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CRS Report for Congress

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

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Summary

The Navy wants to modernize 84 Aegis cruisers and destroyers over a period of more than 20 years at a potential total cost of about $9.7 billion in today's dollars. The modernizations are intended to ensure that the ships can be operated cost-effectively throughout their entire intended service lives. The program poses several potential issues for Congress. This report will be updated as events warrant.

Background

Aegis Cruisers and Destroyers. The Navy's current cruisers and destroyers are called Aegis ships because they are equipped with the Aegis combat system — an integrated combination of sensors, weapons, computers, software, and display systems that was named for the mythological shield carried by Zeus. The Aegis ships are multi-mission ships for conducting missions such as anti-air warfare (air defense), ballistic missile defense, anti-submarine warfare, anti-surface warfare, naval surface fire support for forces ashore, and Tomahawk cruise missile strikes.

The Navy's Aegis ships include Ticonderoga (CG-47) class cruisers and Arleigh Burke (DDG-51) class destroyers. 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, 52 were in service as of the end of FY2007, and the 62nd is scheduled to enter service in 2011. The Navy until recently had planned to keep them in service to age 35, but is now considering extending their service lives to 40 years.

Between 2011, when the 62nd DDG-51 enters service, and 2021, when the first of the 22 remaining CG-47s reaches age 35, the Navy plans to maintain a force of 84 Aegis ships — 22 cruisers and 62 destroyers. These 84 ships equate to about 27%, or more than one-quarter, of the Navy's planned total force of 313 ships.[1] Aegis ships are to account for the majority of the Navy's cruiser-destroyer force until about 2032, and the last of the 84 ships are to remain in service into the 2040s.

Major Contractors for Navy Surface Combatants. The builders of the 84 Aegis ships are General Dynamics' Bath Iron Works (GD/BIW) of Bath, ME (7 CG-47s and 34 DDG-51s), and the Ingalls shipyard of Pascagoula, MS, that forms part of Northrop Grumman Ship Systems, or NGSS (15 CG-47s and 28 DDG-51s). 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.

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).[2]

Purpose of Modernization. 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. Additional maintenance work would be needed to extend the ships' lives to 40 years or some other higher figure.

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 to an Aegis open architecture will permit the

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[1] 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.

[2] For more on the DDG-1000 and LCS programs program, see CRS Report RL32109, *Navy DDG-1000 Destroyer Program: Background, Oversight Issues, and Options for Congress*, by Ronald O'Rourke, and CRS Report RL33741, *Navy Littoral Combat Ship (LCS) Program: Oversight Issues and Options for Congress*, by Ronald O'Rourke.

Aegis system to be updated over the remainder of the ships' lives more easily and less expensively, using contributions from a variety of firms.

Cost. The Navy estimated in 2007 that modernizing the first 8 CG-47s would cost an average of about $221 million per ship, while modernizing the DDG-51s would cost about $78 million per ship in today's dollars. Using these figures, the total cost of the 84-ship effort could be about $9.7 billion in today's dollars. **Table 1** shows annual funding for the Aegis ship modernization program.

Table 1. Funding for Aegis Ship Modernization
(millions of then-year dollars; totals may not add due to rounding)

	FY05	FY06	FY07	FY08	FY09
Aegis cruisers					
RDT&EN	0	13.6	7.7	4.7	4.8
OPN	0	124.5	231.2	216.0	232.4
WPN	0	5.3	18.4	23.4	45.2
OMN	0	41.2	86.7	101.4	111.4
Cruiser subtotal	*0*	*184.6*	*344.0*	*345.5*	*393.8*
Aegis destroyers					
SCN	49.8	49.3	0	0	0
OPN	0	3.0	32.0	52.7	165.5
OMN	0	10.0	3.9	20.9	39.9
Destroyer subtotal	*49.8*	*62.3*	*35.9*	*73.6*	*205.4*
TOTAL	**49.8**	**246.9**	**379.9**	**419.1**	**599.2**

Source: Navy data provided to CRS on May 20, 2008.
Notes: RDT&EN is the Research, Development, Test and Evaluation, Navy appropriation account; **SCN** is the Shipbuilding and Conversion, Navy account; **OPN** is the Other Procurement, Navy account; **WPN** is the Weapon Procurement, Navy account, and **OMN** is the Operation and Maintenance, Navy account. RDT&EN funds are for the ship program only, and do not include funds for Aegis Weapon System development.

Schedule. Under the Navy's plan, the oldest cruisers and destroyers would be modernized first, followed by progressively younger ships. 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. The first cruiser HM&E upgrade began in FY2006, and the first cruiser combat system upgrade was to begin in FY2008 (specifically, February FY2008). Two fully modernized cruisers per year are to be delivered in FY2009 and FY2010, and three per year are to be delivered starting in FY2011. Under this schedule, all 22 cruisers would be fully modernized by FY2016.

The Navy wants each destroyer to receive its combat system modernization two years after its HM&E modernization. The Navy wants to begin the first two destroyer HM&E modernizations in FY2010 and its first two destroyer combat system modernizations (on the same two ships) in FY2012. The Navy want to reach a sustaining rate of three destroyer HM&E modernizations and three destroyer combat system modernizations per year starting in FY2013. Under this schedule, the final fully modernized destroyer would be delivered in FY2032.

Shipyards Performing The Work. The Navy plans 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.

