivalent study that rigorously examined a broader question: given projected Navy roles and missions, and projected Navy and DOD capabilities to be provided by other programs, what characteristics of all kinds (not just AAW and BMD capability) are needed in surface combatants in coming years, and what is the most cost-effective acquisition strategy to provide such ships?

## AAW and BMD Capability

*Would a Flight III DDG-51 have sufficient AAW and BMD capability to perform projected AAW and BMD missions?*

The Flight III DDG-51 would have more AAW and BMD capability than the current DDG-51 design, but less AAW and BMD capability than was envisioned for the CG(X), in large part because the Flight III DDG-51 would be equipped with a roughly 14-foot-diameter version of the AMDR that would have more sensitivity than the SPY-1 radar on Flight IIA DDG-51s, but less sensitivity than the roughly 22-foot-diameter version of the AMDR that was envisioned for the CG(X). The CG(X) also may have had more missile-launch tubes than the Flight III DDG-51.

Supporters of the Navy's proposal to procure Flight III DDG-51s could argue that a roughly 14-foot-diameter version of the AMDR would provide the DDG-51 with sufficient AAW and BMD capability to perform projected AAW and BMD missions because this radar would be substantially more capable than the SPY-1 radar currently on DDG-51s, and because Flight III DDG-51s (and other Navy ships) would also benefit from data collected by other sensors, including space-based sensors.

Skeptics could argue that Flight III DDG-51s might not have sufficient AAW and BMD capability because a roughly 14-foot-diameter AMDR would be substantially less capable than the roughly 22-foot-diameter AMDR that the Navy previously believed would be needed to adequately perform projected AAW and BMD missions, because the off-board sensors on which the Flight III DDG-51 would rely for part of its sensor data that might turn out to be less capable as the Navy assumed in 2008 that they would be, and because the off-board sensors and their related data-communication links could in any event be vulnerable to enemy attack.

## Growth Margin

*Would a Flight III DDG-51 have sufficient growth margin for a projected 35- or 40-year service life?*

A ship's growth margin refers to its capacity for being fitted over time with either additional equipment or newer equipment that is larger, heavier, or more power-intensive than the older equipment it is replacing, so as to preserve the ship's mission effectiveness. Elements of a ship's growth margin include interior space, weight-carrying capacity, electrical power, cooling capacity (to cool equipment), and ability to accept increases in the ship's vertical center of gravity. Navy ship classes are typically designed so that the first ships in the class will be built with a certain amount of growth margin. Over time, some or all of the growth margin in a ship class may be used up by backfitting additional or newer systems onto existing ships in the class, or by building later ships in the class to a modified design that includes additional or newer systems.

Modifying the DDG-51 design over time has used up some of the design's growth margin. The Flight III DDG-51 would have less of a growth margin than what the Navy would aim to include in a new destroyer design of about the same size.

Supporters of the Navy's proposal to procure Flight III DDG-51s could argue that the ship's growth margin would be adequate because the increase in capability achieved with the Flight III configuration reduces the likelihood that the ship will need much subsequent modification to retain its mission effectiveness over its projected service life. They could also that, given technology advances, new systems added to the ship years from now might require no more (and possibly less) space, weight, electrical power, or cooling capacity than the older systems they replace.

Skeptics could argue that there are uncertainties involved in projecting what types of capabilities ships might need to have to remain mission effective over a 35- or 40-year life, and that building expensive new warships with relatively modest growth margins consequently would be imprudent. The Flight III DDG-51's growth margin, they could argue, could make it more likely that the ships would need to be removed from service well before the end of their projected service lives due to an inability to accept modifications needed to preserve their mission effectiveness. Skeptics could argue that it might not be possible to fit the Flight III DDG-51 in the future with an electromagnetic rail gun (EMRG) or a high-power (200 kW to 300 kW) solid state laser (SSL), because the ship would lack the electrical power or cooling capacity required for such a weapon. Skeptics could argue that EMRGs and/or high-power SSLs could be critical to the Navy's ability years from now to affordably counter large numbers of enemy anti-ship cruise missiles (ASCMs) and anti-ship ballistic missiles (ASBMs) that might be fielded by a wealthy and determined adversary. Skeptics could argue that procuring Flight III DDG-51s could delay the point at which EMRGs or high-power SSLs could be introduced into the cruiser-destroyer force, and reduce for many years the portion of the cruiser-destroyer force that could ultimately be backfitted with these weapons. This, skeptics could argue, might result in an approach to AAW and BMD on cruisers and destroyers that might ultimately be unaffordable for the Navy to sustain in a competition against a wealthy and determined adversary.[22]

## Life-Cycle Ownership Costs

*Would a Flight III DDG-51 have sufficiently low life-cycle ownership costs?*

Supporters of the Navy's proposal to procure Flight III DDG-51s could argue that the annual operating & support (O&S) cost of the Flight IIA DDG-51 design is not onerous, and that the annual O&S cost of a Flight III DDG-51 would not be markedly different. They could also argue that the Navy is studying options for modifying the DDG-51 design to reduce crew size and otherwise reduce total ownership cost.[23] Skeptics could argue that the crew size and other elements of the Flight III DDG-51's life-cycle ownership cost could be reduced only so much,

[22] For more on potential shipboard lasers, see CRS Report R41526, *Navy Shipboard Lasers for Surface, Air, and Missile Defense: Background and Issues for Congress*, by Ronald O'Rourke.

[23] Source: Memorandum dated February 2, 2010, from Director, Surface Warfare Division (N86) to Commander, Naval Sea Systems Command (SEA 05) on the subject "Technical Study In Support Of DDG 51 Class Resource Planning And Requirements Analysis," posted on InsideDefense.com (subscription required) February 19, 2009. See also Zachary M. Peterson, "Navy To Launch Technical Study And Cost Analysis For New DDG-51s," *Inside the Navy*, February 19, 2010.)

given certain unchangeable features of the basic DDG-51 design, and that building significant numbers of Flight III DDG-51s—rather than ships designed from scratch to achieve significant reductions in crew size and other life-cycle ownership costs—would produce a surface combatant fleet with relatively high life-cycle ownership costs.

## Alternative of New-Design Destroyer

*How would a new-design destroyer compare to a Flight III DDG-51 in terms of capabilities, costs, and risks?*

As an alternative to the Flight III DDG-51, a new-design destroyer could be designed with the following characteristics:

- a version of the AMDR that is larger than the roughly 14-foot-diameter version envisioned for the Flight III DDG-51, but smaller than the roughly 22-foot-diameter version that was envisioned for the CG(X);
- enough electrical power and cooling capacity to permit the ship to be backfitted in the future with an EMRG or high-power SSL;
- more growth margin than on the Flight III DDG-51;
- producibility features for reducing construction cost per ton that are more extensive than those on the DDG-51 design;
- automation features permitting a crew that is smaller than what can be achieved on a Flight III DDG-51, so as to reduce crew-related life-cycle ownership costs;
- physical open-architecture features that are more extensive than those on the Flight III DDG-51, so as to reduce modernization-related life-cycle ownership costs;
- no technologies not already on, or being developed for, other Navy ships, with the possible exception of technologies that would enable an integrated electric drive system that is more compact than the one used on the DDG-1000; and
- DDG-51-like characteristics in other areas, such as survivability, maximum speed, cruising range, and weapons payload.

