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**May 1997**

# **SURFACE COMBATANTS**

## **Navy Faces Challenges Sustaining Its Current Program**



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United States  
General Accounting Office  
Washington, D.C. 20548

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**National Security and  
International Affairs Division**

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May 21, 1997

The Honorable John W. Warner  
Chairman  
The Honorable Edward M. Kennedy  
Ranking Minority Member  
Subcommittee on Seapower  
Committee on Armed Services  
United States Senate

The Honorable C. W. Bill Young  
Chairman  
The Honorable John P. Murtha  
Ranking Minority Member  
Subcommittee on National Security  
Committee on Appropriations  
House of Representatives

Surface combatants—cruisers, destroyers, and frigates—represent over one-third of the Navy's war-fighting fleet and a significant portion of the Navy's annual funding for new ships. This report discusses the Navy's basis for its current and planned surface combatant force, its plans to sustain the current force size into the next century, and the key factors that could affect future force requirements. We conducted this review under our basic legislative responsibilities and are addressing this report to you because we believe it will be useful to your committees in their deliberations on future naval force size and composition, particularly on decisions for the Arleigh Burke-class destroyer, 21st Century Surface Combatant, and the Arsenal Ship. This report contains a recommendation that the Secretary of Defense provide Congress with specific information on the basis for the surface combatant force and on the Navy's plan for sustaining the force.

We are sending copies of this report to the Secretaries of Defense and the Navy and the Director, Office of Management and Budget. Copies will also be made available to others on request.

Please contact me on (202) 512-3504 if you or your staff have any questions concerning this report. Major contributors to this report are listed in appendix IV.

Richard Davis  
Director, National Security  
Analysis

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# Executive Summary

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## Purpose

The Navy currently spends about \$3 billion each year to modernize its surface combatant force. The high cost of these ships, especially the Arleigh Burke-class destroyer at about \$870 million per ship,<sup>1</sup> raises questions about whether the Navy will be able to sustain the fleet size it says is needed to achieve U.S. national security objectives. As a result of these concerns, GAO initiated a review to determine (1) the basis for the Navy's current and future force size, (2) the Navy's plans to sustain the current force size into the next century, and (3) key factors that could affect future force requirements.

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## Background

Surface combatants—cruisers, destroyers, and frigates—provide the Navy with a wide range of capabilities and choices to satisfy U.S. national security objectives. In peacetime, these large, heavily armed multimission ships carry out a wide range of day-to-day overseas presence missions and enhance U.S. crisis response capabilities. During a conflict, surface combatants would conduct combat operations against enemy submarines, surface ships, aircraft, missiles, and targets ashore either independently or with other military forces. Over the last decade, technological advances, such as the Aegis combat system, the vertical launching system (VLS), and the capability to launch Tomahawk cruise missiles,<sup>2</sup> have significantly expanded the range of tasks that the newer, more capable ships entering the force can undertake.

With the end of the Cold War, the Navy significantly reduced its number of surface combatants from about 220 in the late 1980s to 125—115 active cruisers, destroyers, and frigates and 10 reserve frigates—at the end of fiscal year 1996. Although the size of the force has declined, surface combatants represent more than one-third of the Navy's battle force ships,<sup>3</sup> and the proportion and number of ships in the force with the Aegis combat system have been increasing, as shown in table 1. According to the Navy, Aegis-capable ships are considered to be effective in numerous

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<sup>1</sup>This figure is based on the procurement of four Arleigh Burke-class destroyers in fiscal year 1997. The cost for each destroyer depends on the number of ships built each year and the changes made to the ship's design in that year's procurement.

<sup>2</sup>Aegis is an integrated network of computers and displays linked to sensors and weapon systems capable of simultaneously detecting, tracking, and engaging numerous air and surface targets. VLS is a computer-controlled launching system that can store, select, initialize, and rapidly launch different type missiles. Tomahawk is an all-weather, subsonic missile capable of striking sea and land targets located more than 500 miles away. It is launched from surface combatants or attack submarines.

<sup>3</sup>Other battle force ships include active and reserve aircraft carriers, amphibious ships, strategic and attack submarines, patrol and mine warfare ships, and logistics ships. At the end of fiscal year 1996, the Navy had 359 battle force ships.

war-fighting areas and tasks and are best able to defend themselves and protect other forces while providing critical support to ground forces.

**Table 1: Number of Aegis-Capable Surface Combatants by Fiscal Year**

	Actual			Funded		Planned		
	1990	1993	1996	1999	2002	2005	2007	2010
Ticonderoga-class cruisers <sup>a</sup>	16	26	27	27	27	27	27	27
Arleigh Burke-class destroyers	0	2	16	28	37	46	51	57
<b>Total for Aegis-capable surface combatants</b>	<b>16</b>	<b>28</b>	<b>43</b>	<b>55</b>	<b>64</b>	<b>73</b>	<b>78</b>	<b>84</b>
<b>Percentage of surface combatants that are Aegis capable</b>	<b>8</b>	<b>19</b>	<b>34</b>	<b>43</b>	<b>49</b>	<b>54</b>	<b>57</b>	<b>59</b>
<b>Total for all surface combatants</b>	<b>199</b>	<b>148</b>	<b>125</b>	<b>127</b>	<b>130</b>	<b>136</b>	<b>137</b>	<b>142</b>

<sup>a</sup>The first five Ticonderoga-class cruisers have an early, less capable version of the Aegis combat system and do not have VLS or the capability to launch Tomahawk cruise missiles.

The Navy is currently building only one class of surface combatant—the Arleigh Burke destroyer. The Navy has 38 Arleigh Burke-class destroyers in its force, under construction, or under contract as of April 21, 1997, and plans to procure an additional 19 destroyers through the next decade. Completion of the Arleigh Burke destroyer program, along with the earlier procurement of Ticonderoga-class cruisers, will allow the Navy to achieve a force of 84 Aegis-capable surface combatants by fiscal year 2010. The Navy is completing a cost and operational effectiveness analysis for a new surface combatant—known as the 21st Century Surface Combatant—sometime in 1997. This analysis will help determine the surface combatant force levels and mix and the design or designs for this new ship, which will begin construction around fiscal year 2003 and enter the fleet starting around fiscal year 2009.

As mandated by the National Defense Authorization Act for Fiscal Year 1997, the Secretary of Defense is conducting a comprehensive quadrennial review of the defense program. This review, expected to be completed by May 15, 1997, is intended to assess defense needs through the year 2005 and examine strategy, force structure, and modernization plans. The act also requires an independent panel of defense experts to submit a comprehensive assessment of DOD's report and conduct an assessment of alternative force structures through the year 2010 and beyond by December 1, 1997.

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## Results in Brief

The Department of Defense (DOD) and the Navy are pursuing a surface combatant force size and construction program based largely on budget priorities, industrial base concerns, and operational requirements. DOD has not clearly explained the link and any underlying assumptions between the force and the national military strategy. DOD and Navy studies illustrate that the size of the force can vary widely depending on the specific assumptions considered. An explanation of the linkage between force size and key assumptions would assist Congress in evaluating the appropriateness of the Navy's surface combatant program.

The Navy can sustain at least 125 surface combatants through 2013 if it (1) completes its Arleigh Burke-class destroyer construction program as planned, (2) maintains its current build rate of three ships a year, and (3) retains existing ships in its inventory for their expected service lives. However, these conditions hinge on the Navy's ability to sustain budget levels to support its ship construction plans, successfully compete with other Navy and defense programs, and retain its surface combatants longer than achieved for previous ships.

Several factors could affect the size, composition, and overall capability of the surface combatant force through the middle of the next century. These factors include (1) decisions related to the appropriate size and mix of surface combatants within the Navy and other DOD priorities; (2) the design and construction program for the 21st Century Surface Combatant; (3) the results of DOD's ongoing quadrennial defense review, which could change the planning parameters for meeting the mandates of the U.S. military strategy; (4) introduction of new or improved capabilities that could affect doctrine, operational concepts, and responsibilities for the force; (5) introduction of the Arsenal Ship, which could lead DOD and the Navy to reexamine force requirements and employment; and (6) force efficiency strategies, such as expanded overseas home porting and alternative deployment schemes, which could help to increase force availability and use.

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## Principal Findings

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### Basis for the Surface Combatant Force Has Not Been Clearly Explained

The post-Cold War Bottom-Up Review concluded that a Navy comprised of 346 battle force ships<sup>4</sup> would be sufficient to carry out the U.S. military strategy by fiscal year 1999. It did not, however, specify a force goal for surface combatants. In congressional presentations subsequent to the review, DOD and the Navy indicated that 120 to 126 surface combatants would be needed to meet national security objectives. However, this force was determined largely from budget-driven priorities. DOD's current Future Years Defense Program, for fiscal years 1998 through 2003, supports a force of at least 125 surface combatants that, according to DOD officials, is largely based on budget, industrial base, and operational considerations. DOD has not yet established a long-term surface combatant goal based on the number of ships it needs to implement the national security strategy.

DOD has not clearly explained the process used to determine the number of surface combatants needed to fulfill the two nearly simultaneous major regional conflict (MRC) scenario specified in DOD guidance or the number needed to meet desired levels of peacetime presence, as it has done with aircraft carriers. It is unclear what key assumptions support the force size, such as expected allied contributions to war-fighting objectives.

Information is also unclear concerning the Navy's assumptions on the expected service lives of the ships; the pace of the shipbuilding program; the funding level required to sustain the force within and beyond the current Future Years Defense Program; or the effect of emerging technologies and concepts, such as the Arsenal Ship, on force requirements and levels. DOD officials told us that DOD and the Navy are currently examining these issues as part of ongoing studies, such as the quadrennial defense review.

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### Navy Faces Challenges in Sustaining Its Force

The Navy will retire a large number of its older surface combatants as they reach the end of their estimated service lives over the next 2 decades. GAO estimates, using the Navy's notional service life estimates, that the Navy will retire about 75 of its surface combatants between fiscal year 2000 and 2020. Although a relatively small number of ships are expected to retire early next decade, the majority of retirements—55 ships—will occur between fiscal year 2011 and 2018. The ships retiring in these years are the

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<sup>4</sup>Assessments and programming decisions subsequent to the Bottom-Up Review have modified the projected fleet size to about 330 to 346 ships.

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Navy's remaining non-Aegis ships—the Oliver Hazard Perry-class frigates and the Spruance- and Kidd-class destroyers.

By completing the 57-ship Arleigh Burke program, maintaining its current building rate for the new 21st Century Surface Combatant, and retaining ships to their expected service lives, the Navy can sustain at least 125 ships through 2013. The Navy is currently procuring about three Arleigh Burke destroyers annually, with construction taking about 5 years before the ship is delivered to the force. The Navy believes that this rate is the minimum needed to ensure that the shipbuilding industry makes the necessary investment and manages its overhead to reduce Navy program costs. The last Arleigh Burke destroyer is due to be delivered to the fleet around fiscal year 2010. The Navy plans to start building the 21st Century Surface Combatant around fiscal year 2003 and ships will begin to enter the fleet around fiscal year 2009.

The Navy's ability to achieve and sustain a desired force size is affected by the service lives of existing ships, cost of new ships, and funds Congress makes available to build ships. DOD officials note that the cost of operating and supporting the current fleet and other Navy and defense mission priorities also affect surface combatant force size. Navy cruisers and destroyers have historically been retired by 30 years of service and frigates by 22 years of service. In recent force planning for ships, the Navy uses notional estimated service lives of 35 years for Aegis-capable cruisers and all current classes of destroyers and 24- to 32-year service lives for most Oliver Hazard Perry-class frigates retiring after fiscal year 1999. The extent to which these longer service lives can be achieved will have an important bearing on whether the Navy is able to sustain a force of at least 125 ships through 2013.

The high cost of surface combatants is also an important factor in sustaining the force. Acquisition of new surface combatants represents a large portion of the Navy's annual ship and overall procurement funding. Between fiscal year 1990 and 1996, the Navy allocated about 44 percent of its annual funding for ship construction and conversion to surface combatants and about 14 percent of its overall annual procurement funding. Congress appropriated \$3.6 billion for construction of 4 new destroyers in fiscal year 1997 and gave the Navy authority to procure a total of 12 destroyers in fiscal years 1998 through 2001 using a multiyear acquisition strategy. In its biennial budget submission for fiscal years 1998 and 1999, the Navy is requesting about \$2.8 billion and \$2.7 billion, respectively, for the procurement of six destroyers. Continuing this level



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of post-Cold War annual investment could prove increasingly difficult over the long term with the many competing defense modernization programs and other force and readiness priorities in the overall defense program.

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## Several Factors Could Affect Future Force Levels

Several upcoming DOD and Navy decisions are likely to affect the capabilities, size, and composition of the overall force for many decades. For example, an ongoing cost and operational effectiveness analysis for the 21st Century Surface Combatant is due to be completed in 1997 and will be followed later that year by a decision for approval to begin a new acquisition program. In addition, the Navy will be selecting contractor teams to do detailed design work on the Arsenal Ship in early 1998, and Congress will face annual budget decisions on procuring the remaining Arleigh Burke-class destroyers through fiscal year 2005.

Several longer term factors could affect the Navy's future surface combatant force. For example, the ongoing quadrennial defense review could alter the parameters used to plan the future defense program as a whole. Depending on the nature and extent of these changes, the size, composition, required capability, and employment of the surface combatant force, as well as other major military components, could be significantly altered. For example, a recent Navy study illustrated the effect on force size of changing the two nearly simultaneous MRC requirement. With the assumption that a 145-ship force of current ship types, with some allied support, is needed for the current MRC requirement, the assessment calculated that changing the requirement to two simultaneous MRCs could increase the required force size by about 20 ships. Changing the requirement to two sequential MRCs or one MRC could reduce the war-fighting force requirement by as much as 45 ships (assuming some allied support).

Technological innovations could also affect the requirement for surface combatants. These improvements could provide greater efficiencies in the use of the force and allow changes in doctrine and operational concepts that could reduce force requirements. These include improvements to the Tomahawk cruise missile, which could allow the missile to be used for tactical applications in support of ground operations; modifications to the Aegis combat system and Standard missile, which could provide a defense against theater ballistic missile attacks while operating in littoral areas; and introduction of the Cooperative Engagement Capability on existing and new combatants, other ships, and airborne elements, which will enhance ship self-defense capabilities by increasing response time and the

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amount of information available to defend against antiship cruise missile threats. It is also possible that the introduction of the Arsenal Ship, which would carry a large inventory of missiles and potentially serve several military purposes, could permit the Navy and the other services to retire or forego purchases of some assets, such as aircraft carriers, surface combatants, ground-based launchers, or combat aircraft.

Potential changes in operational practices could increase the availability of ships for deployment in peacetime. These changes include consideration of additional overseas home ports and changes to deployment schemes and personnel policies, such as shortening the time between deployments. Lengthening the deployment period, rotating crews, increasing transit speeds, and using different maintenance schemes are other potential options to increase the availability of ships for deployment in peacetime. These options may offer opportunities for the Navy to achieve national security objectives more efficiently as it operates with a smaller force structure and possibly smaller budgets.

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## Recommendations

GAO recommends that the Secretary of Defense provide Congress with specific information regarding the surface combatant force. Such information should include the

- number and types of surface combatants that are needed to fight and win two nearly simultaneous MRCS;
- number of ships that are needed to meet peacetime forward presence objectives;
- key assumptions that support the force level and mix, such as expected allied contributions;
- expected impact of new technologies and capabilities on the size and composition of the future force; and
- impact of the Arsenal Ship on the surface combatant force structure.

GAO also recommends that the Secretary provide information on the Navy's plan to sustain the surface combatant force level, including key assumptions regarding expected service lives, pace of the shipbuilding program, types of ships, required funding, and any other factor that might alter the requirement.

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## Agency Comments

DOD concurred with the information in this report and the recommendation. DOD stated that the information regarding surface

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combatants listed in the recommendation would be provided to Congress as a result of the ongoing quadrennial defense review. DOD indicated that the results of the review should provide a basis for understanding future surface combatant needs. Although the review could establish a strategic context for surface combatants, as did DOD's 1993 Bottom-Up Review, GAO believes that the broad scope of the review may not adequately provide the specific discussion of surface combatant requirements that the recommendation is intended to provide. Thus, considering the significant investment and annual budget requirements needed for surface combatants, GAO has retained the recommendation. DOD's comments appear in appendix III.

