Navy Aegis Cruiser and Destroyer Modernization: Background and Issues for Congress

Ronald O'Rourke
Specialist in Naval Affairs

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Summary

The Navy has begun a program to modernize its 22 in-service Aegis cruisers and the 62 Aegis destroyers procured in FY2005 and prior years. Under Navy plans, the modernization of these 84 ships would occur over a period of more than 20 years. The program's estimated total cost is about $16.6 billion in constant FY2010 dollars. The modernizations are intended to ensure that the ships can be operated cost-effectively throughout their entire 35- or 40-year intended service lives. The modernizations of all 62 destroyers and at least 10 of the cruisers are to include the installation of a capability for conducting ballistic missile defense (BMD) operations.

The Aegis cruiser and destroyer modernization program poses several potential oversight issues for Congress, including the Navy's overall vision behind the program, which shipyards should be used to perform the modernizations, the potential for expanding the scope of work performed in the modernizations, and the Navy's strategy for moving to an open architecture (OA) version of the Aegis combat system. In addition, some observers are concerned that demands from U.S. regional military commanders for BMD-capable Aegis ships are growing faster than the number of BMD-capable Aegis ships. One option for addressing this concern would be to accelerate the Aegis destroyer modernization schedule, so as to get more BMD-capable DDG-51s into the fleet sooner.

The Navy's proposed FY2011 budget requests funding for one Aegis cruiser modernization availability, three Aegis destroyer modernization availabilities, and long lead-time procurement of equipment for three additional Aegis cruiser modernizations and five additional Aegis destroyer modernizations.

Contents

Contacts

Introduction

The Navy has begun a program to modernize its 22 in-service Aegis cruisers and the 62 Aegis destroyers procured in FY2005 and prior years. Under Navy plans, the modernization of these 84 ships would occur over a period of more than 20 years. The program's estimated total cost is about $16.6 billion in constant FY2010 dollars. The modernizations are intended to ensure that the ships can be operated cost-effectively throughout their entire 35- or 40-year intended service lives. The modernizations of all 62 destroyers and at least 10 of the cruisers are to include the installation of a capability for conducting ballistic missile defense (BMD) operations.

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Decisions that Congress makes regarding the Aegis modernization program could affect Navy capabilities and funding requirements, U.S. shipbuilders, and U.S. combat system manufacturers.

Background

Aegis Cruisers and Destroyers

The Navy's cruisers and destroyers are called Aegis ships because they are equipped with the Aegis ship combat system—an integrated collection of sensors, computers, software, displays, weapon launchers, and weapons named for the mythological shield that defended Zeus. The Aegis system was originally developed in the 1970s. The system was first deployed by the Navy in 1983, and it has been updated many times since.

The Navy's Aegis ships include Ticonderoga (CG-47) class cruisers and Arleigh Burke (DDG-51) class destroyers. These ships are multi-mission platforms capable of conducting missions such as air defense (which the Navy calls anti-air warfare), ballistic missile defense (BMD), anti-submarine warfare, anti-surface warfare, naval surface fire support for forces ashore, and Tomahawk cruise missile strikes.

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. The Navy plans to keep the remaining 22 ships in service to age 35.

A total of 62 DDG-51s were procured for the Navy between FY1985 and FY2005; the first entered service in 1991 and the 62nd is scheduled to enter service in late-2011. The first 28 ships, known as Flight I/II DDG-51s, are scheduled to remain in service until age 35. The next 34 ships,

known as Flight IIA DDG-51s, incorporate some design changes and are to remain in service until age 40.

No DDG-51s were procured in FY2006-FY2009.[1] Procurement of DDG-51s resumed in FY2010.[2] The Navy's Aegis modernization program—the focus of this report—applies to the 22 Aegis cruisers and the 62 Aegis destroyers procured through FY2005. These 84 ships equate to about 27% of the Navy's planned total force of 313 ships.[3]

Aegis Ship Industrial Base

Construction Shipyards

The builders of the Navy's Aegis ships are General Dynamics' Bath Iron Works (GD/BIW) of Bath, ME, and the Ingalls shipyard of Pascagoula, MS, which forms part of Northrop Grumman Shipbuilding (NGSB). Of the 84 Aegis ships funded in FY2005 and prior years, GD/BIW built or is building 41 (7 cruisers and 34 destroyers), and Ingalls built or is building 43 (15 cruisers and 28 destroyers). Building surface combatants is GD/BIW's primary business. Ingalls builds both surface combatants and large-deck amphibious assault ships.

