United States Government Accountability Office

GAO

Report to Congressional Committees

November 2004

FORCE STRUCTURE

Navy Needs to Fully Evaluate Options and Provide Standard Guidance for Implementing Surface Ship Rotational Crewing

GAO-05-10

November 2004

FORCE STRUCTURE

Navy Needs to Fully Evaluate Options and Provide Standard Guidance for Implementing Surface Ship Rotational Crewing

GAO Accountability · Integrity · Reliability

Highlights

Highlights of GAO-05-10, a report to congressional committees

Why GAO Did This Study

The Navy has traditionally maintained overseas presence by deploying ships for 6 months. Rotating crews aboard ships that remain deployed for longer periods is an alternative the Navy could pursue to increase the utilization of ships. Senior Navy officials have also cited crew rotations as a way to reduce part of the Navy's plans for a larger force structure and reportedly free billions of dollars for other priorities. On its own initiative, GAO examined the Navy's efforts to evaluate and implement several rotational crewing options and the impacts of ship maintenance on extended rotational crewing deployments.

What GAO Recommends

GAO recommends that the Secretary of Defense direct the Secretary of the Navy to systematically evaluate the feasibility and cost-effectiveness of rotational crewing alternatives; specify standard policies and procedures to ensure consistent management and accountability for ships during crew rotations; collect, record, and disseminate lessons learned; and conduct a study of the maintenance process that includes all ships involved in rotating crews. The Department of Defense concurred with the recommendations and cited actions it will take to implement the recommendations.

www.gao.gov/cgi-bin/getrpt?GAO-05-10.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Janet St. Laurent at (202) 512-4402 or stlaurentj@gao.gov.

What GAO Found

The Navy has initiated change by demonstrating that rotating crews aboard surface ships on extended deployments may be a feasible alternative to traditional 6-month ship deployments. To effectively institutionalize and implement change, best practices show that a comprehensive analytical framework provides useful information to decision makers. However, the Navy has not established such an analytical framework—consisting of formal measurable goals, objectives, and metrics—that could be used to assess the feasibility of various rotational crewing options and determine their impact on operational requirements, ship condition, and crew morale. Further, the Navy has not systematically collected or developed accurate cost data to perform complete cost-effective analyses. Absent such information, the Navy may not know the full impact of rotating crews on surface ships, the extent to which the various options should be implemented, or whether it is getting maximum return on investment.

Because rotating crews on surface ships is evolving as an alternative, the Navy has not provided effective guidance when implementing the practice and has not systematically leveraged lessons learned. Effective guidance and sharing of lessons learned are key tools used to institutionalize change and facilitate efficient operations. While the Navy has well-established crew rotation policies and procedures for ballistic missile submarines that include appropriately documenting a ship's condition and turnover procedures for accountability, it has not provided comparable guidance to surface ships. As a result, the Navy unnecessarily risks repeating mistakes that could decrease warfighting effectiveness and crew morale.

Furthermore, the impact of ship maintenance on the implementation of rotational crewing has not been fully assessed. Effective maintenance strategies help ensure ships can perform their missions without adverse impacts on crew morale. It is a challenge to ensure the mission capability of ships that are deployed for longer periods because most maintenance and repair is usually completed between 6-month deployments. While rotating crews has enabled the Navy to keep ships deployed for up to 24 months, the service has not fully examined all issues related to the best maintenance strategies that could affect a ship's condition and crew's morale. Absent effective strategies, the Navy risks degrading long-term ship condition and discouraging crew support for rotational crewing.

Contents

Letter		1
	Results in Brief	3
	Background	6
	The Navy Has Not Systematically Evaluated the Feasibility and Cost-Effectiveness of Rotational Crewing for Surface Ships	11
	Navy Has Not Provided Effective Guidance or Capitalized on Lessons Learned from Rotational Crewing Experiences	21
	Maintenance Strategies for Alternative Crewing and Potential Impacts Have Not Been Fully Assessed	33
	Conclusions	42
	Recommendations for Executive Action	43
	Agency Comments	43
Appendix I	**Ships Included in Our Evaluation**	46
Appendix II	**Scope and Methodology**	56
Appendix III	**Summary List of Department of the Navy Guidance Implementing 10 U.S.C. 7310**	61
Appendix IV	**Comments from the Department of Defense**	62
Appendix V	**GAO Contact and Staff Acknowledgments**	68

Tables

Table 1: Comparison of Crewing Options during Deployments to the Persian Gulf 12
Table 2: Selected Preliminary Lessons Learned Regarding the Material Condition of U.S.S. *Fletcher* during the Sea Swap Destroyer Initiative 31
Table 3: Examples of Maintenance Problems on Patrol Coastal Ships 40
Table 4: Number of Focus Groups by Personnel Group and Platform 59

Figures

Figure 1: U.S.S. *Nevada*, an *Ohio*-Class Ballistic Missile Submarine 46
Figure 2: The U.S.S. *Fletcher*, a *Spruance*-Class Destroyer 48
Figure 3: The U.S.S. *Benfold*, an *Arleigh Burke*-Class Guided Missile Destroyer, with a Rigid Hull Inflatable Boat Passing in the Foreground 49
Figure 4: The U.S.S. *Firebolt*, a *Cyclone*-Class Patrol Coastal 50
Figure 5: The High Speed Vessel Experimental Craft, HSV-2 *Swift* 52
Figure 6: Design Depiction of the Navy's Next Generation Destroyer, DD(X) 53
Figure 7: Design Depictions of the Littoral Combat Ship 55

Abbreviations

DD	destroyer
DD(X)	next generation guided missile destroyer
DDG	guided missile destroyer
DOD	Department of Defense
HSV	high speed vessel

GAO
Accountability * Integrity * Reliability

United States Government Accountability Office
Washington, DC 20548

November 10, 2004

Congressional Committees

The Navy's fleet of surface ships represents a significant capital investment to provide the forward presence desired. The Navy is also facing an affordability challenge as it invests in new ships, supports a high pace of operations, and manages rising personnel costs. The Navy has traditionally maintained overseas presence by using standard deployments whereby individual ships and their permanently assigned crews are deployed for approximately 6 months out of a 27-month cycle that includes time for training and ship maintenance. Rotating crews aboard ships so that the ships can remain deployed for a longer period is one of many alternatives the Navy could pursue to increase the utilization or the operational on-station days,[1] or both, of Navy ships. Recently, senior Navy officials have also cited crew rotations as one of the ways to partially mitigate the need for a larger force structure and free billions of dollars for higher priority areas, such as the capabilities needed to operate from the sea when the United States is denied access to bases and ports abroad. As such, it is prudent for the Navy to employ its ships in a manner that maximizes its return on investment.

The Navy has rotated crews on ships in several ways, although its use of this practice is not widespread and is still evolving. On its *Ohio*-class Trident ballistic missile submarines, the Navy has used a "Blue-Gold" crew concept since the 1960s, whereby two complete crews are assigned to a single hull and rotate deployments. In the 1990s, the Navy's Mine Warfare Command[2] used a concept whereby four crews rotated among three ships throughout the deployment cycle. More recently, the U.S. Pacific Fleet[3] has

[1] Operational on-station days are defined as those days a ship spends forwardly deployed in the designated theater of operations.

[2] The Navy's Mine Warfare Command is responsible for developing and evaluating mine warfare doctrine, tactics, and equipment. The Command also ensures readiness of mine warfare forces to conduct offensive and defensive mine warfare operations through training and operational experience.