Such a ship might have a full load displacement of roughly 11,000 to 12,000 tons, compared to about 10,000 tons for the Flight III DDG-51, about 15,000 tons for an AAW/BMD version of the DDG-1000, and perhaps 15,000 to 23,000 tons for a CG(X).

The cost and technical risk of developing the new destroyer's hull design could be minimized by leveraging, where possible, existing surface combatant hull designs. The cost and technical risk of developing its combat system could be minimized by using a modified version of the DDG-51 or DDG-1000 combat system. Other development costs and risks for the new destroyer would be minimized by using no technologies not already on, or being developed for, other Navy ships (with the possible exception of some integrated electric drive technologies). Even with such steps, however, the cost and technical risk of developing the new destroyer would be greater than those of the Flight III DDG-51. The development cost of the new destroyer would likely be equivalent to the procurement cost of at least one destroyer, and possibly two destroyers.

The procurement cost of the new destroyer would be minimized by incorporating producibility features for reducing construction cost per ton that are more extensive than those on the Flight III DDG-51. Even with such features, the new destroyer would be more expensive to procure than the Flight III DDG-51, in part because the Flight III DDG-51 would leverage many years of prior production of DDG-51s. In addition, the new destroyer, as a new ship design, would pose more risk of procurement cost growth than would the Flight III DDG-51. The procurement cost of the new destroyer would nevertheless be much less than that of the CG(X), and might, after the production of the first few units, be fairly close to that of the Flight III DDG-51.

Although the new destroyer would use a reduced-size crew and physical open architecture features to reduce life-cycle ownership costs, it is unclear how the life-cycle ownership costs of the new destroyer would compare with those of the Flight III DDG-51.

**Table 2** summarizes potential relative merits of the Flight III DDG-51 and the potential new destroyer considered here. The Flight III DDG-51 offers near-term benefits of lower development cost and risk and lower procurement cost and risk, while the new destroyer would offer longer-term benefits of greater AAW and BMD capability and greater growth margin.

**Table 2. Flight III DDG-51 Compared to Potential New-Design Destroyer**

(X indicates the design that would likely have greater capability or growth margin, or lower cost or risk)

| | Flight III DDG-51 | New-design destroyer |
|---|---|---|
| Capability of AMDR for AAW/BMD operations | | X |
| Electrical power and cooling capacity to support future electromagnetic rail gun (EMRG) or high-power (200 kW to 300 kW) solid state laser (SSL) | | X |
| Growth margin | | X |
| Development cost | X | |
| Development risk | X | |
| Procurement cost | X | |
| Procurement cost growth risk | X | |
| Life-cycle ownership cost | unclear which design would have lower cost | |

**Source:** Prepared by CRS.

## Industrial Base

*What would be the potential industrial-base consequences of developing and procuring a new-design destroyer instead of the Flight III DDG-51?*

Developing and procuring a new-design destroyer would provide an opportunity for the Navy to conduct a competition between Lockheed and Raytheon (and perhaps other firms) to be the lead contractor on the ship's combat system. Procuring Flight III DDG-51s would mean that Lockheed would likely continue its current status as the lead contractor of Navy cruiser and destroyer combat systems. Developing and procuring either ship would provide the Navy with an opportunity to conduct a competition between Lockheed, Raytheon, and Northrop to build the AMDR. The supplier firms for a new-design destroyer could be different in some cases from the supplier firms for a Flight III DDG-51.

## Using an MYP in FY2013-FY2017 to Procure One or More Flight III DDG-51s

Another potential issue for Congress is whether it would be appropriate for the Navy to use a multiyear procurement (MYP) contract in FY2013-FY2017 to procure one or more Flight III DDG-51s.[24] An MYP contract in FY2013-FY2017 would be the third use of MYP contracting in the DDG-51 program: an MYP contract was used to procure 13 Flight IIA DDG-51s in FY1998-FY2001, and another was used procure 10 more Flight IIA DDG-51s in FY2002-FY2005.

An MYP contract in FY2013-FY2017 could would include, in addition to several Flight IIA DDG-51s, at least one Flight III DDG-51 (the one planned for FY2016). The statute covering MYP contracts—10 U.S.C. 2306b—states that an MYP contract can be used for a DOD procurement program when the Secretary of Defense finds, among other things, "that there is a stable design for the property to be acquired and that the technical risks associated with such property are not excessive." For Navy shipbuilding programs, demonstrating the existence of a stable design traditionally has involved building at least one ship to that design and confirming, through that ship's construction, that the design does not need to be significantly changed. This is a principal reason why MYP contracts have not been used for procuring the lead ships in Navy shipbuilding programs.

Skeptics of using an MYP contract to procure the first Flight III DDG-51 could argue that the extent of design changes in the Flight III design—including the change in the ship's radar and associated changes in the ship's power-generation and cooling systems—make the ship different enough from the Flight IIA design that a stable design for the Flight III design has not yet been demonstrated. They can also note that the previous two DDG-51 contracts did not encompass a shift in DDG-51 flights, and that the first of these two MYP contracts began in FY1998, four years after the first Flight IIA DDG-51 was procured.

Supporters of using an MYP contract to procure the first Flight III DDG-51 could argue that in spite of the design changes in the Flight III design, the vast majority of the DDG-51 design will remain unchanged, and that the stability of the basic DDG-51 design has been demonstrated through many years of production. They could also argue that although the two previous DDG-51 MYP contracts did not encompass shift in DDG-51 flights, they nevertheless encompassed major upgrades in the design of the DDG-51. A May 6, 2011, Navy point paper states:

> The Navy intends to procure the first Flight III DDG 51 as part of the Fiscal Year (FY) 2013 – FY 2017 DDG 51 Class Multiyear Procurement (MYP). While the Acquisition Strategy for the FY 2013 – FY 2017 DDGs has not been approved, the Navy has successfully introduced major upgrades in conjunction with the two previous DDG 51 Class MYPs.

[24] Multiyear procurement (MYP), also known as multiyear contracting, is a special contracting authority that Congress permits DOD to use for a small number of procurement programs. MYP permits the service in question to use a single contract to contract for multiple copies of an item that are scheduled to be procured over a period of up to five years. MYP reduces the cost of the items being procured by giving the production plant the confidence in future business that it needs to make labor force and capital plant investments that can reduce the production cost of the item being procured, and because MYP also permits certain long lead-time components of the items to be procured up front, in the first year or two of the MYP arrangement, permitting the manufacturers of these components to make them more economically. The authority to order long lead-time components up front, in batch form, is called economic order quantity (EOQ) authority. Although the savings realized from using MYP arrangements varies from program to program, a typical savings is roughly 10% of the total cost of the items being procured. The statute governing MYP contracts is located at 10 U.S.C. 2603b.

In the FY 1998 – FY 2001 MYP, the Navy conducted a competitive procurement for 13 Flight IIA DDGs. Major upgrades were introduced on the third ship of that procurement, DDG 91. The upgrades for DDG 91 included upgrading the Aegis Combat System from Baseline 6 Phase III to Baseline 7 Phase 1; replacement of the AN/SPY-1D radar with the AN/SPY-1D(V) including a new signal processor; upgrades to the power and cooling systems for the new radar; replacement of the computing system for the Aegis Weapon System with Commercial-Off-the-Shelf (COTS) computers; and the introduction of the Remote Minehunting System (RMS). All of the FY 1998 – FY 2001 DDGs were delivered on schedule and within budget.