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**Abbreviations**

DOD	Department of Defense
GAO	General Accounting Office
MRC	major regional conflict
NATO	North Atlantic Treaty Organization
OPTEMPO	operating tempo
PERSTEMPO	personnel tempo
VLS	vertical launching system



# Introduction

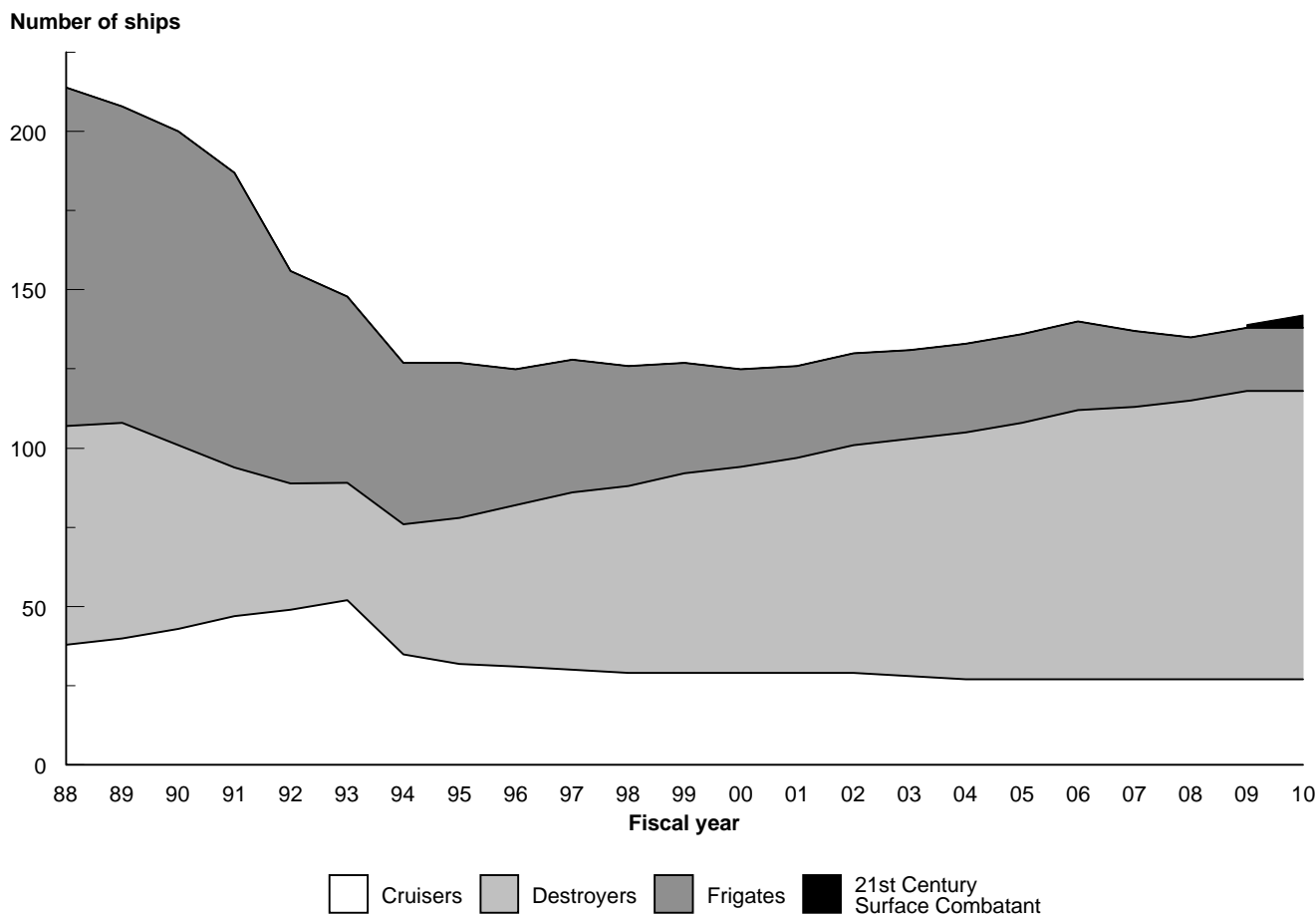
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Surface combatants—cruisers, destroyers, and frigates—are an essential component in most naval and joint force operations. These large, heavily armed multimission ships provide U.S. decisionmakers with a wide range of capabilities and choices to satisfy some overseas presence, crisis response, and war-fighting missions. The overall number of surface combatants has steadily declined over the last decade as the Department of Defense (DOD) has reduced the size of its military forces in response to the end of the Cold War and shifting defense priorities. To reduce its Cold War force, the Navy retired many of its older, less capable surface combatants before the end of their planned service lives. Frigates were reduced more than other surface combatants because of the diminished threat to naval carrier battle groups and merchant shipping in the open ocean. The Navy had 199 surface combatants at the end of fiscal year 1990 and 125 ships at the end of fiscal year 1996. The number of ships will remain at or about the 1996 level through fiscal year 2001 but will gradually increase through the next decade to 142 ships in fiscal year 2010. Figure 1.1 shows the force level changes for cruisers, destroyers, and frigates during fiscal years 1988 through 2010.



Figure 1.1: Changes in Surface Combatant Force Levels From Fiscal Year 1988 to 2010



Source: Our analysis of Navy data.

Although the number of surface combatants has declined, the proportion and number of ships in the force with the Aegis combat system continues to increase.<sup>1</sup> For example, the Navy had only 16 Aegis-capable combatants

<sup>1</sup>The Aegis combat system is an integrated network of computers and displays linked to sensors and weapon systems. It is capable of simultaneously detecting, tracking, and engaging numerous air and surface targets. The system is designed to defeat a wide range of targets from the water's surface to directly overhead. The Navy considers the Aegis system to be effective against antiship cruise missiles and manned aircraft in all environmental conditions. It has an all-weather capability and outstanding abilities against electronic countermeasures. The Navy plans to upgrade the Aegis system to incorporate a capability to defend against theater ballistic missile attacks.

in fiscal year 1990, but at the end of fiscal year 1996 had 43. Completion of the 57 ships in the Arleigh Burke-class destroyer program, along with the earlier procurement of 27 Ticonderoga-class cruisers, will bring the total number of Aegis-capable ships to 84 by fiscal year 2010 and these ships will comprise about 60 percent of the planned surface combatant force. With the exception of the first five Ticonderoga-class cruisers, all Aegis-capable ships will have the vertical launching system (VLS) to fire Tomahawk cruise and Standard surface-to-air missiles.<sup>2</sup> The planned Aegis ship force in 2010 will have about 8,000 VLS cells compared with about 4,600 cells today.<sup>3</sup> Figure 1.2 shows the changes in the number of Aegis-capable ships from fiscal year 1990 to 2010.

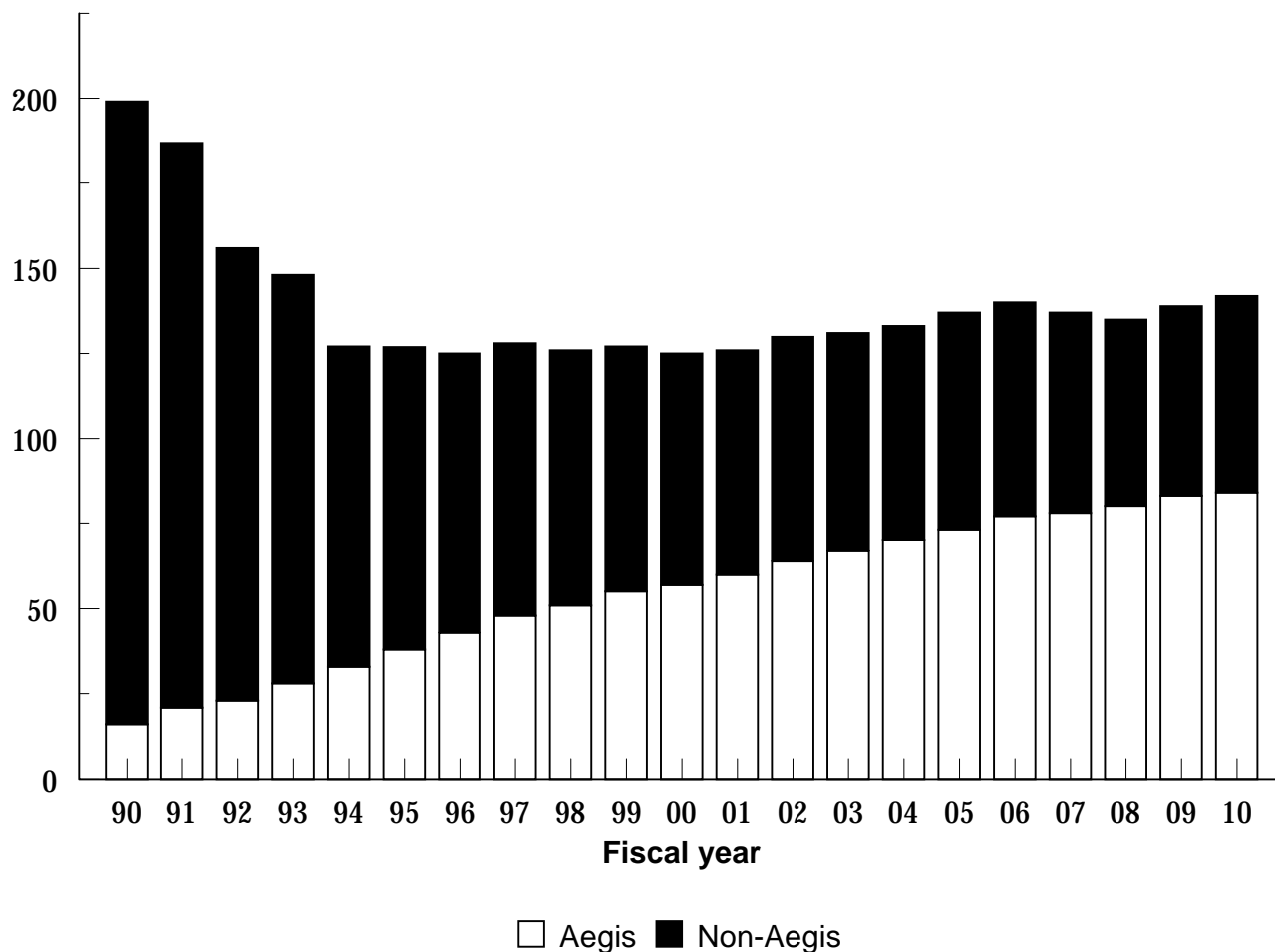
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<sup>2</sup>VLS is a computer-controlled launching system that can store, select, initialize, and rapidly launch different type missiles. Tomahawk is an all-weather, subsonic missile that is capable of striking sea and land targets more than 500 miles away. It is launched from surface combatants or attack submarines. Standard is an all-weather, medium- to long-range, fleet air defense missile that is launched from surface combatants against missiles, aircraft, and ships. The Navy is developing a new version in the family of missiles to provide a future capability to defend against ballistic missiles.

<sup>3</sup>In 2010, Spruance-class destroyers would provide an additional 1,400 VLS cells. The proposed Arsenal Ship force, if built as planned, will have between 2,000 and 3,000 VLS cells. Nuclear attack submarines also provide VLS capability.

Figure 1.2: Number of Aegis-Capable Surface Combatants in the Navy's Fleet Through Fiscal Year 2010

Number of ships



Source: Our analysis of Navy data.

The Navy categorizes its multimission surface combatants as either Aegis-capable or non-Aegis ships. Aegis-capable ships are considered to be effective in numerous war-fighting areas and tasks and are best able to defend themselves and protect other forces while providing critical support to ground forces. Non-Aegis ships are fully capable in several mission areas but have more limited capability in air defense missions.

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Non-Aegis ships include the nuclear-powered Virginia- and California-class cruisers, the Kidd- and Spruance-class destroyers, and the Oliver Hazard Perry-class frigates.

The distinction among surface combatants is primarily the extent of the ship's capabilities, although Aegis-capable ships are normally considered more survivable in more stressing threat environments. For example, Spruance-class destroyers have excellent strike and antisubmarine mission capabilities, but they are limited to self-defense against a narrow range of air threats. The Navy believes that the capabilities of Aegis-capable surface combatants and their ability to perform many tasks simultaneously provide greater flexibility in its operations than non-Aegis ships. Table 1.1 provides some of the major capabilities and differences of cruisers, destroyers, and frigates in the force at the end of fiscal year 1996.

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**Table 1.1: Selected Capabilities of  
Surface Combatant Classes**

<b>Class<sup>a</sup></b>	<b>Number of ships as of Sept. 30, 1996</b>	<b>Initial operational capability date</b>
<b>Cruiser</b>		
Ticonderoga (CG-47) <sup>c</sup>	22	1986
Ticonderoga (CG-47)— without VLS <sup>d</sup>	5	1983
Virginia (CGN-38)	2	1976
California (CGN-36)	2	1974
<b>Destroyer</b>		
Arleigh Burke (DDG-51)	16	1991
Kidd (DDG-993)	4	1981
Spruance (DD-963)	31	1975

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Approximate date of last ship in class retired <sup>b</sup>	Full-load displacement tons	Major combat system	Major weapon systems	Embarked helicopter aircraft	Number of VLS cells
2029	9,600	Aegis	Tomahawk missile Standard missile Antisubmarine rocket MK-46 torpedo MK-45 5"/54 caliber lightweight gun Phalanx close-in weapon system	2 SH-60Bs	122
2022	9,600	Aegis	Standard missile Harpoon missile Antisubmarine rocket MK-46 torpedo MK-45 5"/54 caliber lightweight gun Phalanx close-in weapon system	2 SH-60Bs or 2 SH-2Fs <sup>d</sup>	0
1998	11,000	New Threat Upgrade	Tomahawk missile Standard missile Harpoon missile Antisubmarine Rocket MK-46 torpedo MK-45 5"/54 caliber lightweight gun Phalanx close-in weapon system	None	0
2004	10,450	New Threat Upgrade	Standard missile Harpoon missile Antisubmarine rocket MK-46 torpedo MK-45 5"/54 caliber lightweight gun Phalanx close-in weapon system	None	0
2045	8,300	Aegis	Tomahawk missile Standard missile Harpoon missile <sup>e</sup> MK-46 torpedo MK-45 5"/54 caliber lightweight gun Phalanx close-in weapon system <sup>e</sup>	Planned <sup>e</sup>	90 <sup>e</sup>
2017	9,900	New Threat Upgrade	Standard missile Harpoon missile Antisubmarine rocket MK-46 torpedo MK-45 5"/54 caliber lightweight gun Phalanx close-in weapon system	1 SH-2F	0
2018	9,100	NATO Sea Sparrow Surface Missile System	Tomahawk missile Harpoon missile NATO Sea Sparrow missile Antisubmarine rocket MK-46 torpedo MK-45 5"/54 caliber lightweight gun Phalanx close-in-weapon system	2 SH-60Bs	61

(continued)

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<b>Class<sup>a</sup></b>	<b>Number of ships as of Sept. 30, 1996</b>	<b>Initial operational capability date</b>
<b>Frigate</b>		
Oliver Hazard Perry (FFG-7)	43 <sup>f</sup>	1977

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Approximate date of last ship in class retired <sup>b</sup>	Full-load displacement tons	Major combat system	Major weapon systems	Embarked helicopter aircraft	Number of VLS cells
2018	4,100	Other	Standard missile Harpoon missile MK-46 torpedo MK-75 3"/62 caliber rapid fire gun Phalanx close-in weapon system	2 SH-60Bs or 1 SH-2F <sup>9</sup>	0

<sup>a</sup>Specific capabilities of individual ships or groups of ships in a class may vary because of modifications and upgrades.

<sup>b</sup>Retirement date assumes a 35-year service life for Ticonderoga-class cruisers and all classes of destroyers, and current service life plans for Virginia- and California-class cruisers and the Oliver Hazard Perry-class frigates.

<sup>c</sup>Ticonderoga-class cruisers are from Bunker Hill (CG-52) through Port Royal (CG-73).

<sup>d</sup>The first five Ticonderoga-class cruisers—Ticonderoga (CG-47) through Thomas S. Gates (CG-51)—have an early, less capable version of the Aegis combat system and do not have VLS or the capability to launch Tomahawk cruise missiles. Also, the first two ships of the class have two SH-2F helicopters instead of the SH-60B helicopter employed on later cruisers.

<sup>e</sup>The first 28 Arleigh Burke-class destroyers have a helicopter deck but no hanger or embarked helicopters. Beginning with DDG-79, a helicopter capability—with two embarked SH-60B/F helicopters equipped with the Light Airborne Multipurpose System—will be added for the remaining 29 ships of the class. The modifications require removal of Harpoon missile capability. Also beginning with this ship, the number of VLS cells will be increased from 90 to 96, and the Phalanx close-in weapon system will be replaced by vertical-launched the North Atlantic Treaty Organization (NATO) Evolved Sea Sparrow missiles when they become available.

<sup>f</sup>The Navy currently maintains about 10 Oliver Hazard Perry-class frigates in the Naval Reserve Force to help fill short-term overseas and presence requirements near the United States. All other cruisers, destroyers, and frigates are in the active fleets.

<sup>9</sup>The use of either two SH-60B helicopters or one SH-2F helicopter varies throughout the class. However, two SH-60B helicopters are generally used on the most recently built frigates.

Source: Our analysis of multiple source data.

The Navy considers the newest Arleigh Burke-class destroyer to be its most capable and survivable surface combatant. Originally designed to defend against Soviet aircraft, cruise missiles, and nuclear attack submarines, this higher capability ship is to be used in high-threat areas to conduct anti-air, anti-submarine, anti-surface, and strike operations. It is equipped with an enhanced air and surface multifunctional phased array radar,<sup>4</sup> an Aegis combat system, and VLS. The Navy is also adding several

<sup>4</sup>The radar system—the AN/SPY-1—is the primary air and surface radar for the Aegis combat system. It is a multifunctional phased array radar capable of search, automatic detection, air and surface target tracking, and missile engagement support.

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new capabilities to better adapt the ship for war-fighting in littoral areas.<sup>5</sup> For example, the future version of the ship—Flight IIA—will have an embarked helicopter capability, improved surface-to-air missiles, and increased VLS capacity for missiles. Over the next several years, the Navy plans to upgrade the ship’s multifunctional phased array radar to improve its capabilities while operating in littoral environments and add new capabilities to permit sharing targeting data with other Navy and joint sensors and defend against theater ballistic missiles. Figure 1.3 shows two Arleigh Burke-class destroyers, the U.S.S. Ramage (DDG-61) and U.S.S. Gonzalez (DDG-66).

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<sup>5</sup>Littoral areas extend from the shore to open ocean, generally out to 300 nautical miles, and inland from the shore over that extensive area that can be supported and controlled directly from the sea.

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**Figure 1.3: Arleigh Burke-class Destroyers, U.S.S. Ramage and U.S.S. Gonzalez**



Note: The Navy believes the Arleigh Burke-class destroyer is critical to its fleet modernization plan by supporting future surface combatant force levels and providing the capabilities it considers essential in littoral warfare. The U.S.S. Ramage is on the left, and the U.S.S. Gonzalez is on the right.

Source: Navy.

As a follow-on to the Arleigh Burke-class program, the Navy is evaluating concepts for a new generation of surface combatants—known as the 21st Century Surface Combatant—that is expected to provide the future fleet with the necessary capabilities and be built in sufficient quantities to

provide the required number of ships for overseas presence and war-fighting missions. The Navy is conducting a two-phase cost and operational effectiveness analysis, which is to be completed in 1997, to recommend design alternatives for the new ship, or family of ships, and will be followed later that year by a decision for approval to begin a new acquisition program. A land-attack destroyer is planned as the first variant in the new family of ships, whose primary missions will be to (1) support the establishment of comprehensive battlespace dominance to protect friendly forces from enemy attack and (2) influence events ashore through the application of precision firepower. The Navy intends to begin building the first ship around fiscal year 2003. The new ships will begin to enter the fleet around fiscal year 2009, soon after which a significant number of non-Aegis ships—the Oliver Hazard Perry-class frigates and the Spruance and Kidd-class destroyers—will be retired from the force each year. A full-capability cruiser variant is planned as a replacement for the earliest Aegis-capable cruisers sometime after 2010.