Overhaul and Repair Shipyards

Several U.S. shipyards maintain and repair Aegis ships, with much of the work done under multi-ship/multi-option (MSMO) contracts. Under a MSMO contract, a shipyard is responsible for conducting depot-level maintenance work on several ships in a class.

Combat System Manufacturers

The primary contractor for the Aegis system is Lockheed Martin's Maritime Systems & Sensors division of Moorestown, NJ. Lockheed and the firms that previously owned the Moorestown facility have been the primary Aegis contractor since the 1970s. Other makers of Navy surface ship combat systems include Raytheon, the maker of, among other things, the combat system for the Navy's new DDG-1000 class destroyers, and General Dynamics, the maker of the combat system for the General Dynamics version of the Littoral Combat Ship (LCS).[4] Although Lockheed is the primary contractor for the Aegis system, Raytheon has a share of the system.

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[1] The Navy during this period instead procured three Zumwalt (DDG-1000) class destroyers. The DDG-1000 design does not use the Aegis system. The first of the three DDG-1000s is scheduled to enter service in late-2013. For more on the DDG-1000 program, see CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke.

[2] Navy plans call for procuring nine Flight IIA DDG-51s in FY2010-FY2015, and for shifting in FY2016 to procurement of a new version of the DDG-51 called the Flight III version. The Navy's 30-year (FY2011-FY2040) shipbuilding plan calls for procuring 24 Flight III DDG-51s between FY2016 and FY2031. (Source: Supplementary data on 30-year shipbuilding plan provided to CRS and CBO by the Navy on February 18, 2010.) For more on the Navy's plans for procuring DDG-51s, see CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke.

[3] For more on the Navy's planned 313-ship fleet, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

[4] For more on the LCS program, see CRS Report RL33741, *Navy Littoral Combat Ship (LCS) Program: Background*, (continued...)

Navy Facilities

The Navy's in-house infrastructure for supporting the development and testing of the Aegis system includes a number of laboratories and test facilities in various locations.

Aegis Ship Modernization Program

Purpose of Program

A primary objective of the Aegis ship modernization effort is to improve the ships' combat capabilities so that the ships will remain mission-effective to the end of their intended service lives. A second major objective is to make the ships less expensive to operate, maintain, and modernize over the remainder of their lives. The modernization itself is not intended to extend the ships' expected lives from 35 years to some higher figure, such as 40 years. The Navy's plan to operate Flight IIA DDG-51s for 40 years rather than 35 years could require funding additional maintenance work for these ships.

Planned Modernization Work

The Navy's Aegis ship modernization plan includes modernization of the ships' basic hull, mechanical, and electrical (HM&E) equipment, and modernization of their combat systems. In both areas, the Navy plans to install new systems or components that are more capable than the ones they are to replace. Some of the planned changes are intended to permit the ships to be operated with a smaller crew, thereby reducing their annual operation and support (O&S) costs. Planned changes to the ships' combat systems are intended to, among other things, begin shifting their Aegis computers and software to a more open architecture (OA), meaning, in general terms, an arrangement that uses non-proprietary computers and software. The Navy believes that moving Aegis to an OA design will permit the Aegis system to be updated over the remainder of the ships' lives more easily and less expensively, using contributions from a variety of firms.

The Navy in 2008 decided to expand the scope of the DDG-51 modernization program to include the installation of a BMD capability, so that all DDG-51s would eventually be BMD-capable.[5] Navy plans also call for equipping at least 10 of the 22 Aegis cruisers with a BMD capability.[6]

Cost

In constant FY2010 dollars, the Navy estimates the average cost of each cruiser modernization at about $220 million per ship, and the average cost of each destroyer modernization at about $190 million per ship.[7] On this basis, a program for modernizing 22 cruisers and 62 destroyers would have a total estimated cost of about $16.6 billion in constant FY2010 dollars.

(...continued)

Issues, and Options for Congress, by Ronald O'Rourke.

[5] Otto Kreisher, "BMD Boost," *Seapower*, August 2008: 12-14.

[6] For more on the Navy's plans for BMD-capable ships, see CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke.