In the FY 2002 – FY 2005 MYP, the Navy conducted a competitive procurement for 11 additional Flight IIA DDGs. Major upgrades were introduced on the second ship of that procurement, DDG 103. The upgrades for DDG 103 included upgrading the Aegis Combat System from Baseline 7 Phase 1 to Baseline 7 Phase 1R; upgrades to improve SPY-1D(V) radar performance; implementation of Identification Friend or Foe (IFF) Mode 5; integration of the Digital Fire Control Interface (DFCI) capability; power modifications to increase survivability; and implementation of a Blown Optical Fiber (BOF) cable plant. Additionally, a DDG Modernization effort was introduced on the last two ships of the FY 2002 – FY 2005 MYP (DDG 111 / DDG 112). These modernization initiatives consisted of replacing the Fiber Optic Data Multiplex System (FODMS) with the Gigabit Ethernet DMS (GEDMS); implementation of Machinery Control System (MCS) upgrades to support a single Central Control Station (CCS) watchstander; introduction of a Digital Video Surveillance System (DVSS) and introduction of an Integrated Bridge and Navigation System (IBNS). The first nine of the FY 2002 – FY 2005 DDGs have been delivered on schedule and within budget, and the final two ships are currently on track to be delivered on schedule and within budget.

The major upgrades in the FY 1998 – FY 2001 and FY 2002 – FY 2005 MYPs were included in the Navy's Request for Proposals (RFPs) as separately priced Engineering Change Proposals (ECPs). For upgrades where final Government Furnished Information (GFI) was not available at the time that the RFP was issued, the Navy utilized a Design Budget process. Design Budgeting is an approach used when complete system design and installation details are not available at the time the RFP is issued. Not-to-Exceed parameters (e.g., cable counts, weight, power consumption, size, etc.) are provided to the shipbuilders for use in the preparation of their bids. The Design Budgeting process has been successfully used by the DDG 51 Program since the first ship of the Class, USS ARLEIGH BURKE (DDG 51).

The primary change for the planned Flight III DDGs is the replacement of the AN/SPY-1D(V) radar with the Air and Missile Defense Radar (AMDR) including power and cooling upgrades to support the AMDR. An approach similar to that used in the FY 1998 – FY 2001 and FY 2002 – FY 2005 MYPs may be utilized for the FY 2013 – FY 2017 MYP. The RFP would be structured around nine Flight IIA DDGs with ECPs and/or Design Budgets for the planned Flight III upgrades included in the RFP as separately priced items. These items would be awarded in time to support Flight III design and material procurement, but only after Milestone Decision Authority approval.[25]

## Development Status of AMDR

Some observers have expressed concern about the Navy's ability to complete development of the AMDR and deliver the first AMDR to the shipyard by 2019, in time to support the construction

[25] Source: Navy point paper dated May 6, 2011, and provided by the Navy to CRS on May 12, 2011.

schedule for a first Flight III DDG-51 procured in FY2016. The Navy could respond to a delay in the development of the AMDR by shifting the procurement of the first Flight III DDG-51 to FY2017 or a later year, while continuing to procure Flight IIA DDG-51s.

A March 2011 GAO report assessing DOD weapon acquisition programs stated the following regarding the Flight III DDG-51 and the development status of the AMDR:

> According to the program officials, a new air and missile defense radar will be the major technology effort for Flight III. The radar is being developed through a separate program office. According to the DDG 51 program, improving power generation on Flight III will be important to accommodate the expected increase in power and cooling requirements for this radar. The radar could also pose a risk for Flight III construction. The Navy estimates that it will not be available for delivery to a shipyard until fiscal year 2019—2 years prior to ship delivery according to the Navy….
>
> The AMDR program entered technology development in September 2010 and is one of the first programs to incorporate affordability cost targets as part of the acquisition strategy. In addition, in September 2010, the Navy awarded three fixed-price incentive fee contracts to Northrop Grumman, Lockheed Martin, and Raytheon for S-band radar and radar suite controller technology development. The contractors will build and test prototypes to demonstrate the critical technologies during a 2-year technology development period. The Navy then plans to conduct a limited competition among the technology development contractors for engineering and manufacturing development. According to the program's technology development strategy, the X-band radar technology is mature and the Navy plans to acquire it through full and open competition. The Navy will provide it as government-furnished equipment to the S-band and radar suite controller contractor to manage the integration during engineering and manufacturing development. Additional software development will be required to integrate the two radars.
>
> To support the decision to enter technology development, the Navy conducted an early evaluation of technology maturity and identified six candidate critical technologies—four hardware-related and two software-related. According to program officials, digital beamforming—necessary for AMDR's simultaneous air defense and ballistic missile defense mission—will likely take the longest time in development to mature. Program officials stated that while this technology is currently in use on existing radars, it has not been demonstrated on a large-aperture radar. The Navy is coordinating with the Air Force's Space Fence program on the S-band radar's technology development. The Navy estimates that AMDR will be available for delivery to a shipyard in fiscal year 2019. [26]

## Procuring Flight III DDG-51s with 32 Additional VLS Cells Forward

One option that Congress may wish to consider is whether Flight III DDG-51s should be built to a lengthened configuration that includes 32 additional vertical launch system (VLS) missile cells in the forward part of the ship.[27] All DDG-51s procured to date include 64 VLS cells in the aft

[26] Government Accountability Office, *Defense Acquisitions[:] Assessments of Selected Weapon Programs*, GAO-11-233SP, March 2010, pp. 137 and 131.

[27] A similar option was presented in a CRS Report 94-343 F, *Navy DDG-51 Destroyer Procurement Rate: Issues and Options for Congress*, April 25, 1994, pp. 5, 27-28. Out of print and available directly from the author.

part of the ship, and 32 cells forward, for a total of 96 cells.[28] The Navy's apparent concept for the Flight III DDG-51 would not change this. Building Flight III DDG-51s with 64 rather than 32 VLS cells forward (while keeping other basic elements of the Flight III design unchanged) would

- increase design costs for the Flight III DDG-51 by requiring additional design work for lengthening the DDG-51 hull and making associated changes to various systems inside the ship;
- increase the Flight III DDG-51's VLS capacity by 33%, while increasing its procurement cost by substantially less than 33%;
- give the Flight III DDG-51 a total of 128 VLS cells—a figure that would be the same as on the Navy's Aegis cruisers,[29] and closer to what the Navy had envisioned for the CG(X) cruiser; and
- increase the fleet's total VLS capacity, which might be of value in warfighting situations requiring large numbers of VLS-launched air defense, missile defense, land attack, and antisubmarine weapons.

## Procuring One or More Adjunct Radar Ships

The Navy canceled the CG(X) cruiser program in favor of developing and procuring Flight III DDG-51s reportedly in part on the grounds that the Flight III destroyer would use data from off-board sensors to augment data collected by its AMDR.[30] If those off-board sensors turn out to be less capable than the Navy assumed when it decided to cancel the CG(X) in favor of the Flight III DDG-51, the Navy may need to seek other means for augmenting the data collected by the Flight III DDG-51's AMDR.