Additionally, a new ship concept—the Arsenal Ship—is being developed initially as a demonstration program to provide a large increase in the amount of ordnance available to ground- and sea-based forces in a conflict, particularly during the early days. The Navy envisions that the ship would have a large capacity of different missiles, including Tomahawk and Standard, and space for future extended range gun systems. The ship could also have a sea-based version of the Army Tactical Missile System. This ship could greatly increase capabilities in littoral operations to conduct long-range strike missions, provide fire support for ground forces, defend against theater ballistic missiles, and maintain air superiority. The Navy envisions the ship to have a small crew (possibly less than 50 members) and be highly survivable. The Navy and the Defense Advanced Research Project Agency are jointly developing and funding the program to allow the Navy to accelerate the ship's development and construction and be able to accept delivery of the first limited capability ship for concept evaluation in October 2000.<sup>6</sup> If the evaluation is successful, the Navy plans to expand the mission capabilities of the demonstration ship and construct three to five additional ships early in the next decade.

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<sup>6</sup>The Arsenal Ship Joint Program is managed by the Defense Advanced Research Projects Agency and includes representatives from the Naval Sea Systems Command and the Office of Naval Research.

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## Objectives, Scope, and Methodology

We initiated a review of the Navy's plans and assessments for the size, mix, and capability of its future surface combatant force as part of our ongoing examination of DOD's planned force structure to support peacetime, crisis, and war-fighting requirements. Specifically, we determined (1) the basis for the Navy's current and future force; (2) the Navy's plans to sustain the current force size into the next century; and (3) the key factors that could affect future force requirements.

To examine the basis for the Navy's current and planned surface combatant force, we reviewed pertinent documentation, including policy directives, planning guidance, strategies, threat assessments, operational histories, statistics, and schedules, and studies and assessments on the surface combatant force structure. We reviewed and conducted analyses using the Navy's force presence model to understand the various factors that affect the required numbers of ships to achieve various overseas presence levels, and we obtained and examined the Navy's assessments of surface combatant requirements for overseas presence. We also reviewed several DOD and Navy studies, including the Naval Forward Presence Report, Surface Combatant Force Level Study, and 21st Century Surface Combatant Force Architecture Assessment, and the preliminary results of the Navy's Cost and Effectiveness Analysis for the 21st Century Surface Combatant program to understand how assumptions on key operational factors affect force size. In addition, we obtained and reviewed information on new technologies and system improvements and alternative operational concepts to identify possible effects on future surface combatant requirements, capabilities, and operations.

To understand how the Navy is using its surface combatant force during peacetime and crises, we discussed past and current naval operations with U.S. Atlantic Fleet and U.S. Pacific Fleet officials. We also spoke with officials of the U.S. Atlantic Command, U.S. Pacific Command, and U.S. Central Command to obtain the joint perspective on Navy operations. Our intent was to determine how naval operations may have changed as a result of declining numbers, increasing unit capabilities, and littoral warfare planning emphasis and whether any trends help to validate the Navy's assumptions for its future force. We obtained and examined briefings on recent deployments of the Atlantic and Pacific Fleets' carrier battle groups to understand the role, use, and missions of their associated surface combatants and determine how surface combatants are being used in peacetime. We also obtained and reviewed briefings for deployments of the Middle East Force surface action group, military exercises, and counternarcotics operations. In addition, we visited three of the Navy's

newest surface combatants—an Aegis-capable Ticonderoga-class cruiser and Arleigh Burke-class destroyer and an Oliver Hazard Perry-class guided missile frigate—to discuss ship operations and capabilities with officers and crew.

To determine the Navy's ability to sustain its future surface combatant force, we examined DOD's Future Years Defense Program, budget documents, congressional testimony statements, and current surface combatant construction and force plans. To understand the long-term sensitivity of ship construction rates and retirements on force size, we spoke with Navy officials and obtained documentation on the issues and key assumptions used in developing future force structure projections for surface combatants. We developed a force projection model that we used to conduct several analyses on the effects of different estimated service lives and procurement profiles on sustaining force levels. To determine the effect of different individual ship costs on future annual procurement requirements and sustaining force levels, we conducted analyses using a ship cost model and rough-order-of-magnitude cost estimates for future ship concepts, which we obtained from the Navy. Additionally, we reviewed surface combatant procurement and construction assumptions. To assess the magnitude of competing funding requirements for several major Navy, Marine Corps, Army, and Air Force procurement programs over the next decade, we obtained and reviewed program and budget documents and congressional testimony and discussed these requirements with program officials. We also analyzed data from historical and current defense programs and longer term procurement plans to determine future funding patterns and requirements.

To establish a point-of-reference for our analysis and discussion of future force levels in this report, we used the Navy's surface combatant force level at the end of fiscal year 1996 of 125 ships. This level is close to levels used in recent defense planning guidance following DOD's Bottom-Up Review and is the lowest surface combatant level at any time during the Cold War, in recent years, or for some time into the future. We use this force level only as point of reference rather than as a verified or suggested force size. In our projections of future force levels, we use the Navy's notional service life estimates, which the Navy uses in its current force planning, to determine individual ship retirements. Additionally, in our force level calculations, we include the future procurement of the new 21st Century Surface Combatant or subsequent ship at an annual procurement rate of three ships, which is consistent with current rates for the ongoing Arleigh Burke destroyer program. However, we did not

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include the possible procurement of up to six Arsenal Ships because of the yet-unproven demonstration of the new ship concept. If procured, these ships, with significant ordnance capability, would add to surface combatant levels and the overall force capability beginning next decade.

We contacted experts and academicians from both public and private organizations to obtain additional perspectives covered in our visits with U.S. military and defense officials. We performed work at the following locations:

In the Washington, D.C., area

- Office of the Secretary of Defense
- Office of the Chairman, Joint Chiefs of Staff
- Office of the Chief of Naval Operations
- Surface Warfare Division, Deputy Chief of Naval Operations (Resources, Warfare Requirements, and Assessments)
- Institute for Defense Analyses
- Defense Intelligence Agency
- Office of Naval Intelligence
- Naval Sea Systems Command
- Naval Surface Warfare Center, Dahlgren and Carderock Divisions
- Commission on Roles and Missions of the Armed Forces
- Applied Physics Laboratory, The Johns Hopkins University
- Global Associates, Ltd.

In the Norfolk, Virginia, area

- U.S. Atlantic Command
- U.S. Atlantic Fleet
- Naval Surface Force, U.S. Atlantic Fleet
- U.S.S. Vella Gulf (CG-72)
- U.S.S. Stout (DDG-55)
- U.S.S. Simpson (FFG-56)
- Navy Doctrine Command

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At MacDill Air Force Base, Florida

- U.S. Central Command

In the Honolulu, Hawaii, area

- U.S. Pacific Command
- U.S. Pacific Fleet

In the San Diego, California, area

- U.S. Third Fleet, U.S. Pacific Fleet
- Naval Surface Force, U.S. Pacific Fleet

We conducted our review from July 1994 to February 1997 in accordance with generally accepted government auditing standards.



# Surface Combatant Program Is Not Clearly Linked to the National Military Strategy

The basis for the Navy's surface combatant program,<sup>1</sup> as well as the underlying assumptions, have not been clearly linked to the key elements of the National Military Strategy. Although DOD's 1993 Bottom-Up Review concluded that a Navy comprised of 346 battle force ships would be sufficient to carry out the strategy by fiscal year 1999,<sup>2</sup> it did not specify a force size for surface combatants. In subsequent congressional presentations, DOD and the Navy indicated that between 120 and 126 surface combatants would be needed to meet national security objectives. However, this figure was derived largely from budget-driven objectives rather than an analysis of war-fighting, crisis response, and overseas presence objectives. DOD's current defense program supports a force of 131 surface combatants in fiscal year 2003 that is largely based on budget, industrial base, and operational considerations. DOD has not yet established a long-term surface combatant goal.

## Revised Defense Strategies Have Reduced the Size of the Surface Combatant Force

During the 1980s, the Navy pursued a 600-ship force goal as part of its maritime strategy to prepare for a global war against the former Soviet Union. This goal included 238 surface combatants. In August 1990, the President announced a shift in U.S. defense strategy from a Soviet threat to major regional conflicts (MRC) against uncertain adversaries. The following year, DOD proposed a "base force" plan to reflect the new strategy that reduced the force structure to about 450 ships (including 150 surface combatants), which would be a sufficient level to counter a possible reemergence of the Soviet threat.

In early 1993, DOD initiated a "bottom-up" review to examine the U.S. defense strategy, force structure, modernization, foundations, infrastructure, and resources needed in the post-Cold War era. Through this review, DOD concluded that the United States should maintain sufficient military power to be able to fight and win two MRCs that occur nearly simultaneously.<sup>3</sup> It also required U.S. forces to engage in expeditionary operations, such as peace enforcement or crisis intervention, and fulfill overseas presence missions. The review

<sup>1</sup>According to DOD officials, the program plan for surface combatants reflects the current Future Years Defense Program (for fiscal years 1998 through 2003) and internal planning for fiscal years beyond the program showing anticipated procurements and retirements.

<sup>2</sup>In addition to surface combatants, battle force ships include active and reserve aircraft carriers, amphibious ships, strategic and attack submarines, patrol and mine warfare ships, and logistics ships. At the end of fiscal year 1996, the Navy had 359 battle force ships.

<sup>3</sup>For planning purposes, DOD defined nearly simultaneous to be a certain number of days between the time that enemy forces mobilize in each conflict. The number of days is classified.

deemphasized the possibility of a reemerging Soviet threat and reduced U.S. forces to levels smaller than the earlier base force plan.

The review concluded that a Navy comprised of 346 battle force ships, to be realized by fiscal year 1999, was sufficient to carry out U.S. strategy and meet national security requirements. The review stated a force size for aircraft carriers (12) and attack submarines (between 45 and 55) but did not state a specific number for surface combatants. In congressional presentations subsequent to the review, DOD and the Navy indicated that a force of between 110 and 116 active and about 10 reserve surface combatants would be needed. Navy officials told us that the force level of 120 to 126 ships was derived from a budget reduction effort to reduce the base force goal for surface combatants by about 25 percent rather than an analysis of force structure requirements.

DOD assessments and programming decisions after the review have modified the projected fleet size to between 330 and 346 battle force ships to provide flexibility for future programming decisions. DOD's current Future Years Defense Program retains this goal for battle force ships and establishes a near-term program plan in fiscal year 2003 of 131 surface combatants (123 active and 8 reserve ships). Table 2.1 summarizes the surface combatant and battle force ship goals under various DOD force structure plans.

**Table 2.1: DOD Force Structure Goals for Surface Combatants and Battle Force Ships**

	Cold War		Post-Cold War	
DOD plan	The Maritime Strategy	Base Force	Bottom-Up Review	Current program plan
Date of plan	FY 1988	FY 1991	FY 1993	FY 1998
Number of surface combatants	238	150	<sup>a</sup>	131 <sup>b</sup>
Total number of battle force ships	600	About 450	346	330-346
Goal achievement date	Mid-1990s	FY 1995	FY 1999	FY 2003

Note: Numbers include both active and reserve ships.

<sup>a</sup>Although a goal was not specified by the Bottom-Up Review, DOD planning guidance in 1994 showed a force of between 120 and 126 surface combatants.

<sup>b</sup>This number of surface combatants reflects the programmed force level in fiscal year 2003. DOD has not established a surface combatant force goal.

Source: Our analysis of DOD and Navy data.

In commenting on our report, DOD officials told us that a long-term surface combatant goal has not yet been established and that the current program plan is largely based on budget, industrial base, and operational considerations. The officials noted that a goal and its basis was under review as part of DOD's 1997 Quadrennial Defense Review and the Navy's assessment for the follow-on surface combatant class to the Arleigh Burke destroyer, the 21st Century Surface Combatant.

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## **Current Strategy Calls for Fighting Two Conflicts**

Current U.S. military strategy requires that the military be prepared to fight and decisively win two nearly simultaneous MRCs.<sup>4</sup> However, the strategy specifies a number for aircraft carriers and attack submarines but not a particular surface combatant force size for carrying out this strategy. DOD believes that two nearly simultaneous MRCs will be the most stressing situation the U.S. military will face in the future. The strategy currently envisions that the MRCs would be a conflict similar to the 1991 Persian Gulf War and a conflict potentially in Korea. DOD considers the timing and location of these conflicts to be uncertain and believes that most required U.S. forces would not be in those areas before the outbreak of the conflict. Therefore, forces already in the area, such as naval forces conducting overseas presence, would provide critical capabilities in the early days of the conflict. Current strategy also states that, although planning for the regional conflicts should include the contributions of U.S. allies, the U.S. military should be sized and structured to act unilaterally if necessary.

The only recent example of surface combatants being used for war-fighting roles in an MRC is the 1991 Persian Gulf War. Surface combatants were used to conduct several sea control and power projection missions, which included protecting maritime traffic, performing maritime intercept operations of contraband shipping to sever Iraqi trade, conducting deep-strike Tomahawk missile attacks against Iraq, and providing combat search and rescue operations in the region. On January 17, 1991, the first day of the war, the Navy had 30 surface combatants—14 cruisers, 10 destroyers, and 6 frigates—deployed in the region. Among the 30 ships, 14 had a capability to launch Tomahawk missiles, and 9 ships were equipped with Aegis, including 7 of the Tomahawk-capable ships.

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<sup>4</sup>Current U.S. military strategy also requires the military to be able to (1) deploy or station forces abroad in peacetime to shape the international security environment in favorable ways; (2) conduct a wide range of contingency, or crisis, operations to intervene when U.S. interests are threatened; and (3) prevent and defend against the use of nuclear, biological, or chemical weapons.

The specific circumstances of the two envisioned MRCs would significantly affect the number of ships the Navy might use. According to current strategy documents, the Navy envisions a greater emphasis on fighting in littoral areas in the future. The Navy also envisions that surface combatants will (1) conduct battlespace dominance missions against air, surface, and undersea threats to make the area safe for joint force operations; (2) perform power projection missions to provide strategic strike and naval surface fire support capabilities in support of the joint land and air campaigns; and (3) provide joint forces with command, control, information, and surveillance support. Specifically, surface combatants would

- support and defend carrier battle groups, amphibious task forces, and mine countermeasure ship operations;
- provide defense against enemy theater ballistic missile attacks;
- fire missiles and guns against enemy units ashore;
- protect maritime and air traffic;
- collect intelligence information; and
- interdict enemy maritime shipping.

The Navy has not said how this shift in strategy to fighting in littoral areas would affect the size of its surface combatant fleet. However, it believes that the postulated threats and probable roles and missions assigned to its surface combatants require that the force consist of a large number of Aegis-capable ships. These ships can perform several simultaneous tasks more effectively than the non-Aegis-capable ships and operate independently in high-threat areas. The Navy envisions using its non-Aegis-capable ships for maritime intercept operations; protection of sea and air routes; and battlespace dominance missions, including protection of carrier and amphibious forces. It also expects allies to provide a limited number of less capable ships that would help to offset requirements for similar U.S. ships.<sup>5</sup>

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<sup>5</sup>According to the Navy's August 1995 Surface Combatant Force Level Study, draft Navy MRC scenario plans anticipate that the Japanese Maritime Self-Defense Force would provide surface combatants for protection of sea lanes and defense of their homeland in an MRC in the northwest Pacific Ocean. Additionally, the United Kingdom, France, Australia, New Zealand, and Canada may support the United States in future MRCs with less capable destroyers and frigates than the U.S. Navy's Aegis-capable ships.

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## **Forward Deployed Ships Help Satisfy Crisis Response and Presence Mandates**

Forward deployed ships help the Navy meet the U.S. military requirement to be able to respond rapidly to crises. The extent and location of surface combatant and battle force ship deployments are based on the need to provide deterrence, respond to crises, and maintain a presence overseas.<sup>6</sup>

Crisis and contingency missions for surface combatants include maritime intercept operations to enforce sanctions, humanitarian relief, air surveillance and air control, protection of U.S. forces, and strike operations. For example, in support of ongoing NATO peacekeeping operations in the former Republic of Yugoslavia, a Ticonderoga-class Aegis cruiser, the U.S.S. Normandy, made a high-speed transit in September 1995 from the Strait of Gibraltar to the Adriatic Sea and then fired several Tomahawk missiles against Bosnian Serb military targets. Another Ticonderoga-class cruiser, the U.S.S. Monterey, left the Central Command's area of responsibility in December 1995 and accompanied the aircraft carrier U.S.S. America to the Adriatic Sea to support NATO force deployments into Bosnia.<sup>7</sup>

Figure 2.1 shows an Aegis-capable cruiser conducting maritime interception operations to enforce U.N. sanctions against Iraq in the Arabian Gulf during December 1996.

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<sup>6</sup>During peacetime, the Chairman of the Joint Chiefs of Staff, service chiefs, and chiefs of the five unified commands establish long-range planning guidance for the location and number of U.S. naval forces assigned to all regions on a fair-share basis. This scheduling guidance—Global Naval Force Presence Policy—can be adjusted, as necessary, to meet unexpected contingencies. This policy results in planned gaps in various theaters, particularly in the Mediterranean Sea and Indian Ocean.

<sup>7</sup>The Central Command is one of five unified U.S. commands. The other four are the Atlantic, European, Southern, and Pacific Commands. The commands are composed of forces from two or more of the military services. The commanders in chief of these commands are responsible for all operations within their designated geographic areas.

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**Figure 2.1: U.S.S. Valley Forge Aegis Cruiser Stops and Interrogates a Merchant Ship Crew Suspected of Violating Sanctions Against Iraq**



Note: Maritime interception operations to enforce sanctions or monitor drug traffic into the United States is an increasingly important mission for surface combatants in recent years.

Source: Navy.

The Navy believes that surface combatants and other forward deployed forces will be important early in a conflict. Surface combatants can provide protection of sea and air routes, ports, coastal airfields, and facilities and substantial command, control, and communications capabilities. The Navy also believes that surface combatant forces will provide initial capabilities until additional forces arrive in the area.

Forward-deployed surface combatants could be available to immediately strike targets on land with Tomahawk cruise missiles and provide naval fire support for ground forces. In the future, they are also expected to provide defense against ballistic missiles. A 1995 Navy surface combatant study concluded that defense against theater ballistic missile and Tomahawk strikes will be a high-priority task of Aegis-capable ships early in an MRC.