[3] The U.S. Pacific Fleet provides trained and combat-ready naval forces to combatant commanders. Pacific Fleet ships are at sea in the Pacific, Indian, and Arctic Oceans, from the west coast of the United States to the Arabian Gulf. The Pacific Fleet encompasses approximately 200 ships, 2,000 aircraft, and over 239,000 sailors, Marines, and civilians.

been demonstrating the ability to rotate crews on some of its destroyers as part of a "Sea Swap" demonstration project. Under this concept, there are the same numbers of crews as ships, but the crews rotate for 6 months to those ships that are forward deployed for extended periods of 18 months or more. The Navy is also using this concept on its patrol coastal ships operating in the Persian Gulf and the Blue-Gold concept to support the high speed vessel experimental ship, the HSV-2 *Swift*.

We prepared this report under our oversight authority and are providing it to you because of your oversight on defense issues. Recognizing the Navy's need to explore ways for improving the use of its surface ships and its plan for employing rotational crews on several types of surface ships in the current and planned force (appendix I provides a description of all ships included in our evaluation), this report addresses the following questions: (1) Has the Navy systematically evaluated the feasibility, including the cost-effectiveness, of rotational crewing concepts for existing and future classes of surface ships? (2) Have the Navy's experiences with rotational crewing been effectively implemented? (3) How does ship maintenance affect implementation of rotational crewing?

To assess whether the Navy has systematically evaluated the feasibility and cost-effectiveness of rotational crewing concepts for existing and future classes of surface ships, we reviewed rotational crewing studies performed by and for the Navy, including a recent study by the Center for Naval Analyses;[4] compiled and analyzed sailor reenlistment data; interviewed Department of Defense (DOD) and Navy Headquarters and fleet officials; met with cost analysis experts in the government and the private sector; and reviewed key acquisition documents and crew employment plans. To assess whether the Navy has effectively implemented rotational crewing on surface ships and leveraged lessons learned, we conducted over 40 focus group meetings with rotational crews; interviewed Pacific and Atlantic Fleet[5] officials responsible for

[4] The Center for Naval Analyses is the Department of the Navy's Federally Funded Research and Development Center. The Center's analysts provide direct support to operating forces and senior staffs across the spectrum of Navy and Marine Corps activities.

[5] The mission of the U.S. Atlantic Fleet is to provide combat-ready naval forces and to ensure that those forces are supplied the leadership, manpower, equipment, maintenance, training, and material needed to perform their assigned missions. The Fleet commander determines readiness and training requirements for assigned forces and ensures that deploying units meet prescribed readiness standards.

personnel, operations, maintenance, and training; and reviewed Navy Lessons Learned System instructions and queried the system to determine relevant lessons recorded. We used the strategic ballistic submarine community as a best practice based on its long-standing successful use of rotational crewing. To assess how maintenance on ships homeported in the United States might be affected by extended deployments, we reviewed ship maintenance directives and instructions, reviewed ship maintenance reports, and conducted focus group meetings with the three crews on the *Arleigh Burke*-class destroyers involved with the Sea Swap destroyer demonstration project and several crews that had rotated on patrol coastal ships.

While we did not validate the maintenance reports and sailor reenlistment data used in this report, we discussed the data with DOD officials to determine that the data were sufficiently reliable for our analysis. We did validate the Navy Lessons Learned System data and determined the data were sufficiently reliable for our analysis. We conducted our review from July 2003 through July 2004 in accordance with generally accepted government auditing standards. The scope and methodology used in our review are described in further detail in appendix II.

Results in Brief

The Navy has initiated change by demonstrating that rotating crews aboard surface ships on extended deployments may be a feasible alternative to traditional 6-month ship deployments. However, the service has not institutionalized this change by employing a comprehensive analytical framework that will systematically evaluate all rotational crewing options for current and future classes of surface ships. Best practices show that an analytic framework that includes measurable goals and objectives, performance metrics, and evaluation plans helps decision makers effectively implement change. The Navy has developed some data to demonstrate that rotational crewing aboard surface ships is feasible for increasing the forward presence. But, the Navy has not established formal measurable goals, objectives, and metrics that would be used to assess each of the rotational crewing options to determine their impact on operational requirements, ship condition, and crew morale. For example, one measure of crew morale is the reenlistment rate. While the Navy did not assess the rates for participants in rotational crewing, we found that reenlistments were generally lower on the Sea Swap guided missile destroyers compared to comparable Pacific Fleet ships. Further, the Navy has not systematically collected or developed accurate cost data in order to perform complete cost-effectiveness analyses. For example, cost assessments have been limited to identifying fuel savings resulting from

fewer ship transits to and from homeports, costs for crew transportation and berthing, and some additional maintenance and training costs. A systematic cost-effectiveness assessment, according to cost analysis experts, should include all costs for each of the crewing alternatives, such as housing, training, maintenance, and ship acquisition costs. This capability and cost information is critical for comparing the different crewing options and evaluating which one most effectively meets specific operational requirements. In the absence of a systematic evaluation of the potential feasibility and cost-effectiveness of all rotational crewing options for its current and future classes of surface ships, the Navy may make decisions without knowing the full impact of the practice on surface ships or the extent to which this practice should be implemented to meet operational requirements. Consequently, the Navy does not know that it is getting a maximum return on investment or the extent to which using rotational crewing can economically offset future ship total ownership costs.[6]

The Navy's experiences with rotational crewing as an alternative to standard deployments are still evolving, and thus the Navy has not provided effective guidance for implementing the concept on surface ships and has not systematically leveraged lessons learned to support consistent management of the practice. Effective guidance and sharing of lessons learned are key tools used to institutionalize change and facilitate efficient operations. While the Navy has conducted some planning in support of rotational crewing on Sea Swap destroyers and has well-established crew rotation guidance for fleet ballistic missile submarines, it has not provided comparable guidance, including standard policies and procedures, to conduct rotational crewing on other surface ships. Consequently, management of rotational crewing on these ships has been left to ship commanders, resulting in inconsistent implementation and accountability. Further, the surface ship community has not capitalized on lessons learned from past and current crew rotation experiences. By not systematically recording and sharing lessons learned from its rotational crewing experiences aboard surface ships, the Navy unnecessarily risks repeating mistakes that could decrease warfighting effectiveness and crew morale. For example, experiences have shown the need to properly account for inventories of equipment and supplies during crew turnover

[6] Total ownership costs include the costs to research, develop, acquire, own, operate, maintain, and dispose of weapon and support systems; the costs of other equipment and real property; the costs to recruit, retrain, separate, and otherwise support military and civilian personnel; and all other costs of DOD's business operations.

that affect operations and general support of the crew, yet this inventory control problem during crew turnovers persists.