One option for doing this would be to procure an adjunct radar ship—a non-combat ship equipped with a large radar that would be considerably more powerful than the Flight III DDG-51's AMDR. The presence in the fleet of a ship equipped with such a radar could significantly improve the fleet's AAW and BMD capabilities. The ship might be broadly similar to (but perhaps less complex and less expensive than) the new Cobra Judy Replacement missile range instrumentation ship (**Figure 2**),[31] which is equipped with two large and powerful radars, and

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[28] In the 28 Flight I/II DDG-51s, three cells in each VLS battery are used for a strike-down (i.e., reloading) crane, leaving a total of 90 usable cells – 61 aft and 29 forward.

[29] In the Aegis cruisers, three cells in each VLS battery are used for a strike-down (i.e., reloading) crane, leaving a total of 122 usable cells—61 aft and 61 forward.

[30] Amy Butler, "STSS Prompts Shift in CG(X) Plans," *Aerospace Daily & Defense Report*, December 11, 2009: 1-2.

[31] As described by DOD,

> The COBRA JUDY REPLACEMENT (CJR) program replaces the capability of the current United States Naval Ship (USNS) Observation Island (OBIS), its COBRA JUDY radar suite, and other mission essential systems. CJR will fulfill the same mission as the current COBRA JUDY/OBIS. CJR will collect foreign ballistic missile data in support of international treaty verification.
>
> CJR represents an integrated mission solution: ship, radar suite, and other Mission Equipment (ME). CJR will consist of a radar suite including active S-Band and X-Band Phased Array Radars (PARs), weather equipment, and a Mission Communications Suite (MCS). The radar suite will be capable of autonomous volume search and acquisition. The S-Band PAR will serve as the primary search and acquisition sensor and will be capable of tracking and collecting data on a large number of objects in a multi-target complex. The X-Band PAR will provide very high-resolution data on particular objects of interest.…

(continued...)

which has an estimated total acquisition cost of about $1.7 billion.[32] One to a few such adjunct radar ships might be procured, depending on the number of theaters to be covered, requirements for maintaining forward deployments of such ships, and their homeporting arrangements. The ships would have little or no self-defense capability and would need to be protected in threat situations by other Navy ships.

**Figure 2. Cobra Judy Replacement Ship**

**Source:** Naval Research Laboratory (http://www.nrl.navy.mil/PressReleases/2010/image1_74-10r_hires.jpg, accessed on April 19, 2011).

(...continued)

> The OBIS replacement platform, USNS Howard O. Lorenzen (Missile Range Instrumentation Ship (T-AGM) 25), is a commercially designed and constructed ship, classed to American Bureau of Shipping standards, certified by the U.S. Coast Guard in accordance with Safety of Life at Sea, and in compliance with other commercial regulatory body rules and regulations, and other Military Sealift Command (MSC) standards. The ship will be U.S. flagged, operated by a Merchant Marine or MSC Civilian Mariner crew, with a minimum of military specifications. The ship is projected to have a 30-year operating system life-cycle.
>
> The U.S. Navy will procure one CJR for the U.S. Air Force using only Research, Development, Test and Evaluation funding. CJR will be turned over to the U.S. Air Force at Initial Operational Capability for all operations and maintenance support….
>
> Program activities are currently focused on installation and final integration of the X and S-band radars onto the ship at Kiewit Offshore Services (KOS) following completion of radar production and initial Integration and Test (I&T) at Raytheon and Northrop Grumman (NG). Raytheon and its subcontractors have completed I&T of the X-band radar and X/S ancillary equipment at KOS. The S-band radar arrived at KOS on February 19, 2011. The United States Naval Ship (USNS) Howard O. Lorenzen (Missile Range Instrumentation Ship (T-AGM) 25) completed at-sea Builder's Trials (BT) in March 2011. The ship is expected to depart VT Halter Marine (VTHM) and arrive at KOS in the third quarter of Fiscal Year 2011 (3QFY11).
>
> (Department of Defense, *Selected Acquisition Report (SAR), Cobra Judy Replacement*, December 31, 2010, pp. 3-5.)

[32] Department of Defense, *Selected Acquisition Report (SAR), Cobra Judy Replacement*, December 31, 2010, p. 13.

# Legislative Activity for FY2012

The Navy's proposed FY2012 budget was submitted in February 2011. For details on the Navy's FY2012 funding request for the DDG-51 and DDG-1000 programs, see "FY2012 Funding Request" in "Background."

# Appendix A. Legislative Activity for FY2011

## FY2011 Funding Request

The Navy's proposed FY2011 budget was submitted to Congress on February 1, 2010. The two DDG-51s that the Navy wants to procure in FY2011 received $577.2 million in FY2010 advance procurement funding. The Navy's proposed FY2011 budget requested another $2,922.2 million in procurement funding for the two ships, so as to complete their estimated combined procurement cost of $3,499.2 million. The Navy's proposed FY2011 budget also requested $48.0 million in advance procurement funding for the one DDG-51 that the Navy wants to procure in FY2012, $186.3 million in procurement funding for DDG-1000 program-completion costs, and $228.4 million in research and development funding for the AMDR. The funding request for the AMDR was contained in the Navy's research and development account in Project 3186 ("Air and Missile Defense Radar") of Program Element (PE) 0604501N ("Advanced Above Water Sensors").

## FY2011 DOD and Full-Year Continuing Appropriations Act (H.R. 1473/P.L. 112-10)

According to line-item funding tables posted by the House Rules Committee,[33] the FY2011 Department of Defense and Full-Year Continuing Appropriations Act (H.R. 1473/P.L. 112-10 of April 15, 2011) reduces the Navy's request for FY2011 procurement funding for the DDG-51 program by $53.736 million, and fully funds the Navy's request for FY2011 advance procurement funding for the DDG-51 program. The reduction of $53.736 million in procurement funding for the DDG-51 program includes $4.986 million for "MK-12 IFF Cost Growth," $2.256 million for "CIWS Block 1B Cost Growth," $6.294 million for "Exterior Communication System Cost Growth," $10.2 million for "Main Reduction Gear Systems Engineering Growth," and $30.0 million for "Main Reduction Gear Contract Savings."

According to the funding tables, H.R. 1473 reduces the Navy's FY2011 procurement funding request for DDG-1000 program-completion costs by $108.8 million, with the reduction being for "Volume Search Radar."

According to the funding tables, H.R. 1473 fully funds the Navy's FY2011 research and development funding request for PE 0604501N, Advanced Above Water Sensors, which includes, as Project 3186, the Navy's funding request for research and development on the AMDR.