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## **Forward Presence Is a Key Component of Defense Strategy**

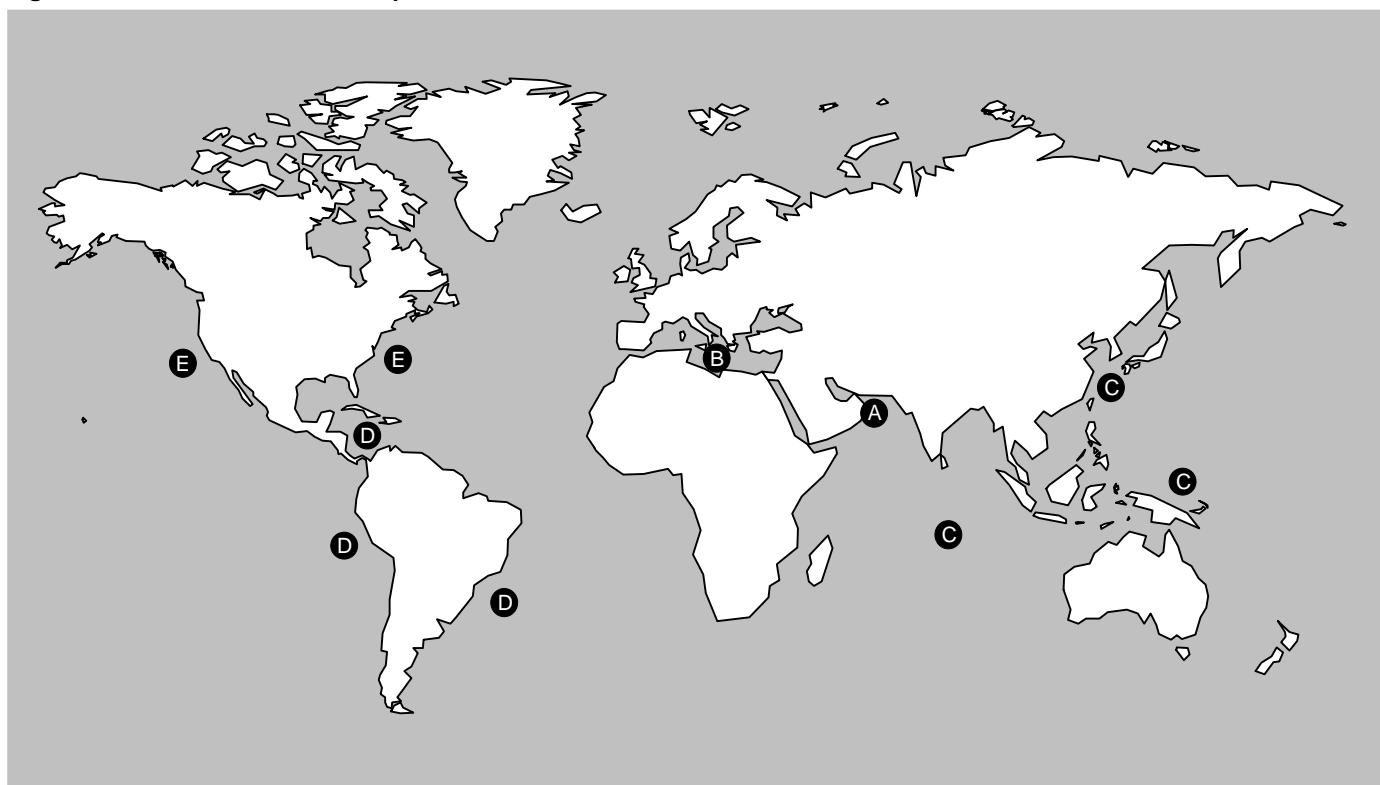
In addition to providing a means to respond rapidly to a crisis, the Navy forward deploys ships to carry out other U.S. strategic objectives, such as providing stability and deterrence. Surface combatants and other naval forces, including aircraft carriers, amphibious ships, and attack submarines, routinely deploy to maintain U.S. presence throughout the world. At any given time, the Navy has about one-fifth of its surface combatant force deployed overseas to conduct a variety of overseas presence missions.

Surface combatants conduct a wide range of presence missions and tasks, such as making protocol visits in foreign ports and conducting regional, bilateral, and multilateral training exercises to enhance diplomacy and improve interoperability among allies. In recent years, these ships have provided substantial contributions to U.S. counternarcotics operations around Central and South America by conducting surveillance and interception missions.

Surface combatants can deploy with an aircraft carrier as part of a carrier battle group, with several other combatants as a surface action group, or independently. The number of surface combatants needed to carry out such operations depends on the types of deployments that DOD elects to use. Figure 2.2 shows the operating areas, deployment types, and activities for surface combatants during peacetime.

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**Figure 2.2: Peacetime Presence Operations of Surface Combatants**



Map location	Unified command	Area	Types of operations	Number of surface combatants deployed or underway on Feb. 3, 1997
A	Central Command	Red Sea and Arabian Gulf	Carrier battle group and surface action group deployments	9 deployed
B	European Command	Mediterranean and Adriatic Seas	Carrier battle group and independent deployments	6 deployed
C	Pacific Command	Pacific and Indian Oceans	Carrier battle group and independent deployments and training	10 deployed
D	Southern Command	Caribbean Sea and Pacific and Atlantic Oceans near South America	Counternarcotics and independent deployments	6 deployed
E	Pacific and Atlantic Commands	Pacific and Atlantic Oceans near the United States	Battle group and independent training	20 underway



Source: Navy.

Currently, the majority of surface combatants deploy as part of carrier battle groups for routine 6-month deployments to the Mediterranean Sea, western Pacific Ocean, and North Arabian Sea. As a major element of a carrier battle group, surface combatants provide the primary defensive capabilities for the group and contribute significant strike and fire support for joint operations ashore. Navy officials stated that one or more surface combatants are necessary at all times to escort and protect the aircraft carrier. Without them, an aircraft carrier could not safely deploy. Although the Navy has emphasized using its surface combatants more independently, they are still inherently linked to carrier force structure and deployments.

The Navy's notional carrier battle group has six surface combatants, an aircraft carrier and its airwing,<sup>8</sup> two nuclear attack submarines, and a fast combat support (logistics) ship. This notional configuration is considered to have the necessary capabilities to provide an initial crisis response from a forward posture. However, the actual number and type of ships assembled for each deployment will depend on the available assets, surface combatants already in area, and the needs of the joint unified commands. As shown in table 2.2, recent Atlantic Fleet carrier battle groups generally deployed with the Navy's notional configuration and corresponding capabilities, whereas recent Pacific fleet deployments were configured with fewer ships and embarked helicopters than the notional configuration. Appendix I summarizes the roles, missions, and specific tasks of surface combatants as part of the deployments of seven carrier battle groups from the Atlantic and Pacific Fleets between May 1994 and February 1996.

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<sup>8</sup>A carrier air wing includes fighter, attack, electronic countermeasures, antisubmarine, refueling, search and rescue, special warfare support, and surveillance aircraft.

**Table 2.2: Surface Combatants in the Navy’s Notional Configuration and Recent Atlantic and Pacific Fleet Carrier Battle Groups**

Carrier battle group configuration	Total number of surface combatants in group	Number of surface combatants with capability			Number of embarked helicopters among ships
		Aegis combat system	VLS	Tomahawk cruise missile <sup>a</sup>	
Navy notional	6	3	4	4	10
Atlantic Fleet <sup>b</sup>	6	2-3	2-5	2-5	7-9
Pacific Fleet <sup>c</sup>	3-4	1-2	1-3	1-3	4-8

<sup>a</sup>Some groups included Virginia-class cruisers, which do not have VLS but can launch Tomahawks with their armored box launcher systems.

<sup>b</sup>These figures are based on five sequential Atlantic Fleet carrier battle group deployments between May 1994 and July 1996.

<sup>c</sup>These figures are based on five sequential Pacific Fleet carrier battle group deployments between June 1994 and May 1996.

Source: Our analysis of Navy data.

Surface combatants can also be deployed without a carrier either independently or as part of a surface action group. A surface action group generally consists of two or more surface combatants and deploys for unique operations, such as augmenting military coverage in world regions, providing humanitarian assistance, and conducting exercises with allied forces.

Several operational factors also affect how the surface combatant forces are employed. For example, routine maintenance and long-term overhaul requirements render about 10 percent of the force unavailable for deployment at any given time. Appendix II discusses various operational factors and their affect on the Navy’s management of its surface combatant fleet.

## Force Size Varies Widely Based on Assumptions

DOD and Navy studies illustrate that the size force needed to meet Navy presence and war-fighting requirements is highly dependent on the assumptions made. For example, in its August 1994 assessment, Naval Forward Presence Report, DOD analyzed peacetime presence options for naval forces to meet the five unified commands’ unconstrained requirements for naval presence. It concluded that the unified commands’ naval force requirements generally exceeded the levels of available assets.

The report stated that “. . . the totality of this set of all-encompassing requirements is beyond what could be reasonably covered by naval forces alone, it is a representation of the broad scope of presence missions confronting the theater commander” and that “. . . any exercise in determining alternative force structures must necessarily account for other service contributions . . . .”

The assessment also stated that the most important overseas presence requirements can be met through a range of measures, including “tethers”,<sup>9</sup> other service forces, and greater acceptance of periodic presence in some cases. Further, the assessment indicated that alternative naval force groups, consisting of various combinations of surface combatants, submarines, and land-based aircraft, can perform certain naval presence tasks when an aircraft carrier and its airwing are unavailable.<sup>10</sup>

Changing assumptions, such as operating tempo, availabilities, and originating ports and destinations, can also alter conclusions about force requirements. The Navy has periodically assessed naval force requirements using a model to calculate the total force necessary to meet the unified commands’ presence requirements for given assumptions and inputs. Altering key assumptions has yielded total force estimates that ranged from 126 to 144 surface combatants. For example, the Navy’s most recent analysis concludes that 126 surface combatants can meet current unified commands’ presence requirements. The lower estimate results from several changes to inputs in the model, such as (1) basing distances used in the model on the location of recent naval engagements, (2) redefining the number of months between deployments, and (3) changing the origin of ships to deployed areas.<sup>11</sup> These changes improve the overall efficiency and availability of ships to deploy and

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<sup>9</sup>Tether refers to the practice of maintaining ships at acceptable distances away from a specific area of presence operations while allowing them to return within a specified number of days. The tethered presence policy is a Chairman, Joint Chiefs of Staff, and DOD policy that is supported by funding in the fiscal year 1998 budget and the Future Years Defense Program for fiscal years 1998 through 2003. This policy results in lower force level requirements than those needed to support continuous presence in all three major regions.

<sup>10</sup>In our reports, *Navy Carrier Battle Groups: The Structure and Affordability of the Future Force* (GAO/NSIAD-93-74, Feb. 25, 1993) and *Cruise Missiles: Proven Capability Should Affect Aircraft and Force Structure Requirements* (GAO/NSIAD-95-116, Apr. 20, 1995), we suggested that DOD consider relying more on groups comprised of surface combatants, particularly those equipped with cruise missiles, for some presence and crisis missions to reduce aircraft carrier requirements.

<sup>11</sup>The Navy revised the origin of surface combatants assigned to the Middle East Force in the Central Command’s area of responsibility to achieve a more efficient forward presence rotation of ships. Instead of assigning all five ships from San Diego, California, the Navy began sending three from Norfolk, Virginia; one from Pearl Harbor, Hawaii; and one from San Diego. By reducing the distance for some ships, the overall number of ships needed to support the forward presence is reduced.

results in an overall reduction in the number of ships required to maintain a given level of presence. More recently, DOD analyses for the ongoing quadrennial defense review show that tethered presence requires about 110 surface combatants, including 16 ships assigned to the Western Hemisphere group and 10 with similar missions on the West Coast of the United States, to support operations, such as counternarcotics, in other areas. DOD considers this force to be adequate to meet the apportionment of forces required by the commanders in chief for the current two nearly simultaneous MRC strategy.

Similarly, the Navy's Surface Warfare Division's August 1995 Surface Combatant Force Level Study concluded that 165 cruisers, destroyers, and frigates would be needed through 2010 to meet war-fighting requirements of two nearly simultaneous MRCs. According to the study, however, this number could be reduced to 145 ships, including 10 reserve frigates, with use of allied surface combatants. Subsequently, a related study, 21st Century Surface Combatant Force Architecture Assessment, completed in February 1996 by the Naval Surface Warfare Center, suggested that the surface combatant force level from 2010 to 2030 could be even smaller than the 145-ship force recommended by the earlier study because (1) better weapon systems could permit some operations to be more effective or allow a ship to operate in safer waters farther from shore; (2) new classes of surface combatants might provide a more tailored mix of capability to fight littoral warfare; and (3) deployment strategies, when used with the new classes, would reduce current peacetime deployment ratios, thereby increasing ship availabilities. The study concluded that peacetime and wartime requirements can be satisfied after 2010 with new ship classes and the use of innovative forward presence concepts.

Neither DOD nor the Navy has endorsed the findings and conclusions of either of the Navy's studies. However, these studies, as well as others, are being used by the Navy's cost and effectiveness analysis group in its evaluations of concepts and force requirements for the 21st Century Surface Combatant.

# Navy Can Sustain Its Current Force Size Through 2013

The Navy can sustain its current surface combatant force size of at least 125 ships through 2013 by completing its 57-ship Arleigh Burke-class destroyer program, building the new 21st Century Surface Combatant, and retaining ships for their expected service lives. If the Navy builds 3 ships each year for the 21st Century Surface Combatant program—the same as its recent average rate for the Arleigh Burke program—the force will fall below 125 ships after 2013 and remain at lower levels for the remainder of the decade. The lower force levels result from the large number of retirements occurring during this time. By 2020, the Navy will have about 115 surface combatants. The Navy would have to build 4 to 5 ships each year after completion of the Arleigh Burke program to sustain a force of at least 125 surface combatants through 2020.

Sustaining a force of at least 125 ships to 2013 depends on the Navy's ability to keep surface combatants longer than it has in the past. Cruisers and destroyers have historically been retired from the force by 30 years and frigates by 22 years. However, the Navy plans to retain most of its current cruisers and all of its destroyers for 35 years and most of its frigates retiring after fiscal year 1999 for 24 to 32 years. The Navy believes this plan is feasible because of the use of less maintenance-intensive gas turbine propulsion systems, rather than steam, and modular, highly computerized weapon systems on some ships, permitting relatively easy and cost-effective upgrades.

Unless the next new combatant class is less costly than the Arleigh Burke-class destroyer, which currently costs about \$870 million per ship,<sup>1</sup> increasing the number of ships built annually may be difficult over the long term because of competition for funding from several other Navy ship, aircraft, and weapon modernization programs as well as other services' programs.

## Ship Retirements Could Affect Future Surface Combatant Requirements

The Navy's current shipbuilding plan through fiscal year 2003 supports continued procurement of the Arleigh Burke-class destroyer and the introduction of the 21st Century Surface Combatant. The Navy is procuring about three Arleigh Burke-class destroyers annually, with construction taking about 5 years before the ship is delivered to the force. The Navy believes that this rate is the minimum needed to ensure that the shipbuilding industry makes the necessary investment and manages its

<sup>1</sup>The \$870 million figure is based on procurement of four Arleigh Burke-class destroyers in fiscal year 1997. The cost varies with the number of ships built each year and the changes made to the ship's design in that year's procurement.

overhead to reduce Navy program costs.<sup>2</sup> The Navy plans to begin building the first 21st Century Surface Combatant in fiscal year 2003. Table 3.1 shows the Navy's current shipbuilding plan for surface combatants through fiscal year 2003, including expected delivery dates and resulting force levels. The Navy plans to procure the remaining four Arleigh Burke-class destroyers in fiscal years 2004 and 2005, with the last ship being delivered to the fleet around fiscal year 2010. However, DOD indicates that the results of the soon-to-be-completed 21st Century Surface Combatant cost and operational effectiveness analysis could change the total number of Arleigh Burke-class destroyers to be procured.

**Table 3.1: Navy's Shipbuilding Plan for Surface Combatants**

	Fiscal year							
	1996	1997	1998	1999	2000	2001	2002	2003
Number of Arleigh Burke-class destroyers	2	4	3	3	3	3	1	2
Number of 21st Century Surface Combatants	0	0	0	0	0	0	0	1 <sup>a</sup>
Number of other new ships <sup>b</sup>	3	2	1	2	2	3	4	3
<b>Total new construction ships</b>	<b>5</b>	<b>6</b>	<b>4</b>	<b>5</b>	<b>5</b>	<b>6</b>	<b>5</b>	<b>6</b>
Approximate fiscal year of delivery for new destroyers	2001	2002	2003	2004	2005	2006	2007	2008
Surface combatant force level after delivery <sup>c</sup>	126	130	131	133	136	140	137	135

<sup>a</sup>The first 21st Century Surface Combatant is planned to be delivered during fiscal year 2008 but will not achieve initial operating capability in the fleet until fiscal year 2009.

<sup>b</sup>Other new ships in fiscal years 1996 and 1997 included an SSN-21 class attack submarine, an LHD-1 class amphibious assault ship, an LPD-17 class amphibious transport dock ship, and two oceanographic ships. In fiscal years 1998 through 2003, the plan includes another Nimitz-class nuclear aircraft carrier, four New Attack Submarines, nine LPD-17 class amphibious transport dock ships, and one fast combat support ship. This plan does not reflect possible procurements of Arsenal Ships, which may occur during this period.

<sup>c</sup>Force levels reflect retirements based on current Navy notional service lives.