The Navy has not fully assessed the impact of ship maintenance on the implementation of rotational crewing because it has been focused on demonstrating the feasibility of the practice and allowed different approaches to conducting maintenance without examining all related issues that could affect success. Effective maintenance strategies help to ensure that ships can perform their missions without adverse impacts on crew morale or incurring unintended consequences. It is a challenge to ensure the mission capability of ships that are deployed for longer periods (up to 24 months) because they must maintain mission capability while deployed and forego standard maintenance periods that generally occur every 6 months. According to the Center for Naval Analyses, a more comprehensive Navy maintenance effort—including predeployment inspections and more overseas mission-essential repairs—was required to sustain the readiness of the two destroyers deployed in the Sea Swap demonstration project than is typical. Even with these extra efforts, the resulting impact on the condition of the ships was uncertain. Although the Center concluded that maintenance was adequate to sustain the ships at high readiness levels and that, upon return, the material condition of one of the demonstration ships was comparable to another recently deployed ship, Navy inspection data suggest otherwise. For example, we found that the Sea Swap ship had significantly more numerous deficiencies and lower inspection scores than the recently deployed ship. Because of the importance of maintenance, the Center concluded that if the demonstration project becomes a more standard practice, the Navy should review the maintenance process and assess maintenance responsibilities, relationships, and costs. We found the need for such an analysis was further supported by the experiences of other deployed ships using rotational crews, such as the patrol coastal ships. These ships did not receive such focused maintenance, and Navy officials identified several maintenance problems that were not corrected while deployed that could have affected the ships' mission capability. Moreover, the Center and our focus groups reported concerns about the extra workload to maintain ships at a high level of readiness. In the absence of effective strategies, the Navy runs the risk that it will degrade the long-term condition of ships as well as discourage crew support for rotational crewing.

To ensure the Navy increases ship utilization in an effective and efficient manner, we are recommending that the Secretary of Defense direct the Secretary of the Navy to systematically evaluate the feasibility and cost-effectiveness of all rotational crewing alternatives; develop a

rotational crewing program with effective management oversight, standard procedures, and lessons learned; and fully assess the maintenance strategies. In commenting on a draft of this report, DOD concurred with the recommendations and cited actions it will take to implement the recommendations.

Background

The Importance of Having a Forward Military Presence Overseas

Maintaining an overseas military presence that is prepared to deter threats and engage enemies remains an enduring tenet of U.S. national military strategy and priorities. For example, the National Military Strategy[7] notes that an overseas presence supports the ability of the United States to project power against threats and support the establishment of an environment that reduces the conditions that foster extremist ideologies. The strategy also notes that keeping an overseas presence serves to assure U.S. allies; improves the ability to prosecute the global war on terrorism; deters, dissuades, and defeats other threats; and supports transformation. The Chief of Naval Operations earlier this year underscored the continuing importance of forward-deployed forces, noting "Our forward rotations remain critically important to our security, to strengthening alliances and coalitions, and to the global war on terrorism. But it is clear we must make these rotations with purpose, not just to fill the calendar."[8]

Current Operational and Budgetary Pressures on Ship Procurement and Operational Accounts

In early 2001, the Chief of Naval Operations recognized the challenge of accomplishing the Navy's missions within its budget. In February 2001, the Vice Chief of Naval Operations established a task force to explore force structure options facing the naval service, noting that in order for organizations to remain vital and competitive "they maintain their options and seek innovative developments that may provide simpler, more convenient, or less costly alternative solutions to their needs." One of the task force's primary assumptions was that the Navy leadership understands that there may be insufficient procurement funds available to maintain current fleet size. Another assumption was that the demand for

[7] "National Military Strategy of the United States of America 2004 - A Strategy for Today; A Vision for Tomorrow," The Joint Chiefs of Staff.

[8] Statement of Admiral Vern Clark, U.S. Navy, Chief of Naval Operations, before the Senate Committee on Appropriations, March 10, 2004.

naval forward presence would remain greater than the supply, regardless of fleet size. Within a year, an operational studies group within the Office of the Chief of Naval Operations noted that the need for alternative crewing approaches might be necessary to sustain the pace of global operations, especially in the global war on terrorism.

More recently, senior Navy officials have warned that budgets will remain tight. In June 2004, the Secretary of the Navy stated that DOD will have less money for recapitalization because the defense budget will not continue growing at the rates it has in recent years. The Navy's acquisition executive has also noted that the Navy is employing multiple strategies that eventually may reduce the number of ships, submarines, and aircraft it purchases, saving taxpayer dollars as it seeks more effective ways of employing its forces so that fewer of them can provide the capabilities needed to accomplish assigned missions.

Rotating Crews Is a Part of Force Structure Assessment

One such effort that may enable the Navy to sustain a high pace of operations within expected budgets involves the rotation of crews on and off forward-deployed Navy surface ships. While the Chief of Naval Operations stated earlier this year that the ideal fleet size would be about 375 ships, he also said that he is no longer willing to commit to any specific number of ships until the Navy completes a new assessment of ship requirements. The assessment, which started this year, will evaluate the potential impact on force structure requirements from keeping ships at sea for longer than standard 6-month deployments by rotating the crews on and off. He noted the Navy's recent experience with keeping two destroyers on extended deployments, whereby these two ships provided the presence overseas that is the equivalent of 8 to 10 ships on normal deployment schedules.

Traditional Ship Employment Cycle Provides Limited Time in Theater

The amount of time a ship ultimately spends forward deployed in a theater of operations is affected by several factors in its employment cycle. These factors include length of a deployment, transit speeds and port calls, crew training and certification, ship maintenance requirements, and maintaining sufficient readiness for surging forces during nondeployed periods. The result is that a ship homeported in the United States and deploying to the Persian Gulf area for 6 months will normally spend less than 20 percent of its time in theater and that the Navy would need about 6 ships to maintain a continuous presence in the region over a 2-year period.

As part of the transformation efforts to increase the fleet's operational readiness and responsiveness, the Navy recently implemented a new

operational strategy—called the Fleet Response Plan—that changes the manner in which it maintains, trains, mans, and deploys its ships. The overall objective of the plan is to create a more responsive force by sustaining a more level balance of training between deployments, instead of dropping to minimum rates of readiness upon return from deployment and then gradually rebuilding its state of readiness throughout a 12-month training cycle that follows major maintenance of the vessel. The plan also modifies long-standing forward presence policy of predictable, 6-month deployments to predetermined regions. This flexible deployment concept allows units that have attained high readiness to embark on deployments of varied duration—but still generally no longer than 6 months—in support of specific national priorities, such as homeland defense, multinational exercises, security cooperation events, deterrent operations, or prosecution of the global war on terrorism. These deployments provide what the Chief of Naval Operations calls "presence with a purpose," and are intended to occur in less predictable patterns to keep potential adversaries off guard.

Ship Crewing Options

In addition to the standard ship and crew employment cycle, the range of Navy crewing options falls into four major categories: (1) Sea Swap, (2) Horizon, (3) Blue-Gold, and (4) partial or graduated crew swapping.[9] Each of these options can be implemented in varying ways and may have different advantages and disadvantages, but the Navy's actual experience with nonstandard crewing concepts on surface ships is limited.

Standard Crew Deployments

Standard crew deployments use one crew per ship. Most of the crewmembers are assigned to the ship for 4 years, and it is common for crewmembers to deploy overseas on the same ship more than once. Standard ship deployments occur once every 27 months for a period of 6 months of which the ship and the crew are on-station for 3 to 4 months, depending upon whether the ship deploys from the east or west coast of

[9] For the purposes of this report, we are not including Navy ships operated by the Military Sealift Command and crewed by civilian mariners. The Command provides sea transportation of equipment, fuel, supplies and ammunition to sustain U.S. forces worldwide during peacetime and in war.

the United States.[10] Most Navy ships and their crews employ the standard crew deployment option.

Sea Swap

The Sea Swap option uses the same number of crews as ships. Notionally under this option, one of the ships deploys two, three, or four times longer than the standard time by rotating crews every 6 months at an overseas location. Ideally, all of the Sea Swap ships share an identical configuration, so crew performance and capability are not degraded because of ship differences.[11] Because crews do not return to the ships on which they trained, under a four-ship Sea Swap option, some crews could serve on three different ships in just over 6 months and be expected to demonstrate combat proficiency on each one. A limited number of destroyers and patrol coastal ships have employed the Sea Swap option in recent years.