## FY2011 DOD Appropriations Bill (S. 3800)

### Senate

The Senate Appropriations Committee, in its report (S.Rept. 111-295 of September 16, 2010) on S. 3800 of the 111th Congress, recommended approval of the Navy's requests for FY2011

[33] The funding tables were posted at http://rules.house.gov/Legislation/legislationDetails.aspx?NewsID=244.

procurement and advance procurement funding for the DDG-51 and DDG-1000 programs (page 86), and for FY2011 research and development funding for the AMDR (page 151, line 106).[34]

## FY2011 Defense Authorization Act (H.R. 6523/P.L. 111-383)

### House (H.R. 5136)

The House Armed Services Committee, in its report (H.Rept. 111-491 of May 21, 2010) on the FY2011 defense authorization bill (H.R. 5136), recommended approval of the Navy's requests for FY2011 procurement and advance procurement funding for the DDG-51 and DDG-1000 programs (page 73), and for FY2011 research and development funding for the AMDR (page 150).[35] The report stated:

> DDG 51 class destroyer
>
> The committee is pleased with the effort by the Navy to undertake a comprehensive analysis of the radar and hull alternatives needed for a future sea-based ballistic missile defense (BMD) platform. The analysis has determined that the proposed Air and Missile Defense Radar (AMDR) system matched to a DDG 51 class destroyer hull is the most cost-effective method of fielding a new generation of sea-based BMD. The committee notes that this new radar development program will leverage existing technologies of both the DDG 1000 class destroyer program and the DDG 51 class destroyer program. The committee understands that the AMDR system is not likely to reach full development for a number of years and that a funding authorization request for the first ship will not occur until fiscal year 2016. In the meantime, the committee understands that the Navy's plan is to continue the restart of the DDG 51 production line begun last year using a procurement strategy of three ships every two years in a ''2–1–2–1'' build plan. The committee has significant concerns whether such an acquisition strategy can sustain a competitive relationship between the two current surface warfare construction yards.
>
> DDG 1000 class destroyer
>
> The committee is concerned with the Nunn-McCurdy cost breach incurred by the DDG 1000 destroyer program. The committee understands that the current cost breach was caused by costs associated with research and development efforts charged against only three vessels vice the original seven.
>
> The committee notes that this cost threshold breach was known by the Navy far in advance of the receipt of notification required by law. The committee was informed that official notification of the cost breach was not technically required until after submission of the budget request for fiscal year 2011, as the budget request was the official truncation of the class to three vessels. This argument is disingenuous in that both the Secretary of Defense and the Secretary of the Navy made public statements and transmitted official correspondence to the committee that the program would be truncated to three vessels as early as mid–2008.

[34] The report recommends a $3 million increase to the Navy's funding request for PE 0604501N ("Advanced Above Water Sensors"), which includes, among other things, Project 3186 ("Air and Missile Defense Radar"). The increase is for an electronic periscope detection radar, an item that does not appear related to AMDR.

[35] The report recommends approval of the Navy's funding request for PE 0604501N ("Advanced Above Water Sensors"), which includes, among other things, Project 3186 ("Air and Missile Defense Radar").

> However, regardless of how the Navy has arrived at this juncture, the fact remains that one vessel is currently under construction and significant materiel orders have been made for the second. The committee is also keenly aware of the industrial base consequences of a decision by the Secretary of Defense to terminate the program. (Pages 75-76)

The report also stated:

> Composite deckhouse design for DDG 51 flight III class ships
>
> The budget request contained $17.9 million in PE 63563N for ship concept advanced design, but contained no funds for development of a composite deckhouse for flight III of the DDG 51 class destroyer.
>
> The committee supports the Navy decision to re-start the DDG 51 class destroyer acquisition program and to work toward a flight III version of the vessel by fiscal year 2016. To support the goal of that flight of ships of advanced radar and ship control systems, the Navy must make significant design changes to the class, in order to upgrade power and cooling capability. The committee realizes that those design changes have the potential to add significant weight to the vessel which could limit operational effectiveness. The committee supports an effort, aimed at reducing overall lifecycle costs of the class, to develop a composite deckhouse for the flight III ships that would significantly reduce the weight to center of buoyancy ratio and increase operational effectiveness of the vessel. The committee notes that the technological advancements for the composite deckhouse of the DDG 1000 program can significantly aid this effort.
>
> The committee recommends an increase of $10.0 million in PE 63563N for development of a composite deckhouse for potential use on flight III DDG 51 class destroyers. (Page 157)

## Senate (H.R. 3454)

The FY2011 defense authorization bill (S. 3454), as reported by the Senate Armed Services Committee (S.Rept. 111-201 of June 4, 2010), recommended approval of the Navy's request for FY2011 procurement and advance procurement funding for the DDG-51 and DDG-1000 programs (see page 677 of the printed bill). The bill as reported recommended a $22.5-million reduction to the Navy's request for FY2011 research and development funding for the AMDR (page 735, line 106). The committee's report stated:

> **Air and missile defense radar**
>
> The budget request included $274.4 million in PE 64501N for advanced above water sensors, including $228.4 million for the air and missile defense radar (AMDR) program.
>
> The Navy's AMDR program is intended to produce a next-generation radar system designed to provide ballistic missile defense, air defense, and surface warfare capabilities. The fiscal year 2010 budget includes $113.6 million for AMDR technology development contracts and the fiscal year 2011 budget request includes $145.3 million for AMDR technology development contracts.
>
> In December 2009, the Navy released a request for proposals for AMDR technology development. The Navy intends to award these technology development contracts after completion of Milestone A, which has been delayed. The Navy had planned to have a Milestone A decision in the third quarter of fiscal year 2010, but the Navy now expects that decision in August, after the Navy completes key analyses.

> Based on this delayed decision, the Government Accountability Office has estimated that $22.5 million of the fiscal year 2010 funds are not needed to fund fiscal year 2010 activities and could be applied to fiscal year 2011 requirements.
>
> Therefore, the committee believes the Navy should use 2010 resources available for AMDR instead of reprogramming them, which obviate the need for $22.5 million of the funds requested in fiscal year 2011. (Page 66)

The committee's report also states:

> The committee continues to have significant concerns regarding the implications of the plan for the non-nuclear surface ship industrial base. If the Navy and industry, working together, are unable to control requirement driven cost growth and deliver the ships in the plan for the projected costs, the inevitable reductions in quantity will likely impact the Navy's ability to reach the required fleet size and further jeopardize the industrial base. The committee notes that the current shipbuilding plan includes the cost of the SSBN (X) program and the committee encourages the Navy to closely scrutinize requirements for this program in order to minimize its impact on the recapitalization of the Navy's battle force.
>
> Furthermore, the committee urges the Navy and the contractors to negotiate as expeditiously as possible fair and reasonable construction contracts for ships previously authorized in order to reduce uncertainty and maintain and foster affordability in the procurement of large surface combatants and other naval vessels….
>
> In large surface combatants, the Navy's last official report stated that the industrial base can only be effectively sustained if naval ship yards were building the equivalent of three DDG–51 destroyers per year, with additional work assumed at one of the yards. Even if the Navy fully executes both of the large surface combatant programs of record in the near-term, the President's fiscal year 2011 budget request and future-years defense program propose to buy an average of 1.5 large surface combatants per year. Even at projected procurement rates, the number of cruisers and destroyers falls below the required level of 88 ships in 2027 and remains below that level for the following 13 years. At its worst, the number of large surface combatants is 21 ships below the expected requirement in 2034.
>
> The Navy has testified that continued demand for large surface combatants to meet forward presence and strike operations requirements coupled with emerging ballistic missile defense requirements drives the Navy to consider abandoning lesser priority missions for more recent, higher priority ones. In light of the current pressure on the large surface combatant force, the committee is concerned that the Navy's projected rate of production is insufficient, and anticipates that the Navy will closely assess future demand for large surface combatants, and operational and additional risk to the industrial base of maintaining relatively low rates of procurement for large surface combatants.
>
> The committee remains concerned with the Navy's ability to execute what it believes is an overly optimistic procurement strategy for large surface combatants. The truncation of the DDG–1000, the restart of the DDG–51 class and the proposed Flight III variant of the DDG–51 inject a great deal of instability into the SCN accounts. The Navy's testimony before Congress has led this committee to identify six risk areas in the Navy's plan for DDG–51s: (1) the availability of the Air and Missile Defense Radar; (2) the extent and cost of modifications to the underlying ship's design package to support proposed changes to the ship; (3) increased limitation on service life margins of the early restart ships; (4) combat system software integration; (5) the overall complexity of various separate programs that need to converge for successful completion of the restart and Flight III programs; and (6) cost and schedule growth for the Aegis Combat System Modernization. The committee