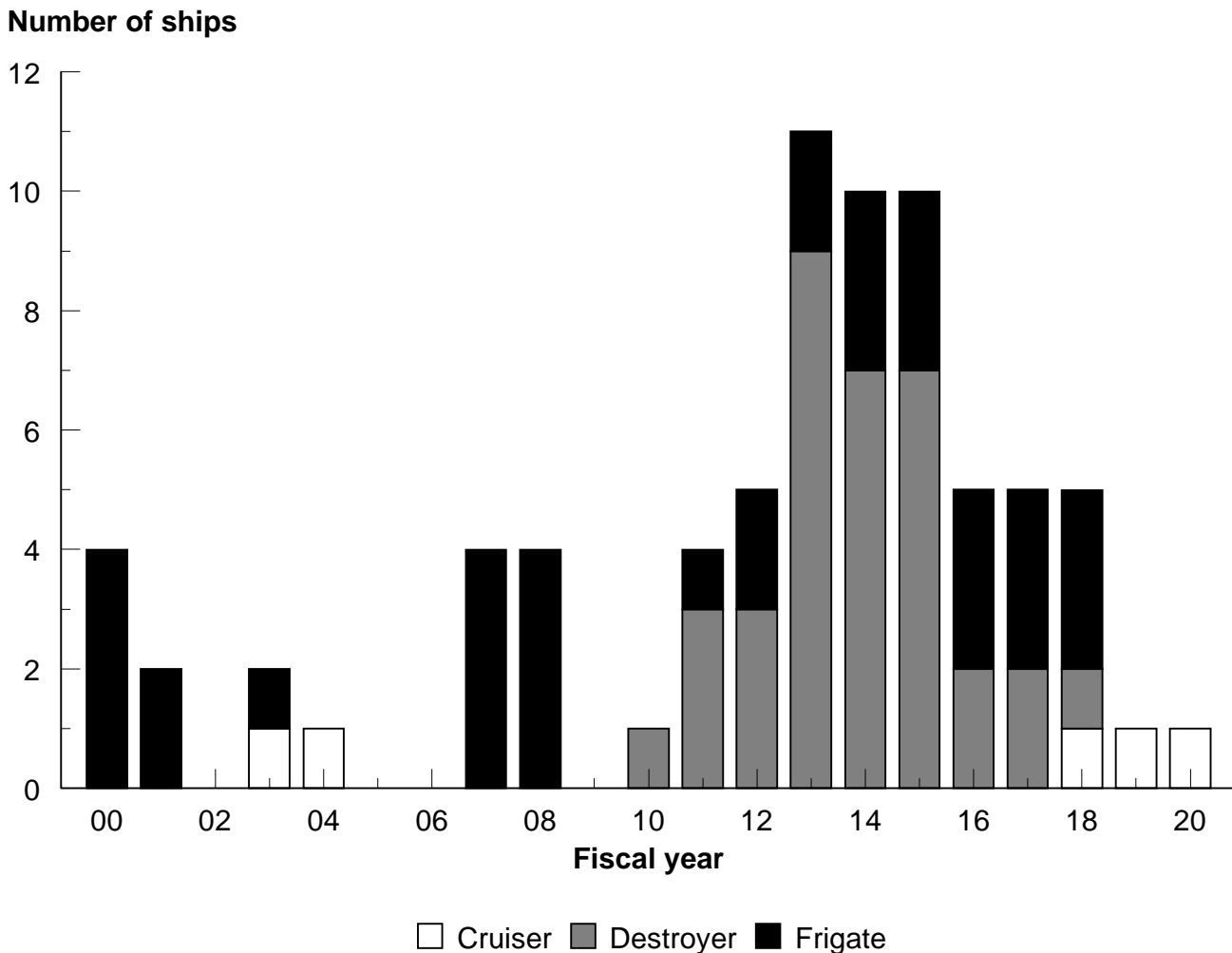
Source: Our analysis of Navy data.

Sustaining a surface combatant force of at least 125 ships beyond the end of the next decade will become increasingly difficult for the Navy because a large number of surface combatant retirements will begin around that time. According to our estimates, the Navy will retire about 75 of its surface combatants between fiscal year 2000 and 2020. However, the majority of these retirements—55 ships—will occur between fiscal year 2011 and 2018. The ships retiring during this 8-year period represent the

<sup>2</sup>Two private shipbuilding contractors currently build Arleigh Burke-class destroyers: Bath Iron Works Corporation in Bath, Maine, and Ingalls Shipbuilding, Inc., in Pascagoula, Mississippi. Both contractors have significant design, construction, and combat systems integration capabilities.

last of the Navy's current non-Aegis ships—the Oliver Hazard Perry-class frigates and the Spruance- and Kidd-class destroyers. Figure 3.1 shows the approximate number of surface combatants that are to be retired each year between fiscal year 2000 and 2020.

Figure 3.1: Projected Surface Combatant Retirements From Fiscal Year 2000 to 2020



Source: Our analysis of Navy data.

The Navy's ability to achieve and sustain a desired force size is affected by the following three major factors:

- the service lives of existing ships (the length of time between a ship's commissioning and retirement), which determine when ships need to be replaced if the force level is to be sustained;
- the cost of new ships, which is determined largely by the capabilities of those ships; and
- the funds Congress makes available to construct new ships, which ultimately determines whether the required ships can be built.

Ultimately, the Navy must achieve a balance among ship retirements, new ship cost, and the likely available funding to enable it to build ships with the necessary capabilities and in sufficient numbers to sustain the desired force. Figure 3.2 shows how these factors affect the Navy's ability to sustain a particular surface combatant force level.

**Figure 3.2: Major Factors That Sustain the Surface Combatant Force**

$$\begin{array}{ccccc}
 & & \text{Average annual procurement} & & \\
 & & \text{funding available for combatants} & & \\
 & & \hline
 \text{Force level to} & = & & \times & \text{Average} \\
 \text{be sustained} & & \text{Average cost of a new combatant} & & \text{service life of} \\
 & & & & \text{current force} \\
 & & \text{<--Average annual construction rate-->} & & 
 \end{array}$$

Source: Navy.

If the average service life of the current force is 35 years and the cost of new ships being built is \$900 million, for example, the Navy would need average annual procurement funding for surface combatants of about \$3.2 billion each year to sustain a 125-ship force level. By contrast, if the Navy plans to sustain a larger force, such as a 138-ship force, it would need about \$3.6 billion each year to support ship construction.<sup>3</sup>

<sup>3</sup>The "average annual procurement funding available for combatants" divided by the "average cost of a new combatant" results in the average annual construction rate necessary to support the force level. In the given examples, the formula would yield a hypothetical average of 3.6 and 3.9 ships each year, respectively.



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DOD believes this calculation assumes a steady-state construction rate, that is, ships leave the force at the same rate they arrive. As a result, DOD believes the calculation provides only a rough estimate for force size planning and is applicable only if the force objective remains constant throughout the service life assumed, which has never occurred historically. However, our intent in using this calculation is to show the dynamics, and the resulting difficulties, of sustaining ship force levels.

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## Retaining Ships Longer Helps to Mitigate New Construction Requirements

Determining the useful service lives of ships is a major factor in planning and budgeting for future force levels. The estimates of expected service lives are used to help determine the rate at which new ships must be acquired to sustain a given force size. The longer the Navy retains ships in its force means the longer it can delay replacing those ships. However, if ships are retired earlier than anticipated, the Navy must adjust its shipbuilding plan and budget to sustain desired force levels. Due to the length of time required to construct modern combatants—about 5 years—early retirements must be identified as soon as possible to make the needed adjustments.

Navy cruisers, destroyers, and frigates have historically been retired by 30 years, although recent deactivations have occurred earlier than planned as the force was downsized since the end of the Cold War. For its August 1995 Surface Combatant Force Level Study, the Navy analyzed the actual service lives of surface combatants constructed since World War II and found that most ships were retired before 30 years (frigates were retired at around 22 years). In particular, the study noted that lives were significantly shorter for ships that were not upgraded with new combat systems or had significant maintenance problems associated with their steam engineering systems. For example, combat systems for cruisers, which usually have the most demanding missions, became obsolete in about 12 to 16 years unless they were extensively modernized to meet projected threats. When the combat systems were upgraded and the ships were modernized, the ships served up to 30 years. Table 3.2 shows the historical service lives of ships built after World War II. In informal written comments to the report, DOD noted that the historical data was somewhat distorted because of earlier-than-planned retirements of some ships, particularly frigates, since 1990.

**Table 3.2: Historical Service Lives for Navy Surface Combatants Built After World War II**

Figures in years		
Ship type	Ship as built	Ship with upgrades
Cruiser	14-22	27-30
Destroyer	15-20	29-30
Frigate	21-22	<sup>a</sup>

Note: Historical service lives are based on actual retirements for ships that were built after the end of World War II.

<sup>a</sup>Frigates that were built as single-purpose antisubmarine warfare escorts have become obsolete in 21 to 22 years. Weight and size limitations have precluded easy modernization, and nonredundant engineering plants have limited survivability in combat.

Source: Navy.

The Navy noted that, on the basis of historical service lives, notional estimates for surface combatants cannot be realized without modernization and upgrades to the ships and their combat systems. When modernized, some ships may exceed the current estimates. The Navy specifically identified most of the Ticonderoga-class cruisers as possible candidates for life-extending upgrades. It also noted that, even though combat systems are becoming obsolete faster as the threat becomes more rapidly adaptive, the use of modular, software-based combat systems will permit more frequent cost-effective upgrades to maximize service lives in the future. Additionally, the use of gas turbine propulsion systems may allow opportunities for longer service lives because of their lower and less costly maintenance requirements than previous steam systems.

Due in large part to the design and construction of modern surface combatants, the Navy plans to keep most current ships longer than previous ships. In recent force planning for ships, the Navy uses notional estimated service lives of 35 years for Aegis-capable cruisers and all current classes of destroyers and 24- to 32-year service lives for 28 of the 35 Oliver Hazard Perry-class frigates retiring after fiscal year 1999. According to Navy officials, these service life estimates are primarily based on the number of years the ship's structure, which includes its hull, mechanical, and electrical systems, is reasonably expected to last without incurring significant repair and modification costs. In the case of frigates, however, the Navy has recently added combat system capability as a factor in its estimates. Unlike prior classes of frigates, the Navy has been able to make some modernization upgrades to the Oliver Hazard Perry-class frigates to extend their lives. Twelve frigates that have had the most extensive modifications to their combat systems are currently

expected to remain in the force for 29 to 32 years. Another 18 that have had significant modernization are planned to average about 25 years of service life. In contrast, seven frigates in the force after fiscal year 1999 that are largely unmodernized are being retired early as new Arleigh Burke-class destroyers enter the force. As a result, current plans show these frigates having an average service life of about 17 years.

The notional estimated service lives used in recent Navy planning also differ from the current officially approved ship service life estimates. The official estimates for current surface combatants are 40 years for Aegis-capable cruisers and all classes of destroyers and 35 years for frigates. These estimates are substantially longer than historical lives and reflect the original engineering design lives. Navy officials have stated that the official estimates are misleading for planning purposes because of the difficulty and expense of maintaining ships beyond 35 years. At that point in the ship's life, it is often more economical and militarily sound to replace the ship. The Navy is currently reviewing its official service life estimates and anticipates that new service estimates, similar to the notional estimates, will be approved soon.

For our analyses, we use the notional estimated service lives that the Navy has used in its recent force planning for surface combatants.<sup>4</sup> These lives are as follows:

- Aegis-capable cruisers, 35 years;
- nuclear-powered cruisers, 17 to 29 years;
- destroyers, 35 years;
- frigates with significant modernization, generally 24 to 32 years; and
- frigates without significant modernization, an average of about 17 years.

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## **Service Life Assumptions Affect Future Force Plans**

The length of estimated service life used for ships in the force has a significant effect on the number of ships to be built each year to sustain a given force level. To illustrate this effect, we examined three different service life assumptions for ships to be retired after fiscal year 1999:

- historical service lives based on actual retirements of surface combatants built since World War II (cruisers and destroyers, 30 years; frigates, 22 years),

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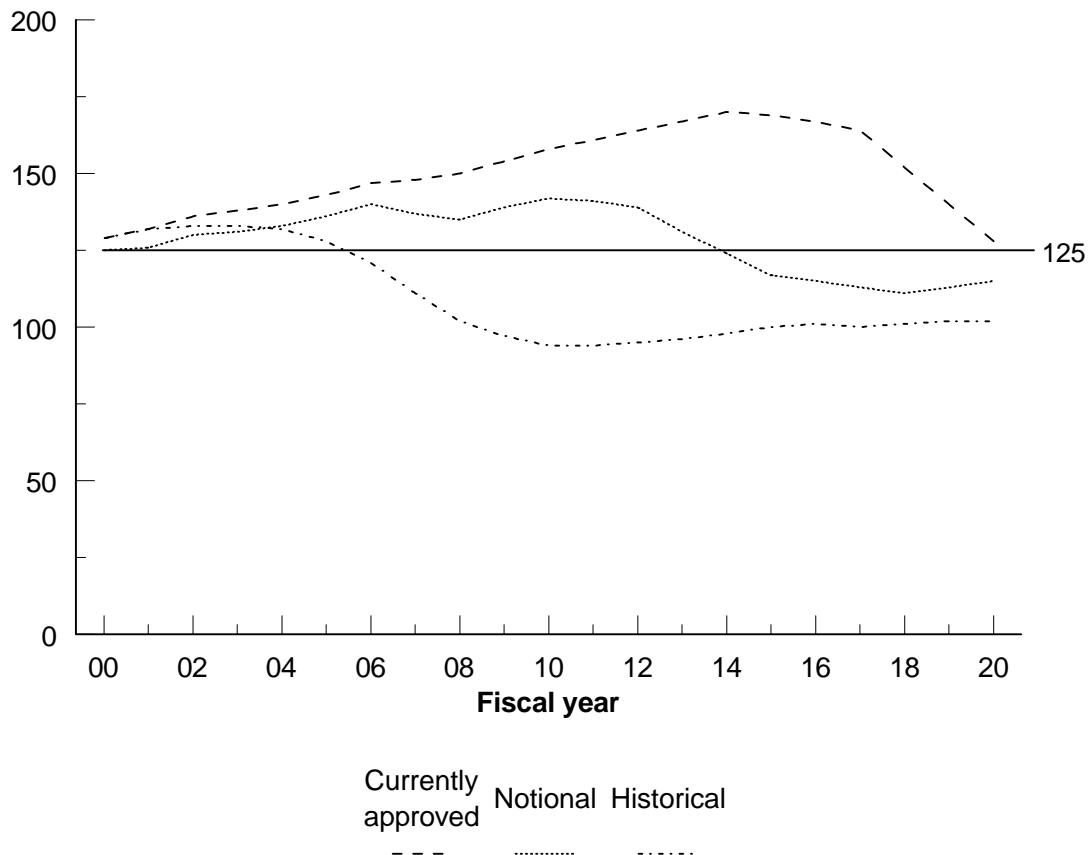
<sup>4</sup>Notional estimated service lives are used for all force level projections in this report unless otherwise noted. The actual service life of a surface combatant, however, may vary somewhat from the estimated life depending on the ship's unique configuration, modernization, operational history, and cost considerations.

- notional estimates used in recent Navy force structure planning, and
- officially approved service life estimates based on projected lives of recent ship classes as designed (cruisers and destroyers, 40 years; frigates, 35 years).

Our analysis assumed implementation of the current Arleigh Burke-class construction plan and that the lead ship for the 21st Century Surface Combatant will be procured in fiscal year 2003. Follow-on construction of that ship and other future surface combatants was assumed to proceed at a rate of three ships annually beginning in fiscal year 2005. This projected construction rate for future surface combatants is consistent with the current construction profile for Arleigh Burke-class destroyers. Figure 3.3 shows the force levels achieved for each of the three service life assumptions.

Figure 3.3: Projected Surface Combatant Force Levels Achieved at Various Service Life Estimates

Number of ships



Source: Our analysis of Navy data.

If ships are retired close to historical averages, the force will fall significantly below 125 ships beginning about 2007. Keeping ships for the currently approved estimates actually increases the size of the force through 2014 before leveling off and then declining sharply to 128 ships in 2020. The principal reason for the higher force levels achieved with the currently approved estimates is the significantly longer lives assumed for the frigates than the other two service life assumptions.

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If ships are retired at the Navy's current notional estimates, the force will decline below 125 ships in 2014. After that, the Navy could sustain a force of between 111 to 117 surface combatants through 2020 and as long as 2029, assuming continued procurement of 3 ships each year.<sup>5</sup> However, to sustain a force of at least 125 ships through 2020, the Navy would need to increase the average rate to slightly more than 4.5 ships each year for 9 years beginning in 2005 before returning to a 3-ship annual rate in 2014. Therefore, the construction program for the next surface combatant class—the 21st Century Surface Combatant—depends on the Navy's ability to retain its current surface combatants longer than historical experience. Otherwise, the Navy will need to replace ships earlier than anticipated to sustain its desired force size or accept a smaller force level.

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## **Navy May Have Difficulty Financing Its Shipbuilding Program**

The cost of new surface combatants is a large share of the Navy's annual ship and overall procurement funding. Between fiscal year 1990 and 1996, the Navy allocated about 44 percent of its annual funding for ship construction and conversion to surface combatants and about 14 percent of its overall annual procurement funding.

Funding for surface combatants remains a high priority in recent Navy budgets and through the end of the current defense program. Congress appropriated \$3.6 billion for construction of 4 new destroyers in fiscal year 1997 and gave the Navy authority to procure a total of 12 destroyers in fiscal years 1998 through 2001 using a multiyear acquisition strategy. In its biennial budget submission for fiscal years 1998 and 1999, the Navy is requesting about \$2.8 billion and \$2.7 billion, respectively, for a total procurement of six destroyers. Table 3.3 compares recent annual funding for Arleigh Burke-class destroyers, other Navy ships, and overall Navy procurement for fiscal years 1995 through 1999.

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<sup>5</sup>If future surface combatants are procured at 3 ships each year and retained for 35 years, the force eventually reaches a steady-state level of 105 ships around 2032. Therefore, surface combatants would be replaced on a one-for-one basis with new ships.

**Table 3.3: Recent Annual Funding for Surface Combatants, Other Ships, and Overall Navy Procurement**

Then-year dollars in billions

	Fiscal year				
	1995 (Actual)	1996 (Actual)	1997 (Current estimated)	1998 (Requested)	1999 (Requested)
<b>Procurement</b>					
Arleigh Burke-class destroyer (construction and advance procurement) <sup>a</sup>	\$2.6	\$2.2	\$3.5	\$2.8	\$2.7
Other ship construction and conversion	3.8	4.3	2.0	4.6	3.3
<b>Total Navy shipbuilding and conversion<sup>b</sup></b>	<b>\$6.5</b>	<b>\$6.6</b>	<b>\$5.5</b>	<b>\$7.4</b>	<b>\$6.0</b>
<b>Total Navy procurement<sup>c</sup></b>	<b>\$17.3</b>	<b>\$15.8</b>	<b>\$17.5</b>	<b>\$18.2</b>	<b>\$20.5</b>

Note: Numbers may not add due to rounding.

<sup>a</sup>The Navy was appropriated funding for three Arleigh Burke-class destroyers in fiscal year 1995, two in fiscal year 1996, and four in fiscal year 1997 and has requested funding for three in fiscal year 1998 and three in fiscal year 1999.

<sup>b</sup>Shipbuilding and conversion includes construction of new ships and certain modifications and overhauls to existing ships, such as the refueling of nuclear-powered ships and submarines and extending the service lives of ships.

<sup>c</sup>Navy procurement includes ships, aircraft, weapons, ammunition, and equipment for the Navy and the Marine Corps.

Source: DOD.

## Capability Is the Key Driver of Surface Combatant Cost

The average ship cost is determined by a number of factors, including business strategy, contractor competition and productivity, procurement rates and stability, and technical requirements and specifications. However, the key cost driver is the types of capabilities necessary for a ship to effectively perform its intended missions against anticipated threats. Procurement of combat and weapon systems with the necessary capabilities has comprised a large percentage of a surface combatant's basic construction cost. For example, combat and weapon systems account for about 55 percent of the cost of the latest version of the Arleigh Burke-class destroyer. Navy officials indicate that the Aegis combat system is a large cost—at about \$235 million, or about 25 percent of the ship's cost. As a result, the Navy is examining ways to reduce the cost of combat and weapon systems while maintaining or improving the ship's overall capability. Such cost savings approaches are being studied for the 21st Century Surface Combatant and Arsenal Ship programs.