[7] Source: Telephone conversation with Navy Office of Legislative Affairs, May 29, 2009.

Schedule

Under the Navy's plan, the oldest cruisers and destroyers are to be modernized first, followed by progressively younger ships. In general, the Navy wants to divide the modernization work for each ship into two shipyard periods—one for HM&E work, the other for combat system work. An exception was the first cruiser to be modernized (Bunker Hill [CG-52]), which received a combined HM&E and combat system modernization that began in February 2008 and was completed in June 2009. The Navy states that the ship's modernization was completed on time and within budget. Two more fully modernized cruisers were scheduled to be delivered in FY2009 and FY2010. Navy plans call for delivering one more in FY2011, and three per year starting in FY2012, until all 22 cruisers are modernized.[8]

The Navy wants each destroyer to receive its combat system modernization two years after its HM&E modernization. The Navy planned to begin the first two destroyer HM&E modernizations in FY2010, followed by three more in FY2011, and two more in FY2012. The Navy plans to begin the first destroyer combat system modernization in FY2012.[9]

Shipyards Performing the Work

The Navy wants to use competitively awarded MSMO contracts for executing the Aegis modernizations. Under the Navy's plan, all U.S. shipyards would be eligible to compete for the contracts. Navy policy calls for modernizations lasting longer than six months to be competed on a coast-wide basis, meaning that competitions would be open to all yards located along the same coast where the Aegis ships in question are homeported.

FY2011 Funding Request

The Navy's proposed FY2011 budget requests funding for one Aegis cruiser modernization availability,[10] three Aegis destroyer modernization availabilities, and long lead-time procurement of equipment for three additional Aegis cruiser modernizations and five additional Aegis destroyer modernizations.[11]

Potential Issues for Congress

Accelerating DDG-51 Modernizations

Some observers are concerned—particularly following the Administration's September 2009 announcement of its intention to use Aegis-BMD ships to defend Europe against potential ballistic missile attacks—that demands from U.S. regional military commanders for BMD-

[8] Navy briefing to CRS and Congressional Budget Office (CBO) on cruiser modernization program, June 10, 2009.

[9] Navy briefing to CRS and Congressional Budget Office (CBO) on cruiser modernization program, June 10, 2009.

[10] When used in this context, the term availability means a period of time during which the ship is in a shipyard, available for work to be performed on it.

[11] Department of the Navy, *Highlights of the Department of the Navy FY2011 Budget*, February 2010, p. 5-5 (pdf page 78 of 165).

capable Aegis ships are growing faster than the number of BMD-capable Aegis ships. Much of the concern focuses on the situation over the next few years, prior to the scheduled establishment of two Aegis Ashore sites in Europe, which observers anticipate will permit a reduction in the number of BMD-capable Aegis ships needed for European BMD operations. One option for addressing this concern would be to accelerate the DDG-51 modernization schedule, so as to get more BMD-capable DDG-51s into the fleet sooner.[12]

Overall Vision Behind Program[13]

Some industry sources have questioned the Navy's logic behind the Aegis ship modernization program, arguing that the Navy lacks a sufficiently thought-through overall vision—a desired end point—for the surface combatant force, and that in the absence of such a vision, the Navy is planning to spend money on Aegis ship modernizations in a scattershot manner, without knowing whether this will lead to the best possible future surface fleet for the Navy. These sources argue that, before spending money on Aegis ship modernizations, the Navy should develop a more fully considered overall vision for the future of the surface fleet that looks at the surface force and the Navy as a whole as parts of a larger network of defense capabilities involving other U.S. military forces. One potential alternative to the Navy's plan would be to forego some or all of the Aegis ship modernizations, accelerate the planned procurement of new cruisers and destroyers, and replace the unmodernized Aegis ships with the accelerated replacement ships.

Shipyards For DDG-51 Modernizations

Some industry sources have proposed allocating all the DDG-51 modernizations to GD/BIW and NGSB, with each firm receiving one-half of the ships. These sources argue that this would reduce the cost of the DDG-51 modernizations by permitting the two firms to achieve sustained learning-curve benefits in the program, and also support the shipbuilding industrial base by providing additional work to the two yards that have built all Navy cruisers and destroyers procured in recent years. Competitive pressure on GD/BIW and NGSB, these industry sources argue, can be maintained by using Profit Related to Offer (PRO) bidding, under which the two yards would bid prices for performing the modernizations allocated to them, with the lower bid winning a higher profit margin.