> expects the Navy to keep it closely apprised of developments in these risk areas so that it can monitor appropriate risk mitigation efforts. (Pages 40-41)

## Final Version (H.R. 6523/P.L. 111-383)

Section 102(a)(3) of H.R. 6523/P.L. 111-383 of January 7, 2011, authorizes FY2011 funding for the Navy's entire shipbuilding account at the requested amount. The bill contains no provisions relating specifically to procurement of DDG-51 or DDG-1000 destroyers. The joint explanatory statement of the House and Senate Armed Services Committees on H.R. 6523 does not discuss procurement of DDG-51 or DDG-1000 destroyers.

# Appendix B. Additional Background Information on DDG-1000 Program

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

## 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:[36]

- **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.[37]

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, is to be named the 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.[38]

## New Technologies

The DDG-1000 incorporates a significant number of new technologies, including a wave-piercing, tumblehome hull design for reduced detectability,[39] a superstructure made partly of large sections of composite (i.e., fiberglass-like) materials rather than steel or aluminum, an integrated

[36] 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-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).

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

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

[39] 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.

electric-drive propulsion system,[40] a total-ship computing system for moving information about the ship, automation technologies enabling its reduced-sized crew, a dual-band radar, a new kind of vertical launch system (VLS) for storing and firing missiles, and two copies of a 155mm gun called the Advanced Gun System (AGS). The AGS is to fire a new rocket-assisted 155mm shell, called the Long Range Land Attack Projectile (LRLAP), to ranges of more than 60 nautical miles. The DDG-1000 can carry 600 LRLAP rounds (300 for each gun), and additional rounds can be brought aboard the ship while the guns are firing, creating what Navy officials call an "infinite magazine."

## Planned Quantity

When the DD-21 program was initiated, a total of 32 ships was envisaged. In subsequent years, the planned total for the DD(X)/DDG-1000 program was reduced to 16 to 24, then to 7, and finally to 3.

## Construction Shipyards

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 NGSB, 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 NGSB and GD/BIW.

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 NGSB 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 Navy's proposal for a winner-take-all competition. Congress included a provision (Section 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 NGSB 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.

[40] 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.

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 NGSB for the construction of the two lead ships. The awards were modifications to existing contracts that the Navy has with GD/BIW and NGSB 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 NGSB 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 NGSB.

On January 12, 2009, it was reported that the Navy, NGSB, 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 NGSB 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.[41]

On April 8, 2009, it was reported that the Navy had reached an agreement with NGSB and GD/BIW to shift the second DDG-1000 to GD/BIW, and to have GD/BIW build all three ships. NGSB 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 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).

## 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

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

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.[42]

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.[43] 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-10000. The resulting increase in program acquisition unit cost (PAUC)—one of two measures used under the Nunn-McCurdy provision for measuring cost growth[44]—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.[45] 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

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

[43] 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.

[44] 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.

[45] 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.

> 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.[46]

A July 26, 2010, press report quotes Captain James Syring, the DDG-1000 program manager, as stating: "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 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%,

[46] 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.

[47] Cid Standifer, "Volume Radar Contracted For DDG-1000 Could Be Shifted To CVN-79," *Inside the Navy*, July 26, 2010.

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]

Under Secretary of Defense Ashton Carter's June 1, 2010, letter and attachment restructuring the DDG-1000 program and DOD's decision on October 8, 2010, to reinstate the DDG-1000 program's Milestone B certification (see **Appendix B**) raise the following potential oversight questions for Congress:

- Why did DOD decide, as part of its restructuring of the DDG-1000 program, to change the primary radar on the DDG-1000?
- What are the potential risks to the DDG-1000 program of changing its primary radar at this stage in the program (i.e., with the first ship under construction, and preliminary construction activities underway on the second ship)?
- How will the upgraded MFR differ in cost, capabilities, and technical risks from the baseline MFR included in the original DDG-1000 design?
- What is the net impact on the capabilities of the DDG-1000 of the change to the DDG-1000's primary radar (i.e., of removing the VSR and upgrading the MFR)?
- Given change to the DDG-1000's primary radar and the May 2010 CAPE estimates of the program's program acquisition unit cost (PAUC) and average program unit cost (APUC), is the DDG-1000 program still cost effective?
- What impact on cost, schedule, or technical risk, if any, will the removal of the VSR from the DDG-1000 design have on the Navy's plan to install the dual-band radar (DBR), including the VSR, on the Ford (CVN-78) class aircraft carriers CVN-78 and CVN-79?[49]

## March 2011 GAO Report

A March 2011 GAO report assessing major DOD weapon acquisition programs stated the following of the DDG-1000 program:

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

[49] For more on these aircraft carriers, see CRS Report RS20643, *Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress*, by Ronald O'Rourke.

**Technology Maturity**

Three of DDG 1000's 12 critical technologies are mature, and the remaining 9 have been demonstrated in a relevant environment. The Navy plans to fully demonstrate the integrated deckhouse before installation on the ship, but the remaining 8 technologies will not be demonstrated in a realistic environment until after ship installation. The design review for one of the technologies—the ship's long-range land-attack projectile—was delayed from 2010 to 2011 to allow time to correct issues found during rocket motor testing, but program officials noted that the projectile has performed well and met accuracy and range requirements in flight tests completed to date. The total ship computing environment (phased over six releases and one spiral) is now nearing maturity, and, according to program officials, the integration and testing of software release 5 is complete. However, software development challenges remain. According to the Defense Contract Management Agency (DCMA), there has been significant cost growth due to testing delays for release 5, and several unresolved problems have been deferred to release 6. DCMA has reported that these deferred requirements, coupled with software requirements changes for release 6, could create significant cost and schedule challenges.

**Design Maturity**

The DDG 1000 design appears stable. The design was 88 percent complete at the start of lead ship construction and 100 percent complete shortly thereafter.

**Production Maturity**

The first DDG 1000 began construction in February 2009 and the Navy estimates that approximately 30 percent of the ship is complete. Fabrication of the second ship began in March 2010, and 38 percent of the units that make up the ship are now in various stages of production. The Navy reported that it contractually requires the shipbuilders to specify detailed structural attributes to be monitored during unit fabrication and integration in order to reduce the risk of rework. While the shipbuilders are not currently meeting some of the production metrics, program officials reported that these issues have been addressed in part by retraining personnel.