Horizon

The Horizon option involves one or two more crews than hulls, such as four crews for three ships or five crews for three ships. Crews serve for no more than 6 months on ships that are deployed for 18 months or more. Under a three-ship Horizon option, crews could serve on at least two ships in just over 6 months and be expected to demonstrate combat proficiency on each one. In addition, each crew would be without a ship for a period of time and stay ashore at a readiness, or training, center. This crewing option was employed on mine countermeasure ships during the 1990s.

Blue-Gold

The Blue-Gold option assigns two complete crews, designated "Blue" and "Gold," to a single ship. Most of the crewmembers are assigned to a ship for several years, and it is common for them to deploy overseas on the

[10] A ship based in San Diego, California, would spend a greater portion of its deployment in-transit to the Persian Gulf-operating area than a ship based in Norfolk, Virginia, because of the distance. As a result, a ship based in San Diego may spend about 14 percent of its time in the Persian Gulf area whereas a ship based in Norfolk would spend closer to 20 percent of its time in the Persian Gulf area.

[11] Surface ships are continuously having their combat and other systems upgraded or replaced so maintaining "identical" configurations is a challenge. Also, despite surface ships with the same "design" being built within years of each other, no two ships are exactly alike and even more differences are likely when these ships are built in different shipyards.

same ship more than once. Crew deployments would not exceed 6 months and are often of much shorter duration. An advantage with this option includes the crews' familiarity with the ship. However, a disadvantage is that the proficiency can degrade since crews sometimes do not have a ship on which to train and must rely on mock-ups and simulators. The Blue-Gold option has been employed by the strategic submarine force and the HSV-2 *Swift*.[12]

Partial or Graduated Crew Swapping

Partial crew swapping has been employed on a limited basis. The most notable use of this option involved the exchange of crewmembers between a ship based in Japan with a ship based in the United States in 1999. A variation on this theme is when portions of a ship's crew are swapped out at regular intervals, for example, one-quarter of the crew every 2 or 3 months.

Rotational Crewing Believed to Provide Forward Presence Benefits

The most significant advantage attributed to rotational crewing options is the more efficient use of a ship in an overseas operating area. This is accomplished by keeping the ship on extended deployments, ranging from 12 to 36 months or longer, while at the same time not increasing the crew's time away from home. Top Navy officials, including the Chief of Naval Operations, believe that increased efficiencies from rotating crews enable the Navy to perform the same number of missions with fewer ships or to increase the number of missions with the same force size. For example, the Navy's acquisition executive stated that if the Sea Swap option is employed on its next generation guided missile destroyer, the DD(X),[13] the Navy might be able to reduce requirements from 24 to 16 ships and apply the savings toward the next generation cruiser.

Disadvantages often associated with rotational crewing include increased infrastructure costs; deteriorating ship material condition and lack of ready access to maintenance support while on extended deployment; decreased readiness due to differences between ships; and decreased quality of life and other sociological issues for crew members, including the sense of less "ship ownership," fewer port calls, and cultural changes.

[12] The HSV-2 *Swift* is a high-speed aluminum–hulled catamaran acquired as an interim mine warfare command and control ship. For a picture and details on the ship, see appendix I.

[13] The DD(X) is the Navy's next generation, multimission destroyer, tailored for land attack missions.

Recent Sea Swap Destroyer Demonstration Project Assesses Feasibility

The Navy recently conducted a 2-year demonstration to determine if two destroyers could (1) provide more deployment time on-station and (2) maintain sailor quality of life while rotating crews. The Navy declared the demonstration a success, stating that the ships operated well while increasing their operational capability. In its report on the Sea Swap demonstration project, the Center concluded that the feasibility of the concept clearly was a success.[14] However, the Center noted that there were problems and limitations. While none of the problems was considered a showstopper, the Center stated that the Sea Swap demonstration afforded the opportunity to learn lessons in order to enhance the use of the practice in the future. Many of these, such as the need for improved accountability, oversight, and understanding of maintenance strategies, are discussed in this report.

Key Commands Responsible for Implementing Rotational Crewing on Surface Ships

The Chief of Naval Operations has charged the Commander, Naval Surface Force, U.S. Pacific Fleet, with being the primary proponent for demonstrating the feasibility of rotating crews on surface ships as well as assessing the cost of the various options and providing oversight and accountability. To date the Command's emphasis has been on using the Sea Swap demonstration as a "proof-of-concept" for rotational crewing. It provided the guidance implementing the concept, approved the assessment plan, and used Center support to collect and analyze some data. However, other commands are involved in implementing other rotational crewing options on surface ships; they include the Mine Warfare Command and the Amphibious Group Two Command. See appendix II for a more complete list of organizations involved.

The Navy Has Not Systematically Evaluated the Feasibility and Cost-Effectiveness of Rotational Crewing for Surface Ships

Although the Navy's senior leadership has initiated a change in how the Navy can operate in the future by demonstrating that rotational crewing is a feasible alternative to traditional 6-month ship deployments, the Navy has not systematically evaluated the feasibility and cost-effectiveness of all rotational crewing options for its current and future classes of surface ships. The Navy has documented that rotational crewing helps to increase the forward presence of its ships beyond the traditional 6-month deployment periods, and officials have indicated that they want to make greater use of rotational crew options. While the Navy has conducted some limited assessments of the Sea Swap destroyer demonstration project, it has not developed a comprehensive common analytical framework to assess the potential impact of all rotational crewing options

[14] Center for Naval Analyses, *Sea Swap Assessment* (Alexandria, Virginia: September 2004).

on the material condition of all of the ships, operational requirements, and the quality of life for crews.

In addition, the Navy has not collected complete and consistent information that is critical for comparing different crewing alternatives for such factors as evaluating which alternative most cost-effectively meets specific requirements and warfighting effectiveness. In the absence of a common analytical framework, Navy officials assigned to ships that have used or experimented with crew rotations have been left to develop their own goals, objectives, and metrics and the results have to date been uneven. As a result, the Navy does not have complete and accurate data, including cost data that reflect total ownership and operating and support costs, readiness, and crew quality of life, making success or failure of the individual options involving different types of ships difficult to determine. In the absence of a systematic evaluation, the Navy also does not know the extent to which rotational crewing options can provide maximum return on investment and economically offset future ship total ownership costs.

Navy Has Some Evidence to Show That Rotational Crewing Increases Forward Presence and Is Considering Greater Use

The Navy has developed some data to demonstrate that rotational crewing helps to increase the forward presence of its ships beyond the traditional 6-month deployment periods. Table 1 shows the percentage of time a ship would be notionally forward deployed during the employment cycle for each type of crew deployment option and the number of ships that would be required to keep one vessel continuously operating in the Persian Gulf.

Table 1: Comparison of Crewing Options during Deployments to the Persian Gulf

Crewing option	Percent of ship's employment cycle forward deployed	Number of ships required to continuously keep one forward deployed
Standard	17	6
Sea Swap	24	4
Horizon	32	3
Blue-Gold	71	1.5

Source: GAO's analysis of Navy data.