Potential Issues for Congress[3]

Overall Vision Behind Modernization Plan. Some industry sources question 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 next-generation cruisers and destroyers, and replace the unmodernized Aegis ships with the accelerated replacement ships.[4]

Schedule And Sequence For DDG-51 Modernizations. Some industry sources propose that Navy fund four DDG-51 modernizations per year, rather than three, so that the 62-ship DDG-51 modernization program could be finished years sooner. A 4-per-year rate, these sources argue, would reduce total Navy expenditures considerably be improving economies of scale for the DDG-51 modernizations and by more quickly reducing DDG-51 operating costs. Other industry sources argue that the Navy should begin the DDG-51 modernizations with DDG-51s currently under construction, followed by whatever DDG-51s are scheduled for depot-level maintenance. Still others argue that the Navy should upgrade the combat systems on younger DDG-51s when they come into yards for periodic overhaul and repair work, while modernizing older DDG-51s at the same time.

Shipyards For DDG-51 Modernizations. Some industry sources propose allocating all the DDG-51 modernizations to GD/BIW and NGSS, 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

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[3] This section is 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.

[4] The Navy plans to replace the 22 CG-47s with 19 CG(X) cruisers to be procured between FY2011 and FY2023, and the 62 DDG-51s with a comparable number of DDG(X) destroyers, the first of which would be procured in FY2023. The DDG(X) is not to be confused with DD(X), the prior name of the DDG-1000 destroyer (which is not intended as a replacement for either the CG-47s or the DDG-51s). For more on the CG(X) program, see CRS Report RL34179, *Navy CG(X) Cruiser Program: Background, Oversight Issues, and Options for Congress*, by Ronald O'Rourke.

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 NGSS, 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.[5]

Service Life Extension to 40 Years. Another potential option for the Aegis ship modernization program would be to expand its scope to include work that would be needed to extend the service lives of the Aegis ships from 35 years to a higher number, such as 40 years. Extending the Aegis ships' service lives to 40 years could permit the Navy to maintain higher numbers of cruisers and destroyers in future years. The Navy's report on its FY2009 30-year shipbuilding plan, submitted to Congress in early February 2008, incorporates a new assumption that the service lives of all 62 Aegis destroyers will be extended from 35 years to 40 years.[6] Subsequent to the submission of this report, however, a Navy official was quoted as stating that the Navy had not yet officially approved the idea of extending the service lives of those ships.[7]

Aegis Open Architecture. Some industry sources 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. Aegis open architecture is viewed as important by the Navy and industry not only because of its potential effect on the Aegis ships, but also because it might become an initial step toward developing a common open-architecture combat system for other Navy surface ships, such as aircraft carriers, amphibious ships, and LCSs. The issue of how to implement open architecture more widely through the surface fleet is a topic of significant discussion in the Navy. For firms that make (or could make) Navy surface ship combat systems, or parts of them, the financial stakes of the issue are potentially very large. 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.

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[5] 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.

[6] U.S Navy, *Report to Congress on Annual Long-Range Plan for Construction of Naval Vessels for FY 2009*, p. 9.

[7] Zachary M. Peterson, "Destroyer Extension Part of 313-Ship Plan," *NavyTimes.com*, February 11, 2008.

Legislative Activity for FY2009

FY2009 Defense Authorization Bill (H.R. 5658/S. 3001). The *House Armed Services Committee*, in its report (H.Rept. 110-652 of May 16, 2008) on H.R. 5658, recommended approval of the Navy's FY2009 requests for WPN funding for Aegis cruiser modernization (page 73, line 033) and OPN funding for Aegis cruiser and destroyer modernization (page 86, line 016, and page 85, line 007, respectively). The report also recommended $3 million in additional FY2009 Navy research and development funding for DDG-51 permanent magnet hybrid electric propulsion (page 186, line 98).

The *Senate Armed Services Committee*, in its report (S. Rept., 110-335 of May 12, 2008) on S. 3001, recommended approval of the Navy's FY2009 requests for WPN and OPN funding for Aegis cruiser modernization (page 55, line 033,and page 60, line 016, respectively). The report recommended increasing the Navy's FY2009 request for OPN funding for Aegis destroyer modernization by $25 million for planning, engineering, and procurement for service life extension alterations (page 60, line 007). The report also recommended $7.6 million in additional FY2009 Navy research and development funding for DDG-51 permanent magnet hybrid electric propulsion (page 178, line 35; see also the discussion of this item on pages 192-193).

The report discusses the Aegis destroyer modernization program on pages 79-80. In the discussion, the committee states that it views the Navy's plan to extend DDG-51 service life to 40 years as "very high risk," questions whether the Navy has fully evaluated the option of performing the DDG-51 modernizations in the yards where the ships were built, and directs the Navy to submit a report on this option and on the Navy's plan to perform the work through MSMO contracts

The report discusses the Navy's plan to move toward an Aegis open architecture on pages 121-123. In the discussion, the committee expresses concern regarding the Navy's rate of progress in achieving this goal, and directs that no more than 50% of FY2009 funding authorized for certain Navy research and development work on surface ship combat systems may be obligated "until 30 days after submission by the Secretary of the Navy of a detailed program plan for implementing OA for the Aegis combat system. The program plan shall be included in subsequent quarterly reports to the congressional defense committees on Naval Open Architecture, and shall include methodology and scheduling for incrementally opening the Aegis combat system."