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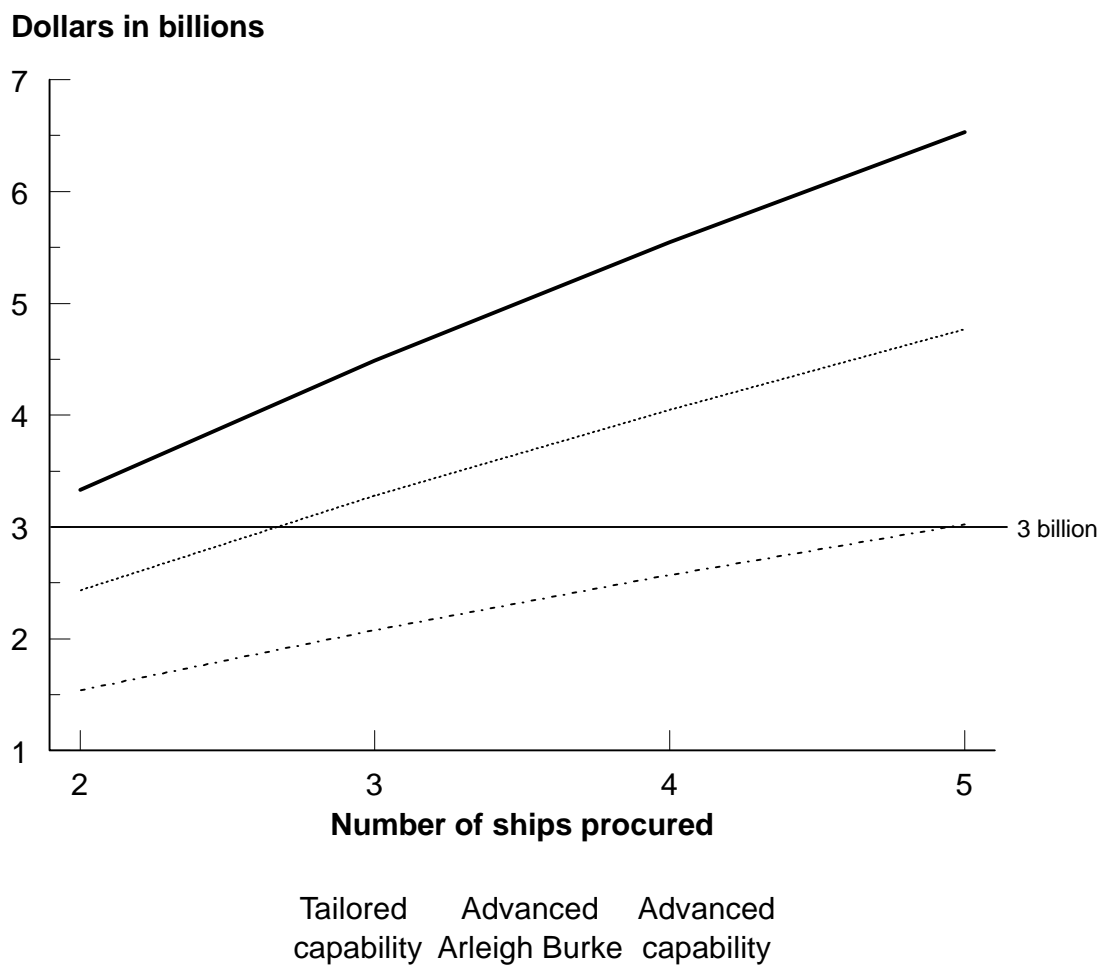
To illustrate the effect of procurement cost of new surface combatants on sustaining the force, we examined three preliminary ship concepts used in the first phase of the Navy's cost and operational effectiveness analysis for the 21st Century Surface Combatant program. Each concept has a different set of capabilities and therefore a different estimated cost. The concepts are as follows:

- The tailored capability ship concept is a lesser capable ship with high capability in one or two missions areas but limited or virtually no capability in others. It would provide capability in mission areas requiring large numbers of ships, such as antisubmarine warfare, rather than those capabilities already sufficiently available in the fleet. One version, an antisubmarine ship, would be a smaller, frigate-type ship equipped with state-of-the-art antisubmarine systems, sufficient antisurface warfare capabilities, and basic self-defense capabilities in other warfare areas.
- The upgraded Arleigh Burke-class destroyer concept would incorporate important radar improvements and limited survivability and reduced manning enhancements. The ship would retain its significant capabilities in all other mission areas.
- The advanced capability cruiser is a ship concept that would be about the size of a Ticonderoga-class cruiser and have advanced systems in all warfare areas, including theater ballistic missile defense; a significant command, control, and communications suite; enhanced survivability; and reduced personnel requirements. However, the ship is unlikely to be procured before 2010 because of the time needed to develop the advanced systems.

The Navy developed rough-order-of-magnitude cost estimates for these notional ship concepts. We used these estimates in a procurement cost estimation model, provided by the Navy, to calculate rough-order-of-magnitude estimates of the average annual funding requirements to procure each of these concepts at different procurement rates. Figure 3.4 illustrates the consequences of funding each of these ship concepts.



Figure 3.4: Annual Funding Requirements for Surface Combatant Concepts at Various Procurement Rates



Note: These cost estimates take into account the effects of higher construction rates and production learning curves. We assumed that the lead ship would be bought in the first year and that the full-scale construction rate would begin in the third year and be maintained through the seventh. We then averaged procurement funding for that 5-year period of construction.

Source: Our analysis of Navy data.

With annual surface combatant construction funding at around \$3 billion, the Navy could procure nearly 5 tailored capability frigates each year, for a total of 24 ships over a 5-year period. However, procurement rates for the

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higher capability ship concepts would be considerably lower due to their higher costs, enabling procurement of only about 13 of the advanced Arleigh Burke destroyers or about 8 of the advanced capability cruisers over the 5-year period. Construction rates for these more capable ship concepts would not be sufficient to sustain a force of at least 125 surface combatants beyond 2013.

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**Surface Combatant  
Funding Will Need to  
Compete With Other  
Defense Priorities**

Attempts to achieve a balanced budget and manage competing priorities both within the Navy and among the other services will make funding surface combatant construction to sustain planned force levels difficult. After fiscal year 2000, the Navy plans to increase its spending on numerous programs to modernize and sustain its forces. These programs include the F/A-18E/F strike fighter aircraft, V-22 advanced vertical lift aircraft, LPD-17 class amphibious transport dock ship, and New Attack Submarine, as well as the 21st Century Surface Combatant and Arsenal Ship programs. Additionally, the Navy plans to procure new aircraft carriers and continue nuclear refueling overhauls of its Nimitz-class aircraft carriers. All of these programs will place considerable fiscal pressures on the Navy's procurement budgets in general and its shipbuilding funding in particular. Table 3.4 shows projected costs and number of years of funding for several ongoing and planned Navy procurement programs.

**Table 3.4: Examples of Competing Navy Procurement Programs and Their Estimated Costs**

Then-year dollars in billions

Navy program	Funding for fiscal year 1998 and balance to complete	Fiscal years of procurement	
		Next	Last
F/A-18E/F strike fighter aircraft	\$72.1	1998	2016
New Attack Submarine	63.7	1998	2015
V-22 advanced vertical lift aircraft	38.7 <sup>a</sup>	1998	2018
LPD-17 class amphibious transport dock ship	9.6	1999	2004
CVN-77 nuclear aircraft carrier	5.4	2002	<sup>b</sup>
First three Nimitz-class aircraft carrier nuclear refueling overhauls <sup>c</sup>	6.8	1998	2005

<sup>a</sup>This amount includes Air Force funding for 50 of the 523 aircraft planned for procurement.

<sup>b</sup>The Navy is evaluating a follow-on program to the Nimitz-class nuclear aircraft carrier and expects to procure the first new design ship in fiscal year 2006.

<sup>c</sup>The Navy plans nuclear refueling overhauls for its Nimitz-class carriers beginning with the U.S.S. Nimitz in fiscal year 1998. The second overhaul is scheduled for fiscal year 2001, and the third is projected to begin about fiscal year 2005. Other Nimitz-class carriers will follow so that a carrier will be in a shipyard undergoing a nuclear refueling overhaul for about the next 30 years, with the exception of about 4 years during this period.

Source: Data from DOD's Selected Acquisition Reports, December 31, 1996, and fiscal year 1998 budget submission documents.

Total new ship construction will be a substantial portion of the Navy's annual procurement funding in the 21st century. In July 1996, the Chief of Naval Operations stated before Congress that the Navy would need to increase its annual ship procurement rates after fiscal year 2000 to support the Bottom-Up Review ship force levels of between 330 and 346 ships. The official stated that, to sustain these levels, the Navy would need to construct an average of 9 to 10 new ships each year, which is about 3 more ships than its current annual construction rate.

A senior Navy official stated that the Navy's planned investment spending—procurement plus research and development—will have annual shortfalls of about \$5.2 billion between fiscal years 2002 and 2010. This estimate assumes a 1-percent real growth in spending from the end of the fiscal year 1997 defense program (fiscal years 1997 through 2001). On the basis of estimated spending in the last year of the program, the overall shortfall represents between 6 and 7 percent of the Navy's total obligational authority in those years.<sup>6</sup>

<sup>6</sup>Total obligational authority is a financial measure unique to DOD that refers to the total value of direct defense programs for a fiscal year. The term is essentially the same as budget authority.

Our analysis of the Navy's June 1996 notional long-range shipbuilding plan suggests that shortfalls in future ship construction funding could be quite large. The plan provided preliminary procurement projections and cost estimates for ship construction programs through fiscal year 2020. It generally assumed that new, more capable ships would replace retiring ships at a slightly less than a one-for-one basis and that future ship costs would approximate those of current ships. On the basis of the plan, we observe that the magnitude of the estimated funding required for ship construction in the next decade, particularly after fiscal year 2002, is significantly higher than for recent budgets. We estimate that average annual Navy shipbuilding funding between fiscal year 2002 and 2010 may require over \$11.6 billion each year, which is about double the average annual funding for ship construction during the latter half of the 1990s. Assuming, as the Navy official did, future funding levels equivalent to the last year of the fiscal year 1997 defense program—about \$7.4 billion for shipbuilding in fiscal year 2001—and a budget growth of 1 percent, we estimate that annual funding for ships will be short, on average, about \$3.8 billion each year between fiscal year 2002 and 2010.<sup>7</sup> If no budget growth is assumed, the average annual shortage for that period increases to about \$4.2 billion.

Further, the other military services are also planning several expensive procurement programs over the same period. The Air Force plans to begin procuring the F-22 fighter aircraft in fiscal year 1999, and that program is expected to cost \$54.9 billion in then-year dollars between fiscal year 1998 and 2015. The Army plans to procure the Longbow Apache attack helicopter at an estimated cost of \$6.1 billion over the next 11 years and the Comanche helicopter at an estimated cost of \$41.7 billion in then-year dollars over the life of the program. The Air Force, the Navy, and the Marine Corps plan to begin procuring the Joint Strike Fighter later in the next decade, which could be DOD's most expensive future weapon program. On the basis of DOD's goals for the Joint Strike Fighter, the Congressional Budget Office estimates the program could cost \$165 billion, excluding inflation, or up to \$219 billion if the program's estimated cost is based on the historical relationship between cost and aircraft performance. Tentative plans are for the Navy and the Marine Corps to procure about one-third, or 940, of the estimated 3,000 aircraft to be bought through fiscal year 2030.

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<sup>7</sup>Planned funding for ship construction in fiscal year 2001 would be the second highest amount in any year since fiscal year 1993.

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The Chairman of the Joint Chiefs of Staff advised Congress in March 1996 that annual procurement funding would need to increase to \$60 billion over the next several years to adequately support the cost of DOD's planned modernization programs. Such an increase in annual procurement funding will require that the current allocation of funds among appropriation accounts change significantly. This change would be made more difficult because of congressional commitment to a balanced budget plan by fiscal year 2002. Reaching and retaining a balanced budget may put pressure on Congress and future administrations to reduce, rather than increase, defense budgets.

# Several Factors Could Affect the Future Surface Combatant Force

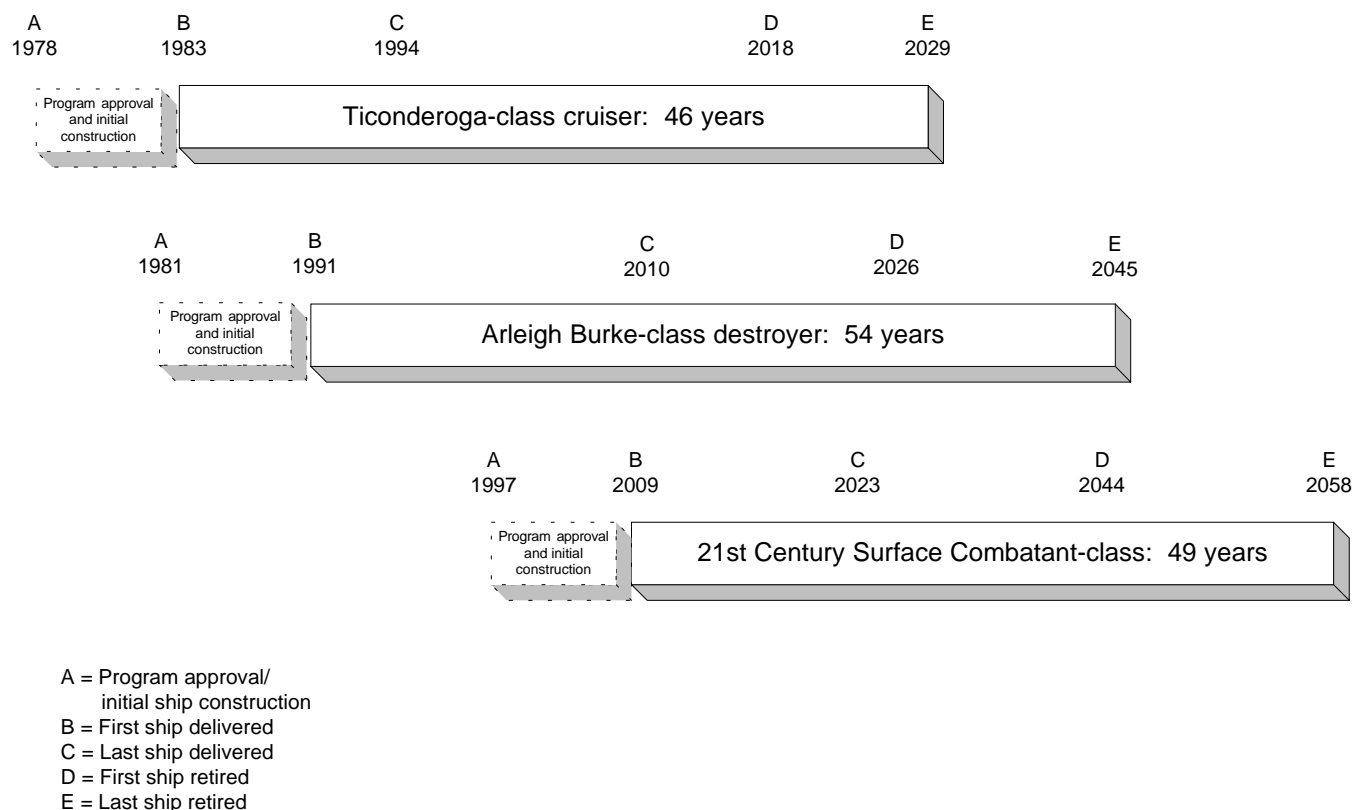
DOD and the Navy are expected to make several decisions regarding surface combatants and other major assets, including those designed to achieve ground attack and provide defense against ballistic missiles. These decisions could affect the size, composition, and overall capability of the surface combatant force through the middle of the next century. The decisions, to be made over the next several years, involve approving a program to design and construct the 21st Century Surface Combatant, evaluating the Arsenal Ship concept and designing and approving the ship's construction, and continuing to procure the remaining new Arleigh Burke-class destroyers.

Several factors could affect future surface combatant force goals. These factors include the results of DOD's planned review of defense strategy and requirements, which could change the planning parameters for meeting the mandates of the U.S. military strategy; new or improved capabilities, which could affect doctrine, operational concepts, and responsibilities for the force; introduction of the 21st Century Surface Combatant and Arsenal Ship, which could lead DOD and the Navy to reexamine force requirements and employment; and force efficiency strategies, such as expanded overseas home porting and alternative deployment schemes, which could help to increase force availability and use.

## Near-term Decisions Could Affect the Force for Many Decades

Force structure decisions for ships have long-term consequences on the size and overall capability of future forces. The number of years between the introduction of a class of ships into the force and their progressive retirements can span nearly half a century. This time span does not include the many years needed for the initial planning, design, and construction before the first ship's delivery. Figure 4.1 shows the approximate force lives of the Ticonderoga-class cruiser, the Arleigh Burke-class destroyer, and the planned 21st Century Surface Combatant class. As shown, the Ticonderoga-class cruisers and the Arleigh Burke-class destroyers are expected to remain a part of fleet force structure for about 46 and 54 years, respectively. The 21st Century Surface Combatant force life of about 49 years assumes a 20-year building program beginning in fiscal year 2003, a 5-year construction period for each ship, fleet delivery of the first ship in fiscal year 2009, and a 35-year expected service life.

**Figure 4.1: Projected Force Lives of Selected Surface Combatant Classes**



Source: Our analysis of Navy data.

Over the next several years, DOD and the Navy are expected to make many important decisions on the surface combatant force structure, as well as for other joint military assets with capabilities in similar mission areas. These decisions, which are likely to affect the capabilities, size, and composition of the overall force for many decades, include the following:

- A series of “acquisition milestones” decisions for the 21st Century Surface Combatant program to proceed through the design, development, and construction of the new ship, as well as annual funding decisions on the ship’s procurement for many years. The next major decisions are to

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complete the ongoing cost and operational effectiveness analysis in 1997 and approve the program to begin design and development work (acquisition milestone I)<sup>1</sup> around July 1997.