**Other Program Issues**

In fiscal year 2008, the Navy truncated the DDG 1000 program to three ships, triggering a Nunn-McCurdy unit cost breach of the critical threshold and a restructure of the program. To reduce program costs, DOD removed the volume search radar from the design, leaving only the multifunction radar on the ship. According to program officials, removing the volume search radar will save the program $300 million and will not preclude DDG 1000 from meeting its key performance parameters. However, the software for the multifunction radar will have to be modified to provide a volume search capability that meets all planned threat scenarios. The program office has not yet estimated the cost of these multifunction radar modifications; it does not expect them to affect the program's schedule. According to program officials, the ship could accept the volume search radar in the future because space and weight will be reserved, but there are currently no plans to include it. The program restructure also delayed initial operational capability by 1 year to the third quarter of fiscal year 2016 to allow additional time for the program to retire remaining software and production risks. The program expects all three ships to be operational by 2018.

**Program Office Comments**

In commenting on a draft of this assessment, the Navy stated that the program received milestone B approval, after the critical Nunn-McCurdy breach, in October 2010 and is

closely monitoring and managing risk through comprehensive program metrics, program reviews, and an earned value management system. At the time of the review, all critical technologies had been at the appropriate level of maturity for the program phase. Earned value assessments of both shipbuilders and an independent logistics assessment are to be completed in fiscal year 2011. All 26 major mission systems equipment are in production and on track for on-time delivery to the shipyard. Software release 6 is on track to support land-based testing for the propulsion system and light off of the main engine. The first advanced gun system magazine was delivered on time and the first gun has been shipped for testing. A successful test mission readiness review and associated tests for the multifunction radar were completed in September 2010. The Navy also provided technical comments, which were incorporated as appropriate.[50]

[50] Government Accountability Office, *Defense Acquisitions[:] Assessments of Selected Weapon Programs*, GAO-11-233SP, March 2010, p. 58.

# Appendix C. Additional Background Information on CG(X) Cruiser Program

## Background Information on CG(X) Program

The CG(X) cruiser program was announced by the Navy on November 1, 2001.[51] The Navy wanted to procure as many as 19 CG(X)s as replacements for its 22 CG-47s, which are projected to reach the end of their 35-year service lives between 2021 and 2029. The CG-47s are multi-mission ships with an emphasis on AAW and (for some CG-47s) BMD, and the Navy similarly wanted the CG(X) to be a multi-mission ship with an emphasis on AAW and BMD. The CG(X) was to carry the Air and Missile Defense Radar (AMDR), a new radar that was to be considerably larger and more powerful than the SPY-1 radar carried on the Navy's Aegis ships. Some press reports suggested that a nuclear-powered version of the CG(X) might have had a full load displacement of more than 20,000 tons and a unit procurement cost of $5 billion or more.[52]

The Navy's FY2009 budget called for procuring the first CG(X) in FY2011. Beginning in late 2008, however, it was reported that the Navy had decided to defer the procurement of the first CG(X) by several years, to about FY2017.[53] Consistent with these press reports, on April 6, 2009,

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[51] The Navy on that date announced that that it was launching a Future Surface Combatant Program aimed at acquiring a family of next-generation surface combatants. This new family of surface combatants, the Navy stated, would include three new classes of ships:

- a destroyer called the DD(X)—later redesignated DDG-1000—for the precision long-range strike and naval gunfire mission,
- a cruiser called the CG(X) for the AAW and BMD mission, and
- a smaller combatant called the Littoral Combat Ship (LCS) to counter submarines, small surface attack craft, and mines in heavily contested littoral (near-shore) areas.

The Future Surface Combatant Program replaced an earlier Navy surface combatant acquisition effort, begun in the mid-1990s, called the Surface Combatant for the 21st Century (SC-21) program. The SC-21 program encompassed a planned destroyer called DD-21 and a planned 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, but the start of development work on the CG-21 was still years in the future. The DD(X) program, now called the DDG-1000 or Zumwalt-class program, is essentially a restructured continuation of the DD-21 program. The CG(X) might be considered the successor, in planning terms, of the CG-21. After November 1, 2001, the acronym SC-21 continued for a time to be used in the Navy's research and development account to designate a line item (i.e., program element) that funded development work on the DDG-1000 and CG(X).

[52] For a discussion of nuclear power for Navy surface ships other than aircraft carriers, see CRS Report RL33946, *Navy Nuclear-Powered Surface Ships: Background, Issues, and Options for Congress*, by Ronald O'Rourke.

[53] Zachary M. Peterson, "Navy Awards Technology Company $128 Million Contract For CG(X) Work," *Inside the Navy*, October 27, 2008. Another press report (Katherine McIntire Peters, "Navy's Top Officer Sees Lessons in Shipbuilding Program Failures," *GovernmentExecutive.com*, September 24, 2008) quoted Admiral Gary Roughead, the Chief of Naval Operations, as saying: "What we will be able to do is take the technology from the DDG-1000, the capability and capacity that [will be achieved] as we build more DDG-51s, and [bring those] together around 2017 in a replacement ship for our cruisers." (Material in brackets in the press report.) Another press report (Zachary M. Peterson, "Part One of Overdue CG(X) AOA Sent to OSD, Second Part Coming Soon," *Inside the Navy*, September 29, 2008) quoted Vice Admiral Barry McCullough, the Deputy Chief of Naval Operations for Integration of Capabilities and Resources, as saying that the Navy did not budget for a CG(X) hull in its proposal for the Navy's budget under the FY2010-FY2015 Future Years Defense Plan (FYDP) to be submitted to Congress in early 2009.

An earlier report (Christopher P. Cavas, "DDG 1000 Destroyer Program Facing Major Cuts," *DefenseNews.com*, July 14, 2008) stated that the CG(X) would be delayed until FY2015 or later. See also Geoff Fein, "Navy Likely To Change (continued...)

Secretary of Defense Robert Gates announced—as part of a series of recommendations for the then-forthcoming FY2010 defense budget—a recommendation to "delay the CG-X next generation cruiser program to revisit both the requirements and acquisition strategy" for the program.[54] The Navy's proposed FY2010 budget deferred procurement of the first CG(X) beyond FY2015.

## Cancellation of CG(X) Program

The Navy's FY2011 budget proposed terminating the CG(X) program as unaffordable. The Navy's desire to cancel the CG(X) and instead procure Flight III DDG-51s apparently took shape during 2009: at a June 16, 2009, hearing before the Seapower Subcommittee of the Senate Armed Services Committee, the Navy testified that it was conducting a study on destroyer procurement options for FY2012 and beyond that was examining design options based on either the DDG-51 or DDG-1000 hull form.[55] A January 2009 memorandum from the Department of Defense acquisition executive had called for such a study.[56] In September and November 2009, it was reported that the Navy's study was examining how future requirements for AAW and BMD operations might be met by a DDG-51 or DDG-1000 hull equipped with a new radar.[57] On December 7, 2009, it was reported that the Navy wanted to cancel its planned CG(X) cruiser and instead procure an improved version of the DDG-51.[58] In addition to being concerned about the projected high cost and immature technologies of the CG(X),[59] the Navy reportedly had concluded that it does not need a surface combatant with a version of the AMDR as large and capable as the one envisaged for the CG(X) to adequately perform projected AAW and BMD missions, because the Navy will be able to augment data collected by surface combatant radars with data collected by space-based sensors. The Navy reportedly concluded that using data collected by other sensors would permit projected AAW and BMD missions to be performed

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CG(X)'s Procurement Schedule, Official Says," *Defense Daily*, June 24, 2008; Rebekah Gordon, "Navy Agrees CG(X) By FY-11 Won't Happen But Reveals Little Else," *Inside the Navy*, June 30, 2008.