Given such promise for improving deployment efficiencies, Surface Force Pacific Command[15] officials have considered using rotational crewing options on other ships. For example, in July 2004, the Commander, Naval Surface Force, indicated plans to use the Sea Swap option on an *Arleigh Burke*-class destroyer based in the Atlantic Fleet and an expeditionary strike group based in the Pacific Fleet, during the spring and summer of 2005, respectively. In addition, Mine Warfare Command officials informed us in July 2004 that it intends to rotate crews on mine warfare ships based in the Persian Gulf later in the year, but it had not yet determined which option it will use.

The Navy is also considering rotational crewing for operating future ships and, as a result, it could change the number of new ships that might be purchased. For example, the Navy is designing and procuring the littoral combat ship[16] and the DD(X), which will cost billions of dollars. The Navy has suggested that if crew rotations with an expeditionary strike group are as successful as with the Sea Swap destroyers' demonstration, procurement plans for the number of the DD(X) destroyers can be reduced and the savings applied to other high priority ships.

No Established Framework and Limited Information for Comparing Crew Rotation Options

While the Center and the Surface Force Pacific Command have conducted some assessments of the Sea Swap demonstration project, the Navy did not have an analytical framework or collect the information that would be needed to assess and compare all crewing options. Lacking such a framework, the Navy has not systematically assessed the effect that rotational crewing has on such factors as the ships' material condition and readiness or crew quality of life and training. Additionally, the Navy has not systematically evaluated the cost-effectiveness of the various crewing options.

[15] Commander, Naval Surface Force, U.S. Pacific Fleet, located in San Diego, California, ensures surface ships of the Pacific Fleet are properly trained, maintained, and crewed to support military operations. The Command is responsible for the readiness of 81 ships, including cruisers, destroyers, frigates, amphibious assault ships, logistics, and fleet support ships.

[16] The littoral combat ship will be a new class of Navy surface combatants. It is intended to be fast, agile, stealthy, affordable, and tailored for specific missions such as antisubmarine, antisurface, or mine warfare in heavily contested coastal area waters, and will use interchangeable mission modules tailored for specific missions.

Analytic Framework Would Improve Ability to Evaluate Crewing Options

Best practices show that an analytic framework that includes measurable goals and objectives, performance metrics, and evaluation plans[17] would allow decision makers and others to receive consistent information needed to compare and assess different policy options, measure implementation progress, and determine whether the desired results were being achieved. Without such information for the various crewing options, Navy managers do not have a clear picture of the status of the crew rotation efforts, whether potential benefits from different crew rotations are being achieved, which option might be best in certain situations, and whether major issues need to be resolved.

The Navy has not established formal criteria for evaluating the implementation of the various rotational crewing options because its focus has been on demonstrating the feasibility of the concept rather than on assessing and formalizing the options. For example, the Navy did not establish evaluation criteria prior to implementing Sea Swap, and none was identified in the Center's Sea Swap assessment plan. As a result, the Center lacked criteria for judging ship condition and crew quality of life. According to the Center's September 2004 report, the Navy had no intent to control the operational activities in the sense of a scientific experiment, where one notionally scores a probability of success or other such measure of effectiveness. It said the intent was that general conclusions about the feasibility and difficulties of pursuing the Sea Swap concept for future force employment planning would be drawn from the experiment. Moreover, the Navy did not have comparable assessments for the options employed on other ships such as the patrol coastal ships and the HSV-2 *Swift*.

More common data and analyses are not available for comparison because, in the absence of a common analytical framework, individual commands using crew rotations have been able to decide on their own what (1) goals, objectives, and metrics to establish; (2) data to collect; and (3) evaluations to do, if any. Such goals, objectives, and metrics on ship condition and quality of life, which could affect crew retention, were not established prior to deployment, and complete information on these factors was not systematically collected during and after deployments. As a result, while the Navy has reported that the Sea Swap demonstration

[17] The Government Performance and Results Act offers a model for developing an effective management framework to improve the likelihood of implementing initiatives and assessing results.

project was a success for the destroyers involved, the Navy lacks clear criteria to objectively evaluate how well the project did and the project's potential against other rotational crewing options in two key areas we assessed—the condition of the ship and the crew's quality of life.

Material Condition of Ships Not Systematically Assessed

The Sea Swap demonstration project collected data on ship condition that could be valuable. However, complete data were not systematically collected on the ships before deployment and there were no clear criteria for comparing the ships' condition upon return. For example, the Navy conducted a total ship readiness assessment of the U.S.S. *Higgins*, one of the two demonstration destroyers, in April 2004, shortly after the ship returned from its 18-month deployment. This post-deployment assessment of the combat, hull, mechanical, and electrical systems was used to compare the U.S.S. *Higgins*'s material condition to the U.S.S. *Decatur*'s. The U.S.S. *Decatur*, a guided missile destroyer, had recently completed a standard 6-month deployment. According to Surface Force officials, there was no significant difference between the two ships' material condition upon return. However, there is some disagreement about the criteria and interpretation of the data used in reaching this conclusion. This is discussed in more detail on pages 37-39. In its report, the Center cautioned that further analyses of ship material condition are needed. Comparable assessments of ship condition are not being performed on the U.S.S. *Fletcher*, the other Sea Swap destroyer on extended deployment.

The Navy is missing an opportunity to collect data and more objectively assess the impact of extended deployments on ship condition. A more stringent independent inspection[18] for the U.S.S. *Higgins* is scheduled in January 2005, about 8 months after its return from deployment and likely after having received significant shipyard maintenance and modernization. Furthermore, Surface Force officials also told us that a comparable pre-inactivation inspection, which is normally performed, would not be done

[18] Known as a trials and material inspection, this more stringent inspection is conducted by an independent Navy organization whose responsibilities include conducting material inspections of all naval ships at least once every 3 years, if practicable, for the purpose of determining and reporting upon a ship's fitness for further service and material conditions that limit her capability to carry out assigned missions and periodically ascertaining and reporting on the material condition and performance capabilities or limitations of Navy ships.

on the U.S.S. *Fletcher* because it is being decommissioned and they do not want to spend the money.[19]

Quality-of-Life Issues Not Fully Assessed

An objective of Sea Swap was to maintain the crews' quality of life. The Center's study plan stated the Center would examine how the project improved or degraded the quality of life and quality of work for Navy personnel through surveys and interviews with crewmembers. However, the Navy did not establish goals for determining the quality-of-life success of the Sea Swap program. As a result, even though the Center had collected data on morale, it could not conclude whether Sea Swap had succeeded or failed in this regard. Also, the Navy has no plans to monitor crews' quality of life for the patrol coastal ships and the HSV-2 *Swift*. The need for such an analysis is borne out by the impact of crew morale on reenlistment rates.

Quality of Life Is an Important Factor in Sailors' Career Choice

Sailors' views of their quality of life is an important factor in determining whether they will choose to continue their military career. The Chief of Naval Operations has recognized the importance of people in making the Navy successful in performing its mission and has consistently made manpower and quality of service top priorities. According to the Chief, "Quality of work includes everything that makes your workplace a great place to be—from getting the spare parts you need in a timely manner to working spaces that are up to current standards."

Sea Swap's Implementation May Have Been Key to Quality-of-Life Concerns

Information collected by the Center, and by us during our review, indicated that implementation of the Sea Swap demonstration project had a negative effect on crewmember quality of life. While noting that Sea Swap had been successful technically, the Center's pre- and post-surveys of the crew showed that Sea Swap adversely affected morale because of the increased workload, fewer opportunities for liberty port calls, and crewmembers' general impression that the Sea Swap deployment was worse than their previous deployment. For example, the Center asked crews about their expectations for Sea Swap compared to

[19] Chief of Naval Operations Instruction 4770.5F, May 29, 1991, "General Instructions for Inactive Ships and Craft," states that a Board of Inspection and Survey will inspect a ship to determine and document the material condition of the ship prior to inactivation.

previous deployments. The survey results showed that 65 percent of the arriving crews expected that Sea Swap would be a worse experience than their last deployment and of departing crews; 84 percent said participating in Sea Swap was worse.