- Decisions on operational concepts and design of an Arsenal Ship, construction of a demonstration ship for evaluation, and potential follow-on construction program for 3 to 5 additional ships. Near-term events include industry teams to do detailed design work through 1997, authorize a contract to one of three industry teams for construction of a demonstration ship in January 1998, and begin concept evaluation at sea in late 2000.<sup>2</sup>
- Annual budget decisions on the continued procurement of the remaining Arleigh Burke-class destroyers through fiscal year 2005.

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## **Review May Change DOD Planning Parameters for Meeting National Security Objectives**

In its May 1995 report,<sup>3</sup> the Commission on Roles and Missions of the Armed Forces recommended that the Secretary of Defense conduct a quadrennial review of the defense program at the beginning of each newly elected presidential administration. The Commission believed the review “. . . would provide the foundation for a consistent military strategy, defense force posture, and budget estimate for use in the Secretary’s [of Defense] programming direction to Defense components” and “. . . could in addition serve as a basis for developing a consensus between the executive and legislative branches on a four-year DOD funding level.”

The Secretary of Defense endorsed the concept, and Congress later included a provision mandating such a review in the National Defense Authorization Act for Fiscal Year 1997. The review is to involve a comprehensive examination of defense active and reserve force structure, modernization plans, infrastructure, and other elements of the defense program and policies to determine defense strategy and establish a revised defense program through 2005. Results of the review are due by May 15, 1997. Additionally, the act required an independent panel of defense

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<sup>1</sup>Milestone I, Approval to Begin a New Acquisition Program, in the DOD acquisition process establishes a new program and approves an acquisition strategy and concept baseline containing initial program cost, schedule, and performance objectives.

<sup>2</sup>The three industry teams performing design work during 1997 are (1) General Dynamics, Marine/Electric Boat, Raytheon Electronic Systems, and Science Applications International Corporation; (2) Lockheed Martin, Litton Industries/Ingalls Shipbuilding, and Newport News Shipbuilding; and (3) Northrop Grumman Corporation, National Steel and Shipbuilding Company, Vitro Corporation, and Band Lavis and Associates, Inc. The Defense Advanced Research Projects Agency plans to select one of the three industry teams in January 1998 to complete final design work and construct a demonstration ship.

<sup>3</sup>Directions for Defense (Report of the Commission on Roles and Missions of the Armed Forces, May 24, 1995).



experts to submit a comprehensive assessment of DOD's report and conduct an assessment of alternative force structures through the year 2010 and beyond by December 1, 1997.

This quadrennial defense review could result in significant changes in the parameters used to plan the forces needed to meet national security objectives. These changes could include adopting different planning scenarios and parameters for future MRCS, readjusting force structure priorities to meet national security objectives, and proposing new initiatives to meet requirements and create efficiencies in defense spending. Depending on the nature and extent of these changes, the size, composition, required capability, and employment of the surface combatant force, as well as other major military components, could be significantly altered. For example, a recent Navy report, 21st Century Surface Combatant Force Architecture Assessment, illustrated the effect on force size of changing the two nearly simultaneous MRC requirement. With the assumption that a 145-ship force of current ship types, with some allied support, is needed for the current MRC requirement, the assessment calculated that changing the requirement to two simultaneous MRCS could increase the required force size by about 20 ships. Changing the requirement to two sequential MRCS or one MRC could reduce the war-fighting force requirement by as much as 45 ships (assuming some allied support).

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## **New Capabilities Could Affect Surface Combatant Roles and Missions**

Several significant improved or new capabilities could affect the requirement for surface combatants. Even though these improvements and capabilities could add new responsibilities for the force, they could provide greater efficiencies in the use of the force and allow changes in doctrine and operational concepts that could reduce force requirements. Various improvements to the Tomahawk cruise missile to enhance its effectiveness and capabilities could allow the missile to be used for tactical applications in support of ground operations during crisis and war. Also, the Navy is modifying the Aegis combat system and improving the Standard missile to provide a defense against theater ballistic missile attacks while operating in littoral areas. Additionally, the introduction of the Cooperative Engagement Capability on existing and new combatants and other ships will enhance the ships' self-defense capabilities by increasing the response time and amount of information available to defend against antiship cruise missile threats. This capability is also critical for theater ballistic missile defense operations.

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**Planned Improvements for  
Tomahawk Will Likely  
Affect Its Use in Warfare**

The Navy is making various improvements to the Tomahawk cruise missile to increase its effectiveness, flexibility, and responsiveness and strengthen mission planning capabilities aboard ships. In addition to upgrades to the missile's guidance, navigation, and control systems, the Navy plans to incorporate a penetrating warhead, which will expand potential targets to include weapon bunkers and reinforced structures.<sup>4</sup> Several enhancements, such as the Afloat Planning System and the Advanced Tomahawk Weapon Control System, will allow forces at sea to plan and modify land attack missions more rapidly than currently possible.

A significant change planned for Tomahawk is to employ it for tactical applications against an adversary's military forces and to support the ground war. Currently, it can be deployed against strategically important targets, such as command and control facilities and radar sites, under the control of the unified commanders. According to Navy officials, using the missile for tactical applications could have a significant affect on ship operations and the number of Tomahawk missiles because of the potential increase in missions and targets. Additionally, the U.S. military is making changes to the command and control structure, which may allow theater commanders to use Tomahawk missiles for tactical applications. Figure 4.2 shows the Aegis cruiser U.S.S. *Shiloh* launching a Tomahawk missile against a target in southern Iraq in September 1996.

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<sup>4</sup>Tomahawk land attack missiles can currently carry a 1,000-pound-class high-explosive or a submunition warhead against land targets that are fixed or not easily relocatable.

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**Figure 4.2: An Aegis Cruiser Launching a Tomahawk Cruise Missile Against an Iraqi Target**



Note: Several planned Tomahawk improvements will greatly enhance Navy surface combatants' unique capability to conduct long range precision strikes from the sea.

Source: Navy.

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## Theater Ballistic Missile Defense Capability Is a Major New Mission

Theater ballistic missiles have been used in six regional conflicts since 1973—the most recent of which was the 1994 conflict between North and South Yemen in which Scud missiles were armed with conventional warheads.<sup>5</sup> The Navy is developing a capability for Aegis-equipped cruisers and destroyers to defend against this threat by using improved Standard

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<sup>5</sup>A ballistic missile does not rely on aerodynamic surfaces to produce lift and consequently follows a ballistic trajectory when thrust is terminated. Generally, a theater ballistic missile travels less than 3,500 kilometers, or 1,889 nautical miles. These missiles can carry conventional, nuclear, or chemical warheads.

surface-to-air missiles. The Navy believes that this defensive capability will become an important new mission for its surface combatants in MRCs and that a sea-based capability is essential for protecting U.S. and allied forces, population centers, logistics facilities, and key coastal areas from missile attacks. The Navy also believes its surface combatants will (1) provide the only initial capability to defend arriving ground forces against ballistic missile attacks, particularly in the early days of a crisis, and (2) have the advantages of independent operations, rapid relocation, high survivability, and self-sustainability.

The Navy plans to modify the Aegis combat system and make improvements to its Standard surface-to-air missile. The system's primary air search radar will be modified to allow it to search at higher elevations and for longer ranges and maintain its tracking on ballistic missile targets. The system is being designed to predict intercept points and engagement limits, initialize missile firings, and provide communication with the missile as it travels to intercept the target. Aegis equipment is to be modified to display missile tracks and engagements and communicate with other elements of the combat system and remote sensors.

The Navy intends to (1) initially deploy the area defense portion of this capability to protect joint forces in littoral areas and coastal airfields and (2) later add the theaterwide portion to protect vital assets over entire regions. The Navy plans to equip two Aegis cruisers with an operational evaluation version of the area defense portion in fiscal year 1998 and deploy the tactical version on Aegis cruisers and destroyers beginning in fiscal year 2001.

Increased use of a theater ballistic missile capability for littoral operations could allow the Navy to protect larger areas with fewer surface combatants. Also, the capability allows the use of a more efficient firing doctrine for many engagement situations than the doctrine used for area defense missiles. This doctrine reduces magazine space requirements and, in turn, reduces the number of ships.

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### **Cooperative Engagement Capability Could Increase Connectivity Among Forces**

The Navy plans to begin deploying the Cooperative Engagement Capability on many of its ships later in the decade. This computer-based information exchange system permits the simultaneous sharing of detailed targeting information between ships or forces at extensive ranges within the littoral area, thereby increasing reaction time and firing opportunities against enemy missile attacks. By creating a single composite threat picture from

all the sea-, air-, and land-based sensors in the area, ships with less sophisticated combat systems will have the same quality sensor, decision, and engagement information as Aegis-equipped ships. This system is designed to enhance capabilities to rapidly respond to enemy attacks by providing an over-the-horizon capability that will give the local commander the ability to defend against threats not yet detected by sensors. The Navy believes this capability will be a major defense against antiship sea-skimming cruise missiles.

This capability may allow the Navy to acquire some ships with lesser capability than Aegis. For example, the proposed Arsenal Ship will depend heavily on this capability for its operations, and thereby reduce its need for a sophisticated combat system and sensors. The capability is currently installed on the aircraft carrier U.S.S. Eisenhower, the Aegis cruisers U.S.S. Anzio and U.S.S. Cape St. George, and the amphibious assault ship U.S.S. Wasp. The Navy plans to install this equipment on additional aircraft carriers, surface combatants, amphibious ships, and carrier-based E-2C tactical warning and control system aircraft between fiscal year 2000 and 2010. By fiscal year 2003, the Navy plans to have the capability on about 60 ships and aircraft.

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## **Arsenal Ship Could Significantly Augment Surface Force Capabilities**

The Navy and the Defense Advanced Research Projects Agency are developing a new type of ship—the Arsenal Ship—that has the potential to provide substantial fire support to a variety of missions in regional conflicts without the logistics burden of transporting both delivery systems and ammunition to the shore and forward areas. The Arsenal Ship is expected to carry a large number of VLS cells but without the sophisticated command and control and radar equipment found on Aegis-equipped ships. This ship, which will rely on other military assets, including surface combatants, to provide the targeting information and connectivity necessary to launch its weapons, will have the equivalent ordnance—about 500 vertically launched weapons from a wide variety of the military's inventory—of about four or five Aegis cruisers and destroyers. Figure 4.3 shows design proposals for the Arsenal Ship from three competing industry teams.

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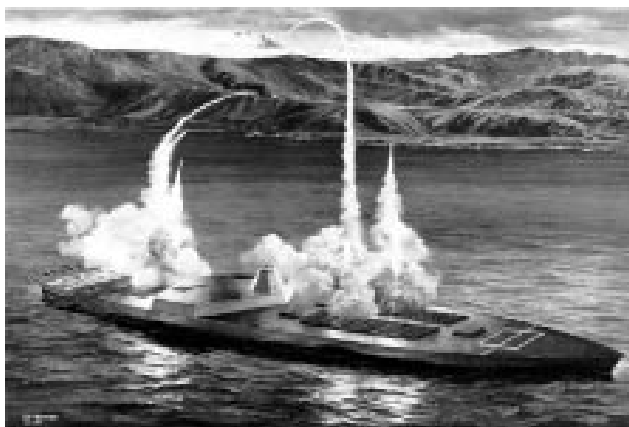
**Figure 4.3: Design Proposals for the**  
**Navy's Arsenal Ship Concept**



Source: General Dynamics, Marine team.



Source: Lockheed Martin team.



Source: Northrop Grumman team.

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The Navy plans to maintain the Arsenal Ship forward deployed in major overseas regions for extended periods by rotating the ship's crew and returning the ship only for major maintenance and overhauls. This plan will allow the Navy to use fewer Arsenal Ships to maintain overseas presence than if the ships were deployed routinely from the United States and permit their early availability in a conflict. Additionally, if the Arsenal Ship concept proves successful and within its current cost projections (around \$500 million for construction of each ship), DOD and the Navy may be able to retire or forego purchases of some assets, such as aircraft carriers, surface combatants, ground-based launchers, or combat aircraft.<sup>6</sup>

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## **Opportunities May Exist to Improve Force Efficiencies**

Several operational factors, such as distance and transit speeds to reach areas of deployment, deployment schemes and group configurations, and personnel and maintenance policies affect how the force is employed. Over the years, Navy and independent studies have suggested ways to improve the use and availability of the surface combatant force by adjusting these factors. For example, a Navy report, Surface Combatant Force Level Study, provided some options to increase not only availability of ships for crisis and war but also their availability during peacetime. The study suggested that the Navy home port more ships in more locations overseas, if possible, and increase the home porting of Aegis-capable ships overseas to reduce transit distances and maintain capabilities closer to potential crisis areas. Although increasing overseas home porting of surface combatants may be difficult, Pacific Fleet officials indicated that the Navy began home porting more Aegis-capable ships in Japan and Hawaii as older, less capable ships returned for overhaul or retirement. The study also suggested having surface combatants deploy to potential trouble areas early and independently of other forces, such as carrier battle groups, to increase the capabilities available early in a conflict.

Other studies have suggested changes to deployment schemes and personnel policies, such as shortening the time between deployments, lengthening the deployment period, rotating crews, increasing transit speeds, and using different maintenance schemes, to increase the availability of ships for deployment in peacetime. As these studies show, those and other changes have the potential for significant cost and force structure savings and improved force efficiencies. On the other hand, such changes could also affect personnel retention and morale, training,

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<sup>6</sup>In informal written comments to the report, DOD indicated that a potential issue with the Arsenal Ship would be the cost of the weapons for additional VLS cells. DOD stated that the number of programmed VLS cells without the Arsenal Ship is about 30 percent larger than the funded inventory of VLS-cell weapons.

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**Chapter 4**  
**Several Factors Could Affect the Future**  
**Surface Combatant Force**

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readiness, and fleet structuring. Many of these changes are not new, but they may help the Navy to achieve sufficient risk aversion as it operates with a smaller force structure and budget.



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# Conclusions and Recommendations

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Surface combatants will continue to play an important role in the deployment of naval and joint forces overseas during peacetime and in conflict by providing a wide range of defensive and offensive capabilities. Since the capabilities of individual ships have increased and a greater emphasis has been placed on fighting in littoral areas, the surface combatant force has assumed new or increased roles and missions, such as conducting deep strikes against land targets with their Tomahawk missiles and providing a future capability to defend against theater ballistic missiles. The Navy believes this force, to be composed of increasingly capable multimission ships with the Aegis combat system, may assume greater importance in supporting joint forces in future conflicts. However, the Navy has not yet provided an adequate explanation to Congress of the relationship between surface combatant force structure requirements and national security objectives.

DOD faces a major challenge in recapitalizing its forces across the military services during a period when the administration and Congress attempt to balance the federal budget. Given this challenge, the Secretary of Defense must make difficult tradeoff decisions among competing weapon modernization programs. The Navy is nearing completion of a cost and operational effectiveness analysis for a new surface combatant class and plans to initiate the program this year. It also has begun an accelerated effort to develop a new ship concept, the Arsenal Ship. Both these programs will help to modernize and sustain the surface combatant force but will also require significant funding in future Navy budgets. However, DOD's annual budget presentations to Congress have not clearly indicated how surface combatant ships contribute to achieving U.S. national security objectives and why large future budgetary outlays are needed to sustain the surface combatant force into the next century.

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## Conclusions

Since the end of the Cold War, the Navy's surface combatant force has been resized to a smaller yet increasingly more capable force as older, less capable ships have been replaced with Aegis-capable Ticonderoga-class cruisers and Arleigh Burke-class destroyers. These new ships bring to the force significant new capabilities, such as the Aegis combat system, VLS, and Tomahawk cruise missile, and will bring in the future the Cooperative Engagement Capability and theater ballistic missile defense. By the end of fiscal year 2003, the Navy will have about the same number of cruisers and destroyers as it had during the Cold War in the late 1980s—about 105. However, the cruisers and destroyers in the surface combatant force in

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2003 will far exceed the capabilities possessed by similar-type ships in the late 1980s.

The Navy's Arleigh Burke-class destroyer program remains essentially as envisioned when it was initiated during the Cold War as a counter force to the former Soviet Union. It remains driven by the desire to increase the capabilities of the force and sustain the surface combatant shipbuilding industrial base. The ongoing Arleigh Burke-class destroyer construction program allows the Navy to sustain surface combatant force through the next decade at a level higher than the current size of about 125 ships.

The Bottom-Up Review generally established the size of the current surface combatant force to implement the national military strategy. Subsequent budget, industrial base, and operational considerations have supported a near-term force size of at least 125 ships. The Navy will have 131 surface combatants (123 active and 8 reserve ships) by the end of the current defense program in fiscal year 2003. However, DOD's long-term surface combatant force goal beyond the current defense program and the range of capabilities that Navy surface combatants need to implement the national military strategy objectives are still undecided.

The Navy has conducted several internal studies to define surface combatant war-fighting roles and missions and the size of force and capabilities that are anticipated to deploy in the future. These studies show that size of the needed force can vary significantly depending on the assumptions underlying the analyses. Some key assumptions include the planning parameters made for the type and occurrence of future MRCs; the roles and missions of naval, other U.S. military, and allied forces in a joint or combined warfighting environment; and operational constraints. The studies concluded that the various assumptions made in the analyses indicate that the Navy could support a larger surface combatant force than now exists. However, the variability in these assumptions can also result in numbers below the currently programmed force levels.

DOD and the Navy are moving forward with several programs that could significantly change surface combatant requirements. For example, the significant offensive and defensive capabilities of the proposed Arsenal Ship could lessen the need for costly, higher capability surface combatants, as well as permit the Navy and the other services to retire or forego purchases of some assets, such as aircraft carriers, ground-based launchers, or combat aircraft. Likewise, the development and implementation of a Cooperative Engagement Capability, which allows

radar and other data to be shared among remote users, may allow the Navy to design, build, and deploy fewer, less costly surface combatants.

The Navy plans to retire a large number of surface combatants after the end of the next decade. To sustain force levels of at least 125 ships through 2020, the Navy will need to begin building more new ships than are currently built each year sometime before these retirements begin. However, we believe that, with such a large percentage and number of Aegis-capable cruisers and destroyers in the force at the time of these retirements (about 84 ships) and with the significant firepower potential of the proposed Arsenal Ship, the significant number of retirements will not have a great effect on the overall capability of the force as it declines below 125 ships after 2013. As a result, the Navy may be able to accept a smaller, but still highly capable, surface combatant force or begin procuring a less costly and capable ship than the Arleigh Burke-class destroyer. The Navy can further defer difficulties with force size by retaining its ships as long as planned or longer if maintenance considerations allow this to be practical. For example, the Navy plans to keep its current destroyers for 35 years—longer than the historical average of 30 years. If the Navy is unable to achieve these longer service lives, it will be forced to decide on whether to procure replacement ships sooner than planned.