[54] Source: Opening remarks of Secretary of Defense Robert Gates at an April 6, 2009, news conference on DOD recommendations for the then-forthcoming FY2010 defense budget.

[55] Source: Transcript of spoken remarks of Vice Admiral Bernard McCullough at a June 16, 2009, hearing on Navy force structure shipbuilding before the Seapower subcommittee of the Senate Armed Services Committee.

[56] A January 26, 2009, memorandum for the record from John Young, the then-DOD acquisition executive, stated that "The Navy proposed and OSD [the Office of the Secretary of Defense] agreed with modification to truncate the DDG-1000 Program to three ships in the FY 2010 budget submission." The memo proposed procuring one DDG-51 in FY2010 and two more FY2011, followed by the procurement in FY2012-FY2015 (in annual quantities of 1, 2, 1, 2) of a ship called the Future Surface Combatant (FSC) that could be based on either the DDG-51 design or the DDG-1000 design. The memorandum stated that the FSC might be equipped with a new type of radar, but the memorandum did not otherwise specify the FSC's capabilities. The memorandum stated that further analysis would support a decision on whether to base the FSC on the DDG-51 design or the DDG-1000 design. (Memorandum for the record dated January 26, 2009, from John Young, Under Secretary of Defense [Acquisition, Technology and Logistics], entitled "DDG 1000 Program Way Ahead," posted on InsideDefense.com [subscription required].)

[57] Zachary M. Peterson, "Navy Slated To Wrap Up Future Destroyer Hull And Radar Study," *Inside the Navy*, September 7, 2009. Christopher P. Cavas, "Next-Generation U.S. Warship Could Be Taking Shape," *Defense News*, November 2, 2009: 18, 20.

[58] Christopher J. Castelli, "Draft Shipbuilding Report Reveals Navy Is Killing CG(X) Cruiser Program," *Inside the Navy*, December 7, 2009.

[59] Christopher J. Castelli, "Draft Shipbuilding Report Reveals Navy Is Killing CG(X) Cruiser Program," *Inside the Navy*, December 7, 2009.

adequately with a radar smaller enough to be fitted onto the DDG-51.[60] Reports suggested that the new smaller radar would be a scaled-down version of the AMDR originally intended for the CG(X).[61]

The Navy's February 2010 report on its FY2011 30-year (FY2011-FY2040) shipbuilding plan, submitted to Congress in conjunction with the FY2011 budget, states that the 30-year plan:

> Solidifies the DoN's [Department of the Navy's] long-term plans for Large Surface Combatants by truncating the DDG 1000 program, restarting the DDG 51 production line, and continuing the Advanced Missile Defense Radar (AMDR) development efforts. Over the past year, the Navy has conducted a study that concludes a DDG 51 hull form with an AMDR suite is the most cost-effective solution to fleet air and missile defense requirements over the near to mid-term....
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> The Navy, in consultation with OSD, conducted a Radar/Hull Study for future destroyers. The objective of the study was to provide a recommendation for the total ship system solution required to provide Integrated Air and Missile Defense (IAMD) (simultaneous ballistic missile and anti-air warfare (AAW) defense) capability while balancing affordability with capacity. As a result of the study, the Navy is proceeding with the Air and Missile Defense Radar (AMDR) program....
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> As discussed above, the DDG 51 production line has been restarted. While all of these new-start guided missile destroyers will be delivered with some BMD capability, those procured in FY 2016 and beyond will be purpose-built with BMD as a primary mission. While there is work to be done in determining its final design, it is envisioned that this DDG 51 class variant will have upgrades to radar and computing performance with the appropriate power generation capacity and cooling required by these enhancements. These upgraded DDG 51 class ships will be modifications of the current guided missile destroyer design that combine the best emerging technologies aimed at further increasing capabilities in the IAMD arena and providing a more effective bridge between today's capability and that originally planned for the CG(X). The ships reflected in this program have been priced based on continuation of the existing DDG 51 re-start program. Having recently completed the Hull and Radar Study, the Department is embarking on the requirements definition process for these AMDR destroyers and will adjust the pricing for these ships in future reports should that prove necessary.[62]

In testimony to the House and Senate Armed Services Committees on February 24 and 25, 2010, respectively, Admiral Gary Roughead, the Chief of Naval Operations, stated:

> Integrated Air and Missile Defense (IAMD) incorporates all aspects of air defense against ballistic, anti-ship, and overland cruise missiles. IAMD is vital to the protection of our force, and it is an integral part of our core capability to deter aggression through conventional means....

[60] Amy Butler, "STSS Prompts Shift in CG(X) Plans," *Aerospace Daily & Defense Report*, December 11, 2009: 1-2.

[61] Cid Standifer, "NAVSEA Plans To Solicit Contracts For Air And Missile Defense Radar," *Inside the Navy*, December 28, 2009; "Navy Issues RFP For Phase II of Air And Missile Defense Radar Effort," *Defense Daily*, December 24, 2009: 4.

[62] U.S. Navy, *Report to Congress on Annual Long-Range Plan for Construction of Naval Vessels for FY 2011*, February 2010, pp. 12, 13, 19. The first reprinted paragraph, taken from page 12, also occurs on page 3 as part of the executive summary.

> To address the rapid proliferation of ballistic and anti-ship missiles and deep-water submarine threats, as well as increase the capacity of our multipurpose surface ships, we restarted production of our DDG 51 Arleigh Burke Class destroyers (Flight IIA series). These ships will be the first constructed with IAMD, providing much-needed Ballistic Missile Defense (BMD) capacity to the Fleet, and they will incorporate the hull, mechanical, and electrical alterations associated with our mature DDG modernization program. We will spiral DDG 51 production to incorporate future integrated air and missile defense capabilities....

The Navy, in consultation with the Office of the Secretary of Defense, conducted a Radar/Hull Study for future surface combatants that analyzed the total ship system solution necessary to meet our IAMD requirements while balancing affordability and capacity in our surface Fleet. The study concluded that Navy should integrate the Air and Missile Defense Radar program S Band radar (AMDR-S), SPY-3 (X Band radar), and Aegis Advanced Capability Build (ACB) combat system into a DDG 51 hull. While our Radar/Hull Study indicated that both DDG 51 and DDG 1000 were able to support our preferred radar systems, leveraging the DDG 51 hull was the most affordable option. Accordingly, our FY 2011 budget cancels the next generation cruiser program due to projected high cost and risk in technology and design of this ship. I request your support as we invest in spiraling the capabilities of our DDG 51 Class from our Flight IIA Arleigh Burke ships to Flight III ships, which will be our future IAMD-capable surface combatant. We will procure the first Flight III ship in FY 2016.[63]

## Author Contact Information

Ronald O'Rourke
Specialist in Naval Affairs
rorourke@crs.loc.gov, 7-7610

[63] Statement of Admiral Gary Roughead, Chief of Naval Operations, before the House Armed Services Committee on 24 February, 2010, pp. 10-11; and Statement of Admiral Gary Roughead, Chief of Naval Operations, before the Senate Armed Services Committee on 25 February 2010, pp. 10-11.