Our focus groups with crews on the U.S.S. *Higgins* and the patrol coastal ships also revealed a negative quality of life. The Center and we both identified several factors that contributed to sailors' feelings, including workload, training and professional development opportunities, quantity and quality of port visits, and several sociological issues (e.g., culture, ship "ownership," sense of pride and recognition, predictability, or Navy tradition). The Center also noted that Navy leadership would need to understand which features of Sea Swap cause negative perceptions.

We addressed quality-of-life issues in each of our 43 focus group meetings. All 26 of our focus group meetings with Sea Swap destroyer crews that served on the U.S.S. *Higgins* and with crews on patrol coastal ships attested to a highly negative quality of life, a decreased morale, and a strong desire to not participate on any more crew rotations implemented like their most recent experience. Many crewmembers indicated that rotational crewing might have had a more positive effect if the following conditions were met:

- crew swapping had been better managed to ensure work accountability to reduce the workload,
- there had been time for individual training and professional development,
- promises had been kept on designated port calls,
- port calls had been phased throughout the deployment instead of at the end when sailors just wanted to return home,
- return flight schedules had been better coordinated, and
- proper recognition had been given to each crew.

A small number of crewmembers indicated that their Sea Swap experience was positive in that they liked knowing they would be on a finite deployment period of 6 months.

In contrast, the 17 focus groups we conducted with Blue-Gold crewmembers from the HSV-2 *Swift* and the strategic submarine force found that these crewmembers had a generally positive crew rotation experience. They attributed their positive experiences to a level workload, management accountability, predictable schedules, individual training and professional development opportunities, and sufficient amounts of

personal time during the interdeployment cycle, despite the ships' high operational tempo.

Negative Morale Impacted Reenlistment Rates

Lower reenlistment rates for sailors with less than 6 years of service[20] that served on Sea Swap guided missile destroyers and patrol coastal ships reinforced the Center's survey results and our focus group findings. Both Pacific Fleet and Surface Force Command officials identified reenlistment data as a key indicator of whether crews are satisfied with rotations. The Center's survey and our analysis showed that negative morale associated with participating in Sea Swap had an adverse impact on reenlistment rates. The Center's conclusion was based on a series of crew surveys. According to the Center,

- 55 percent of the crew said after the deployment that they thought that Sea Swap would make them less likely to stay in the Navy, versus 39 percent before the deployment, and
- 73 percent stated that if all deployments were like Sea Swap, they would be less likely to stay in the Navy.

Our analysis of overall reenlistment data for sailors with less than 6 years of active service indicated that the crews on all three *Arleigh Burke*-class destroyers involved in the Sea Swap demonstration experienced 50 percent reenlistment rates. These rates were below the Navy-wide reenlistment goal of 56 percent for this group and the actual 64 percent reenlistment rate for non-Sea Swap *Arleigh Burke*-class destroyers based in the Pacific Fleet.[21] Because the first-term reenlistment rates for the three Sea Swap destroyer crews were as low as 23 to 37 percent during their Sea Swap cycle, these ships were among the few that did not meet the

[20] These sailors are commonly called first termers. These enlisted personnel eligible for reenlistment are from what DOD calls "Zone A" and cover reenlistments falling between 17 months and 6 years of active service. This group was selected as a proxy for crew morale because the personnel are less likely to reenlist if their experience is not good since they have little investment in a career at this point. Sailors with more than 6 years of experience are more likely to remain in the Navy.

[21] Based on our request, the Navy provided reenlistment data for all DDG-51 class ships by 6-month increments from 11/1/01 through 4/30/04. We excluded from our analysis two ships that experienced low reenlistment rates, the U.S.S. *Milius*, a ship experimenting with reduced manning, and the U.S.S. *Paul Hamilton*, a ship that was on an extended 10-month deployment, because we wanted to compare destroyers on normal deployments with destroyers in the Sea Swap initiative.

Navy-wide reenlistment goal. If the Navy expands rotational crewing with out understanding its full impact on crews, the results could affect retention and crew support.

Cost-Effectiveness of Crew Rotation Options Not Systematically Evaluated

The Offices of the Chief of Naval Operations and Navy commands using crew rotations have not systematically collected cost data for assessing the return on investment or cost-effectiveness of all surface ship rotational crewing options for current and future ships. The Navy testified to the Senate Committee on Armed Services in March 2002 that it would determine the true cost and potential savings of one rotational crewing option, Sea Swap, to provide a firm analytical basis in order to decide whether to expand use of that option or look for other alternatives.[22] Recently, the Commander, Naval Surface Force, initiated a limited effort to collect and model costs. However, to date, data collection and analyses comparing the cost of all the crew rotation options have not been completed. Cost-effectiveness is a method used by organizations seeking to gain the best value for their money and to achieve operational requirements while balancing costs, schedules, performance, and risks. The best value is often not readily apparent and requires an analysis to maximize value. A cost-effectiveness analysis is used where benefits cannot be expressed in monetary terms but, rather, in "units of benefit," for example, days of forward presence. Such an analysis would be of particular importance when making return on investment decisions about how many ships to buy and how to operate them.

Moreover, officials in DOD's Office of Program Analysis and Evaluation told us that they have not conducted a basic cost-effectiveness analysis of rotational crewing alternatives. Nonetheless, they believe that rotational crewing is a good concept, that the Navy needs to perform these analyses, and that they were not aware of any such analyses having been conducted in the Navy. The Naval Cost Analysis Division cited DOD cost analysis guidance and procedures that would be applicable to a cost-effectiveness study of rotational crewing alternatives.[23] According to Division officials, this guidance is to be used as the basis for preparing program life-cycle cost estimates, and provides information on the scope of the cost analysis,

[22] "Navy On-Station Enhancement Options," Statement of Rear Admiral (Lower Half) Miles B. Wachendorf, U.S. Navy, Director, Strategy & Policy Division, before the Senate Armed Services Committee, Sea Power Subcommittee (March 19, 2002).

[23] Department of Defense Manual 5000.4-M, "Cost Analysis Guidance and Procedures," December 1992.

the procedures, and the presentation of the estimates. Division officials also told us they have not participated in any rotational crewing cost-effectiveness studies nor are they aware of any. Officials in both DOD and Navy offices indicated that the cost analyses for crew rotation alternatives should include the development of a cost structure for identifying all the relevant cost elements in the program, including depot level maintenance, fuel, training, infrastructure costs, and other costs unique to the program.

While Surface Force Pacific officials had developed limited information on costs and savings unique to the Sea Swap destroyers, it was not complete, and they have not developed comparable data for the patrol coastal ships and the HSV-2 *Swift*. Examples of information collected included the estimated fuel savings from ship transits that were not needed; transportation, room and board for flying the crews to turnover cities; and special training. These officials told us that they plan to collect additional data to help evaluate Sea Swap costs, but that they are still determining what cost data should be collected and how to establish a baseline for control group comparison purposes. Furthermore, they told us that collection of the data will be challenging because there is no central database or automated system for coding rotational crewing-related expenses that could be used for documenting the unique costs associated with rotational crewing. The officials were also concerned that Navy management and accounting data systems are not integrated, making it difficult to collect complete and actual cost information that could be helpful in identifying the costs of the Sea Swap initiative.