The effects of expected service life, individual ship cost, and annual funding have significant consequences on Navy force structure decisions. The Navy will be challenged to achieve a reasonable balance between these factors. Its ability to maximize ship service lives and manage costs for new ships to a large extent determine the size and type of surface combatant force the Navy will be able to sustain over the long term. Additionally, the competition for procurement funding from other Navy and service programs, as well as from other appropriation accounts, may significantly restrain the annual share allocated for surface combatants. These factors will particularly influence planning and budgeting decisions the Navy makes for sustaining the surface combatant force, particularly the design, cost, and construction of the 21st Century Surface Combatant-class over the next several years.

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## Recommendations

We recommend that the Secretary of Defense provide Congress with specific information regarding the surface combatant force. Such information should include the

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- number and types of surface combatants that are needed to fight and win two nearly simultaneous MRCS;
  - number of ships that are needed to meet peacetime forward presence objectives;
  - key assumptions that support the force level and mix, such as expected allied contributions;
  - expected impact of new technologies and capabilities on the size and composition of the future force; and
  - impact of the Arsenal Ship on the surface combatant force structure.

We also recommend that the Secretary provide information on the Navy's plan to sustain the surface combatant force level, including key assumptions regarding expected service lives, pace of the shipbuilding program, types of ships, required funding, and any other factor that might alter the requirement.

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## Agency Comments and Our Evaluation

DOD concurred with the information in this report and the recommendation. DOD stated that the programmed surface combatant force structure contained in the fiscal year 1998 budget and associated Future Years Defense Program are adequate to support DOD's current presence and contingency response requirements. However, DOD officials stated that the current force structure is based largely on budget, industrial base, and operational considerations rather than specific linkages to national military strategy objectives.

DOD stated that the information regarding surface combatants listed in the recommendation would be provided to Congress as a result of the ongoing Quadrennial Defense Review. DOD indicated that the results of the review should provide a basis for understanding future surface combatant needs. Although the review could establish a strategic context for surface combatants, as did DOD's 1993 Bottom-Up Review, we believe that the broad scope of the review may not adequately provide the specific discussion of surface combatant requirements that our recommendation is intended to provide. Thus, considering the significant investment and annual budget requirements needed for surface combatants, we have retained the recommendation.

DOD's comments appear in appendix III. Additionally, DOD updated the report to reflect information its fiscal year 1998 budget request, and we have incorporated this information into the report.

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# Selected Carrier Battle Group Deployments

Surface combatants are a major element of the Navy’s carrier battle groups.<sup>1</sup> These groups, which also include an aircraft carrier, air wing, nuclear attack submarines, and a fast combat support ship, routinely deploy during peacetime to maintain the primary overseas naval presence on a nearly continuous basis in the Mediterranean Sea, western Pacific Ocean, and North Arabian Sea. They also help provide an initial military capability to respond to crisis and enable the introduction and build up of additional forces as needed. Tables I.1 and I.2 show the number and types of surface combatants that deployed with the Atlantic and Pacific Fleet carrier battle groups, respectively, between May 1994 and February 1996. The tables also show some of the geographic areas and the responsible unified commands where the surface combatants operated during the deployments.

**Table I.1: Atlantic Fleet Carrier Battle Group Deployments**

Carrier battle group and dates of deployment	Number and type of surface combatants	Unified commands and operational areas <sup>a</sup>
U.S.S. George Washington (CVN-73), May to November 1994	2 Ticonderoga-class cruisers, 1 Arleigh Burke-class destroyer, 2 Spruance-class destroyers, and 1 Oliver Hazard Perry-class frigate	European Command—Mediterranean Sea, Adriatic Sea, and Black Sea Central Command—Arabian Gulf
U.S.S. Dwight D. Eisenhower (CVN-69), October 1994 to April 1995	2 Ticonderoga-class cruisers, 1 Kidd-class destroyer, 1 Spruance-class destroyer, and 2 Oliver Hazard Perry-class frigates	European Command—Mediterranean Sea, Adriatic Sea, and Aegean Sea Central Command—Arabian Gulf and Red Sea
U.S.S. Theodore Roosevelt (CVN-71), March to September 1995	2 Ticonderoga-class cruisers, 1 Virginia-class nuclear cruiser, 1 Arleigh Burke-class destroyer, and 2 Oliver Hazard Perry-class frigates	European Command—Mediterranean Sea, Adriatic Sea, and Black Sea Central Command—Arabian Gulf and Red Sea
U.S.S. America (CV-66), August 1995 to February 1996	2 Ticonderoga-class cruisers, 1 California-class nuclear cruiser, 1 Kidd-class destroyer, and 2 Oliver Hazard Perry-class frigates	European Command—Mediterranean Sea and Adriatic Sea Central Command—Arabian Gulf and Red Sea

<sup>a</sup>This listing shows only some of the geographic areas visited by surface combatants from the respective carrier battle group.

<sup>1</sup>In addition to deploying with an aircraft carrier as part of a carrier battle group, surface combatants deploy with other combatants as a surface action group or by themselves.

**Appendix I**  
**Selected Carrier Battle Group Deployments**

**Table I.2: Pacific Fleet Carrier Battle Group Deployments**

<b>Carrier battle group and dates of deployment</b>	<b>Number and type of surface combatants</b>	<b>Unified commands and operational areas<sup>a</sup></b>
U.S.S. Kitty Hawk (CV-63), June to December 1994	2 Ticonderoga-class cruisers, 1 California-class nuclear cruiser, and 1 Oliver Hazard Perry-class frigate	Pacific Command—Korean coastal waters and Japanese coastal waters
U.S.S. Constellation (CV-64), November 1994 to May 1995	2 Ticonderoga-class cruisers and 1 Spruance-class destroyer	Pacific Command—Korean coastal waters <u>Central Command</u> —Arabian Gulf and Red Sea
U.S.S. Abraham Lincoln (CVN-72), April to October 1995	1 Ticonderoga-class cruiser, 1 Arleigh Burke-class destroyer, and 1 Spruance-class destroyer	Pacific Command—Japanese coastal waters and Hawaiian coastal waters <u>Central Command</u> —Arabian Gulf

<sup>a</sup>This listing shows only some of the geographic areas visited by surface combatants from the respective carrier battle group.

Surface combatants from battle groups in the Atlantic Fleet provide presence in the Mediterranean Sea, exercising with allies in the region and conducting port visits. These ships also provide a portion of the carrier battle group presence in the Arabian Gulf. Each of the four Atlantic fleet deployments that we reviewed involved port visits and exercises in the Mediterranean Sea, U.N. peacekeeping operations in the Adriatic Sea, and Iraqi sanctions-related operations in the Arabian Gulf.

Pacific Fleet battle groups provide presence in the western Pacific Ocean, Indian Ocean, and Arabian Gulf. Two of the three Pacific Fleet deployments we reviewed included Arabian Gulf operations to intercept illegal shipping and enforce sanctions against Iraq and bilateral exercises with allies in the region. For example, one battle group that deployed to the Central Command area, which consisted of an Aegis cruiser, an Aegis destroyer, and a Spruance-class destroyer, participated in northern Arabian Gulf operations and maritime intercept operations. The battle group also participated in four different exercises with allies in the Arabian Gulf and made various port visits. Additionally, all three Pacific Fleet deployments conducted training operations and exercises in seas adjacent to Korea and Japan.

During peacetime operations, most surface combatants split from the battle group into smaller formations when reaching an area of deployment to conduct specific missions, such as training, exercises with allies, and port visits in the region. (Usually one or more surface combatants, either a frigate or Aegis-capable cruiser or destroyer, in the group stays with the carrier to provide defense against air threats.) For example, the Atlantic

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Fleet continuously assigned one combatant from a battle group to meet the North Atlantic Treaty Organization (NATO) Standing Naval Force Mediterranean requirement for exercises with various allies in the area.<sup>2</sup> A frigate is usually provided rather than an Aegis-capable destroyer or cruiser. In each of the recent Atlantic Fleet battle group deployments we reviewed, one ship was continuously assigned to the NATO force, although that ship was not the same throughout the deployment. An Atlantic fleet official stated that, for the last 3 years, ships assigned to the NATO force have been in the Adriatic Sea as part of the task force supporting the U.N. peacekeeping operation in the former Yugoslavia.

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<sup>2</sup>The NATO Standing Naval Force Mediterranean requirement consists of destroyers and frigates assigned by member nations that are available on short notice for an early military response to a crisis.



# Operational Factors That Affect How Surface Combatants Are Employed

The Navy's operational, maintenance, and personnel policies affect how surface combatant force are employed. Such factors as maintenance requirements, personnel quality-of-life guidelines, the frequency and duration of operations, training needs, distance, and the time spent traveling to and from deployment areas all enter into determining ship availability and employment.

## Major Overhauls

Surface combatants and other Navy ships periodically require major overhauls that leave them unavailable for immediate deployment. For most surface combatants, these overhauls generally occur every 80 months for periods of over 6 months. The average surface combatant spends about 7.7 percent of its life in major overhauls.<sup>1</sup> For example, in a force of 100 surface combatants, the Navy would have about 92 ships available for deployment at any given time and about 8 ships in some phase of a major overhaul. Figure II.1 shows two of the Navy's Spruance-class destroyers, the U.S.S. John Hancock (DD-981) and U.S.S. Thorn (DD-988), undergoing routine overhauls at the Newport News Shipbuilding and Drydock Corporation at Newport News, Virginia.

<sup>1</sup>According to a Navy official, this figure was derived by computing an average for all surface combatants from the Navy's guidance on depot-level maintenance availabilities of ships.

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**Appendix II**  
**Operational Factors That Affect How**  
**Surface Combatants Are Employed**

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**Figure II.1: U.S.S. John Hancock and U.S.S. Thorn Undergoing Routine Overhauls**



Note: The U.S.S. John Hancock is on the left, and the U.S.S. Thorn is on the right.

Source: Navy.

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## Personnel Tempo

During peacetime, the availability of surface combatants for deployments is affected by the Navy's policy on personnel tempo (PERSTEMPO). This policy limits the amount and duration of time personnel are away from their home port compared with the time they spend at sea and in other ports. Time spent in major overhauls is not included in PERSTEMPO calculations.

In response to concerns about excessive periods at sea, the Chief of Naval Operations established a PERSTEMPO policy in October 1985 to achieve a balance between quality-of-life considerations for Navy personnel and the need to sustain fleet operational readiness. The policy guidelines have three specific goals, which are to

- limit the length of any deployment, including transit time, to 6 months;
- ensure that, before beginning a new deployment, ship personnel spend a minimum of 2 months in their home port operating area for every month the ship was deployed; and
- ensure that the ship and its personnel spend a minimum of 50 percent of the time during a recurring 5-year period in their home port.

By limiting the length of deployments and requiring a minimum time in home port and home operating area for its personnel, PERSTEMPO policy affects the number of ships that can be deployed at a given time. According to Atlantic Fleet officials, PERSTEMPO helps keep up the morale of Navy personnel and maintain acceptable retention levels in an all-volunteer Navy. During crisis and war, these goals can be temporarily suspended to increase the number of deployed ships.

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## Operational Tempo

Operational tempo (OPTEMPO) defines the fuel budgeted to fund operations and training for ships, commonly referred to as the steaming days program. The budget for the steaming days program is based on a formula that considers the number and types of ships; the number of operating and maintenance months; and utility, fuel, repair, and other estimated costs. In recent years, the OPTEMPO goals for ships have been 50.5 days at sea per quarter for deployed forces, 29 days at sea per quarter for nondeployed Atlantic fleet forces, and 27 days at sea per quarter for nondeployed Pacific fleet forces. The remaining time each quarter is intended to be used for overhaul, upkeep, training, and crew rest. If operational requirements are higher than planned, ships may exceed the OPTEMPO goals to meet the additional days required at sea.

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## Interdeployment Cycle

Ships returning from deployment generally require nearly 1-1/2 years to prepare for a subsequent deployment. During this interdeployment cycle, short-term ship maintenance, repairs, and upgrades to the ship's systems are completed, and personnel participate in training activities. Additionally, this period allows the ship's personnel to take leave and spend time in their home port.

The Navy uses a turnaround ratio to measure the rate at which ships will be available for their next deployment. This ratio is determined by dividing the interdeployment cycle time by the length of a deployment. For example, if ships require 18 months between 6-month deployments, they have a turnaround ratio of 3:1. PERSTEMPO policy requires a minimum of a 2:1 ratio to ensure that ship personnel spend at least 2 months in their home port operating area for every month their ship was deployed.

As the ratio increases, fewer ships are available in the force to meet forward deployments. Some efficiencies, such as reduced training or maintenance, can be realized in the interdeployment cycle, which can reduce the ratio and increase ship availability for deployments. For example, if a turnaround ratio of 3:1 is maintained, about five ships are needed to keep one ship from Norfolk, Virginia, forward deployed in the Mediterranean Sea. If the ratio is reduced to 2:1, the same presence can be met with four ships. Lower turnaround ratios allow the Navy to deploy more ships within the current force structure for presence but places pressure on the fleet's ability to train crews and maintain ships.

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## **Distance, Speed, and Port Visits**

The round-trip distance a ship must travel between its home port and a deployment region and the time required for the trip affects ship employment and the number of ships available for peacetime operations. Longer distances require longer transit times, which reduce the amount of time during a 6-month deployment that a ship will spend in an overseas region. For example, Atlantic Fleet ships generally cross the Atlantic Ocean and arrive in the Mediterranean Sea in about 11 days without stops, or around 22 days round trip. This transit time allows the ship to spend more than 5 months in the region during its deployment. On the other hand, the transit times for the Pacific fleet ships deployed from the West Coast of the United States are much greater to deployment regions. For example, a ship deployed from San Diego, California, to the Arabian Gulf can spend around 34 days in transit without stops, and as much as 45 days if port visits and training exercises en route are included. With a similar time required to return to its home port, the ship would spend about half of its 6-month deployment in the overseas region. These greater distances for Pacific Fleet ships are mitigated somewhat by having 9 surface combatants home ported in Japan and 12 in Hawaii.

Similarly, the average speed at which a ship advances toward its destination also affects transit time. The Navy's standard average speed during peacetime deployments is about 14 knots. Increasing the average

speed would reduce transit time and increase the amount of time spent in an overseas region. According to the Navy, faster speeds can increase maintenance requirements and reduce training time while a ship is underway. Additionally, port visits during transit or return also increase transit time and reduce time in the deployment area.

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## **Logistics in Theater**

While deployed in a forward area, ships require periodic repairs and replenishment of fuel, ammunition, and supplies at sea to sustain war-fighting effectiveness. To minimize the risk while operating in high-threat areas during combat, these ships will travel to protected or rear areas for replenishment by combat logistics ships. On the basis of its operational experience, the Navy estimates that about 15 percent of ships deployed in a forward area will be temporarily unavailable while they are being replenished. This in-theater logistics factor is considered in planning the total number of ships required to sustain war-fighting capabilities. Figure II.1 shows the Aegis-capable cruiser U.S.S. San Jacinto (CG-56) and the aircraft carrier U.S.S. Nimitz (CVN-68) conducting underway replenishment operations with the fleet oiler U.S.S. Merrimack (AO-179) in the Arabian Gulf during April 1996.

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**Appendix II**  
**Operational Factors That Affect How**  
**Surface Combatants Are Employed**

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**Figure II.2: Underway Replenishment Operations in the Arabian Gulf**



Note: The U.S.S. San Jacinto is on the left, the U.S.S. Merrimack is in the center, and the U.S.S. Nimitz is on the right.

Source: Navy.

# Comments From the Department of Defense



PROGRAM ANALYSIS  
AND EVALUATION

OFFICE OF THE SECRETARY OF DEFENSE  
1800 DEFENSE PENTAGON  
WASHINGTON, D.C. 20301-1800



February 6, 1997

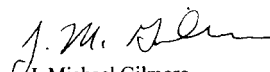
Mr. Richard Davis  
Director, National Security Analysis  
National Security and International  
Affairs Division  
U.S. General Accounting Office  
Washington, D.C. 20548

Dear Mr. Davis:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "SURFACE COMBATANTS: Navy Faces Challenges Sustaining its Current Force Goal," dated January 8, 1997 (GAO Code 701044/OSD Case 1277). The Department concurs with the report. The Department anticipates that the information regarding surface combatant force structure that the report recommends be provided to the Congress will be made available as a result of the Quadrennial Defense Review.

Technical corrections to the report were separately provided. The detailed comments to the report recommendations are provided in the enclosure.

The Department appreciates the opportunity to comment on the draft report.

  
J. Michael Gilmore  
Deputy Director  
General Purpose Programs

Enclosure:  
DoD Response to GAO Recommendations



GAO REPORT - DATED JANUARY 8, 1997  
(GAO CODE 701044) OSD CASE 1277

**"SURFACE COMBATANTS: NAVY FACES CHALLENGES  
SUSTAINING ITS CURRENT FORCE GOAL"**

**DOD RESPONSE TO GAO RECOMMENDATIONS**

- **RECOMMENDATION 1:** The GAO recommended that the Secretary of Defense advise the Congress on the basis for the Navy's surface combatant force goal. The GAO added that such information should include (1) number and type of surface combatants that are needed to fight and win two nearly simultaneous major regional conflicts; (2) number of additional ships that are planned to meet peace time presence objectives; (3) key assumptions that support the force goals, such as expected allied contributions; (4) expected impact of new technologies and capabilities on the size and composition of the future force; and (5) impact of the Arsenal Ship on the surface combatant force goal. (p.8, p. 75/GAO Draft Report)

**DOD RESPONSE:** Concur. The programmed surface combatant force structure contained in the FY 1998 budget and associated FYDP are adequate to support the Department's current presence and contingency response requirements. The Quadrennial Defense Review (QDR) and other ongoing studies are assessing longer-term ship force issues, including alternative surface combatant force structures. The results of the QDR should provide the basis for understanding future surface combatant needs.

- **RECOMMENDATION 2:** The GAO recommended that the Secretary of Defense should also provide information on the Navy's plan to sustain the surface combatant force level, including key assumptions regarding expected service lives, pace of the shipbuilding program, types of ships, required funding, and any other factor that might alter the requirement. (p. 8, p. 75/GAO Draft Report)

**DOD RESPONSE:** Concur. These data are for the most part reflected accurately in the draft report and represent current projections regarding ship service lives and the funding that could be allocated to shipbuilding. The results of the QDR will provide additional relevant information.

Now on pp. 8, 73-74.

Now on pp. 8, 74.



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