Scope of DDG-51 Modernizations

Some industry sources have suggested expanding the scope of the DDG-51 modernizations in various ways to further increase the ships' capabilities or further reduce their crew sizes and operating costs. One proposal would add some electric-drive propulsion equipment to the ships' existing mechanical-drive propulsion systems to more fully interconnect the mechanical-drive components, which could reduce the ships' fuel use and create other operational advantages.[14]

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[12] For additional discussion of this issue, see CRS Report RL33745, *Navy Aegis Ballistic Missile Defense (BMD) Program—Background and Issues for Congress*, by Ronald O'Rourke.

[13] This issue, and most of the subsequent potential issues for Congress, are based in part on CRS interviews conducted in January 2007 with several major defense firms that have an interest in the Aegis ship modernization program.

[14] For more on this proposal, see CRS Report RL33360, *Navy Ship Propulsion Technologies: Options for Reducing Oil Use—Background for Congress*, by Ronald O'Rourke.

Aegis Open Architecture

Some observers have expressed concerns about the Navy's plan for moving to an open architecture (OA) on the Aegis system, arguing that it will not shift the Aegis ships to a truly open architecture, or do so quickly enough.[15] For firms that make Navy surface ship combat systems, or parts of them, the issue of how to implement open architecture on Aegis ships and other Navy surface ships has potentially very large business implications. Potential candidates for the basis of an eventual common open-architecture combat system for Navy surface ships include (but are not necessarily limited to) a modularized version of Lockheed's Aegis system, Raytheon's Total Ship Computing Environment Infrastructure, or TSCEI (the core of the combat system being developed for the DDG-1000 destroyers), and the Core Mission System developed by General Dynamics and Northrop for the General Dynamics version of the LCS. The Senate Armed Services Committee's report on the FY2008 defense authorization bill directed the Navy to report to Congress quarterly on the Navy's plan and progress in implementing OA.[16] The Navy submitted the first such report in February 2008.

On September 22, 2008, Raytheon filed a protest with the Government Accountability Office (GAO) for lack of competition in the Navy's plan to award a sole-source contract to Lockheed for modernizing the Aegis combat systems on the fleet's cruisers and destroyers.[17] On December 22, 2008, GAO denied Raytheon's protest.[18]

Legislative Activity for FY2011

The Navy's proposed FY2011 budget was submitted to Congress on February 1, 2010. The budget requests funding for one Aegis cruiser modernization availability, three Aegis destroyer modernization availabilities, and long lead-time procurement of equipment for three additional Aegis cruiser modernizations and five additional Aegis destroyer modernizations.

[15] See, for example, Dan Taylor, "Roughead: Navy Could Be Implementing Open Architecture Faster," *Inside the Navy*, September 29, 2008. See also Dan Taylor, "Report: All Cruisers, Destroyers To Have Open Architecture by 2025," *Inside the Navy*, September 8, 2008; and Geoff Fein, "Navy OA Report To Congress Shows Service Making Gains Across The Enterprise," *Defense Daily*, September 5, 2008.

[16] S.Rept. 110-77 of June 5, 2007 on S. 1547, pp. 272-273.

[17] August Cole, "Raytheon Files Protest On Aegis Work," *Wall Street Journal*, September 24, 2008: B3; Geoff Fein, "As A Measure if Last Resort, Raytheon Files Protest Over Lack of Aegis Competition," Defense Daily, September 25, 2008: 2-3; Rebekah Gordon, "Raytheon Protests Sole-Source Award For Aegis Modernization," *Inside the Navy*, September 29, 2008.

[18] Zachary M. Peterson, with additional reporting by Rebekah Gordon, "GAO Denies Raytheon Protest of Aegis Contract Awards to Lockheed," *DefenseAlert—Daily News (InsideDefense.com)*, December 24,, 2008; Bettina H. Chavanne, "Raytheon Loses Protest Bid On Aegis Modernization Contract," *Aerospace Daily & Defense Report*, January 6, 2009: 6; Geoff Fein, "Navy's Decision To Sole-Source Aegis Work Was 'Unobjectionable,' GAO Says," *Defense Daily*, January 12, 2009: 6.

Author Contact Information

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