Surface Force Pacific officials have also determined that they have responsibility for assessing the costs of crew rotation in the patrol coastal ships as well, but they had not been doing so. Amphibious Group Two[24] officials told us in October 2003 that they have not systematically evaluated costs and are not aware of any cost-effectiveness analyses of rotational crewing being conducted. Surface Force officials said that more complete costs for patrol coastal ships have to be collected and analyzed to allow for cost-effective comparisons.

[24] Amphibious Group Two provides squadrons, ships, and supporting elements that are manned, trained, and materially and operationally ready to deploy. The Group, part of the U.S. Atlantic Fleet, is located in Norfolk, Virginia. The Group has responsibility for the patrol coastal ships.

Notwithstanding the limitations in the available cost data, Naval Surface Force Pacific officials told us they recently developed and are refining a model that presents information that is more comprehensive. For example, in a July 14, 2004, briefing, the Force's commanding officer presented costs of the Sea Swap demonstration, including a cost comparison for both the U.S.S. *Fletcher* and the U.S.S. *Higgins* to other ships in their respective classes, including the average costs per deployed day. Surface Force Pacific officials said that this model is also used to present similar data for the future littoral combat ship. However, we were informed that much of the data used in the model is based on estimates rather than actual costs and that some costs integral to evaluating rotational crewing options, such as maintenance and training infrastructure, were not included. Furthermore, the model has not been tested or validated by the Navy.

Navy Has Not Provided Effective Guidance or Capitalized on Lessons Learned from Rotational Crewing Experiences

The Navy has done some planning in support of rotational crewing on surface ships, such as for the Sea Swap demonstration project, but because the concept is evolving as an alternative, the service has not provided effective guidance during implementation on all ships to ensure proper oversight and accountability. Furthermore, the Navy has not systematically leveraged lessons learned to effectively support rotational crewing. Effective guidance and sharing of lessons learned are key management tools to overcome challenges associated with institutionalizing change and facilitating efficient operations. The Navy has well-established crew rotation policies and procedures for ballistic missile submarines for use as best practices that include appropriately documenting the ship's condition and using advanced teams to help prepare for crew turnover and help ensure accountability. However, the Navy has not provided comparable guidance with policies and procedures to ensure proper crew turnover and accountability to all surface ships using rotational crewing. Consequently, the management of surface ship crew rotations has been informally delegated to each ship's incoming and outgoing commanding officers. This has resulted in inconsistent management of and accountability for operational factors, such as the ship's condition and ship inventories, when one crew replaces another. In addition, the surface ship community has not systematically collected, recorded, or disseminated lessons learned from all rotational crewing experiences. Although the Navy has a formal system to record lessons learned from fleet operations, experiences from crew rotations are not being recorded in the system so that they could be routinely shared among the surface ships and commands using rotational crewing. As a result, the

Navy unnecessarily risks repeating past mistakes that could decrease warfighting effectiveness and crew morale.

Navy Conducted Some Planning in Support of Rotational Crewing

Because rotating crews aboard surface ships on extended deployments differs from the traditional 6-month ship deployment, it is important that planning be effective to increase institutional knowledge and gain acceptance for implementing the change. The Navy has performed extensive planning in support of rotational crewing on ballistic missile submarines. However, crew rotation planning for the surface ship community has been limited and less formal.

Submarine Community Has Established Planning Elements

The submarine community has a well-established concept for conducting Blue-Gold crew rotations, based on 40 years of experience on fleet ballistic missile submarines. As a result, we analyzed the community's concepts, procedures, and processes to identify "best practices." We found that three key elements of this concept are

- formalized turnover policies and procedures;
- a training plan that maintains proficiency of crews that are in port; and
- a maintenance plan that includes crew and incremental maintenance.

Formalized Crew Rotation Turnover Policies and Procedures Help Ensure Accountability

The Navy's Submarine Forces Command developed formal policies and procedures for crew turnover in order to develop a comprehensive status of a ship's material condition and accountability of controlled material and documents, scheduled maintenance, and supply. The turnover process takes place over 2 to 3 days, during which the on-coming crewmembers from each department and division meet with their off-going counterparts to review detailed turnover checklists that cover issues such as personnel, training, administration, maintenance logs, classified material, ship operational funds, parts, and food supplies. For example, both crews review the status of preventative and corrective maintenance repairs that are recorded in equipment status logs, which help document the material condition of the ship. This information is passed from one crew to another during turnover to maintain continuity of maintenance. Both crews also review an inventory of provisions, medicines, hazardous material, and information technology equipment. Crewmembers from both crews are required to sign the checklists, and the two ship commanders are ultimately responsible for ensuring accountability of the material

condition of the ship. By taking these steps, the on-coming ship command has the opportunity to note unsatisfactory conditions—including significant personnel, training, operational readiness, habitability, and material deficiency issues—on an exchange-of-command report. Turnovers can be delayed if both crews do not agree on the ship's material status. Members from one crew we met mentioned that they take pride in conducting the turnover because they want to set the standard for their partner crew.

Training Programs Maintain Proficiency of the Crew While Ashore

Maintaining the operational proficiency of the crew that is in port without a submarine is the main challenge to the strategic submarine's Blue-Gold system. In response, the strategic submarine force has developed a training program to maintain crew proficiency in core competencies while ashore. This program is designed to update crews on recent procedural changes, allow crews to perform maintenance operations, and refresh personnel who have been away from their duties for several months. Crews receive classroom instruction and maintain their skills in simulators at the Trident Training Facility.[25] Crews are monitored and evaluated through graded individual and group exercises. Officers and crewmembers stated that they generally received adequate and sufficient training at the training facility to perform their mission. Nevertheless, they stated that simulated training is not the same as training on a ship and that crew readiness is lower during the first week of deployment as they try to refamiliarize themselves with the ship and their mission.

Crew and Incremental Maintenance Plan Designed for Rotational Crewing

The ballistic missile submarine maintenance concept was specifically designed to accomplish incremental maintenance over a 42-year life cycle. The concept consists of crews working together to conduct maintenance repairs and incremental maintenance that is planned or unplanned corrective maintenance during an in-port maintenance period.

The submarine community has formal guidance for the in-port maintenance period during which both crews jointly conduct maintenance

[25] The Trident Training Facility provides basic, advanced, functional, refresher, and team training to ballistic missile submarine officers and crews in order to build competence and proficiency in operating and maintaining these submarines.

repairs.[26] One main purpose is to enhance the efficiency and productivity of the maintenance period. During this time, both crews operate under one chain of command; the off-going crew reports directly to the on-coming ship commander. Once the submarine is at sea, the off-crew works with the maintenance facility and the on-crew to develop a work package of needed preventive and corrective maintenance repairs. As a result, during the next in-port maintenance period the crew that has just taken command knows what to expect. Officers and crewmembers in our focus groups stated that this approach was key to completing required maintenance repairs in a short period. It also helps ensure that items that may not have been captured during turnover are identified according to officers on one submarine. In addition, crews stated that this concept decreases the incentives for pushing off work to the other crew because both crews conduct the needed maintenance repairs.

The incremental maintenance plan involves routine maintenance based on a set schedule common to all submarines and corrective repairs, which include those items that break or are in a degraded condition as a result of operations. The Trident Planned Equipment Replacement Program, another aspect of incremental maintenance, provides for repairs on hull, mechanical, electrical, or combat control system equipment that require maintenance beyond the ability of the ship's crew. The incremental overhaul relies on an extensive shore-based maintenance infrastructure, including dedicated full-time maintenance personnel, maintenance facilities that provide a full range of repair and maintenance services, and dry docks that provide the support necessary to conduct required equipment repairs and replacements.

Limited Planning for Surface Ship Crew Rotations

Despite the challenges of implementing this change in crewing practice, the surface ship community's planning in support of crew rotations has been less formal and limited to several areas, including crew training on different systems used on participating ships, use of advanced crew turnover teams, and location and timing of port calls. Crews in our focus groups also identified some limitations to these planning efforts.

[26] This concept is generally referred to as an "integrated crew refit."

Planned Training for Different Equipment and Systems between Ships Had Limitations

A Naval Warfare College study of several crew rotation options identified the crew's unfamiliarity with equipment and systems between different ships as a potential challenge for conducting the program. As part of the Sea Swap demonstration project, the Commander, Naval Surface Force, sought to address differences in ship design, construction, and modernization between forward-deployed and nondeployed ships by providing crews with predeployment training specific to the forward-deployed ship they would join.[27] The Command planned for the training to account for many of the differences between the destroyers, with emphasis on training systems and equipment on the forward-deployed ship, and set-up training classes in the United States and Sea Swap cities.[28] For example, one on-coming crew received training to ensure its proficiency in areas such as critical weapons systems and engineering prior to the ship's turnover. Amphibious Group Two also provided training to patrol coastal ship crews to help them bridge the engineering differences they would face on the deployed ship.

However, in our focus group discussions, ship crews participating in Sea Swap and on the patrol coastal ships cited concerns about the adequacy of this training. The crewmembers indicated that proficiency improved with practice drills, but sufficient proficiency was not achieved prior to deploying, even though they had received their certifications. The delay in achieving proficiency was accentuated for the crew that swapped in the Persian Gulf because the crewmembers did not have the opportunity during a transit to become familiar with their new ship. For example, crewmembers for one ship stated that they only received partial training for operating a new radio that is necessary for conducting strike operations. This partial training degraded the crew's ability to shoot Tomahawk land attack missiles. Crewmembers also stated that they did not receive training to operate damage control radios, which meant the crew would have been unable to use the radios in an emergency.

Patrol coastal ship crewmembers also indicated that they faced challenges in training to operate the deployed ship's different equipment. For example, crewmembers stated they did not receive weapons training for

[27] This type of training is commonly called difference training.

[28] Sea Swap cities are the cities where destroyer crew rotations took place.

Stinger missiles prior to overseas deployment because these weapons systems are not typically used while on deployment in the United States. Patrol coastal ship focus group comments revealed that the crews compensated for training deficiencies with self-initiated training during deployment. These crews also received some training from the Coast Guard while in theater. They felt the deficiencies in training on different systems compromised their ability to perform their respective mission.

Value of Some Advanced Turnover Teams Was Limited

The Surface Force Pacific Command established advance turnover teams to assist ships participating in the Sea Swap destroyer demonstration project, but their assistance was sometimes constrained. These teams were comprised of approximately 15 to 20 members of the on-coming crew who were sent to the forward-deployed ship 2 weeks in advance of the turnover to conduct inventories and observe ship operations. The use of an advanced turnover team was an effort to expedite the turnover process from one crew to another. A Command official cited the work performed by these teams as instrumental in reducing the amount of time required for the turnover as well as for increasing their familiarity with the new ship. However, crewmembers in our focus groups stated that advance teams were not as effective as they could have been in some turnovers because they were denied access to areas and equipment in the ship at the time of turnovers. For example, a regional support office assumed control of a Sea Swap destroyer in the United States, locked up the workspaces, and did not grant the advance team access. In another instance, the advance team arriving on the ship overseas was not given access until the new crew assumed responsibility for the ship, which limited the team's time and ability to expedite an effective turnover.

Navy Crew Rotation Efforts Have Lacked Standard Guidance to Ensure Oversight and Accountability

The Navy's implementation of surface ship crew rotation efforts lacked effective guidance to ensure oversight and accountability. Because the practice differs from the traditional crewing approach, such guidance is a key to ensuring successful implementation. In the absence of such guidance, including standard policies and procedures similar to those used in the ballistic missile submarine community, officers and crews on Sea Swap destroyers, patrol coastal ships, and the HSV-2 *Swift* developed their own turnover procedures. This caused inconsistency between crews conducting the turnovers, which in turn, led to problems in documenting ship condition and accounting for ship inventories. As a result, surface ship crews cited the need to develop and implement standard turnover procedures, including checklists.

Crewmembers said there was no document to sign during the turnover to hold crews accountable for recording necessary maintenance repairs. For example, crews reported that Navy systems for tracking maintenance requirements and accomplishments were not systematically used to record maintenance repairs. Officers and enlisted crews on Sea Swap destroyers and patrol coastal ships indicated that, as a result, the ship maintenance logs did not accurately reflect the material status of the ships. One Sea Swap crew reported that the prior crew did not document that the forward-fueling station had a hole, which took the entire deployment to fix. In another instance, one crew stated that although three portable fire pumps were required to be on board the vessel, the crew only found two pumps, of which only one worked. Additionally, a patrol coastal ship crew indicated that the previous crew reported only a few needed maintenance repairs in the maintenance log. However, after turnover, the on-coming crew said that it noted about 50 repair items, including all 6 main engines that could not operate simultaneously. In another case, the electronic preventive maintenance log was not working during turnover, which the on-coming crew reportedly spent 3 weeks in repairs to make it function.

A ship commander mentioned that there is a challenge associated with properly tracking maintenance logs, which are not valued by all crews. Those logs can be valuable tools when used, but he stated that the maintenance logs did not reflect the material status of the ship. Some patrol coastal ship officers stated that every crew emphasizes different maintenance priorities, which can contribute to perceptions of inadequate material condition of the ship during and after turnover. Notwithstanding different perceptions of the material condition of the ship, Sea Swap and patrol coastal ship crewmembers raised concerns about the lack of accountability, in particular oversight of documenting the material condition of the ship. Crewmembers from the Sea Swap destroyers and patrol coastal ships cited the need to establish turnover standards and checklists and to conduct an independent inspection to monitor the turnover and review the material condition of the ship.

Sea Swap and patrol coastal ship crews also mentioned that accountability for ship inventories was inadequate. Naval supply guidance cites the need to conduct physical inventories of equipment and materials to the extent necessary to ensure effective control of those materials normally required for performing the mission or which require special management

attention.[29] Crewmembers told us that guidance on conducting inventories was not always followed in preparation for and during turnovers. Some crews mentioned that the time to review supply inventories, a time-consuming activity during turnover, was a problem. There were several instances on Sea Swap destroyers of missing equipment—maintenance assistance modules estimated at $90,000—and tools. One Sea Swap destroyer crew also reported that the crew discovered during an inventory a pair of missing night vision goggles. In another case, the on-coming crew lacked basic supplies, such as cleaning materials, light bulbs, and toilet paper. Crewmembers also reported items missing on their assigned ships upon return that were not identified during turnover. In another example, crewmembers of a patrol coastal ship crew stated that, upon return to the United States, they found that 10,000 rounds of ammunition were missing on their assigned ship. Sea Swap destroyer and patrol coastal ship crews cited the need for an independent authority to hold crews accountable for ship inventories.

Surface Ship Community Did Not Capitalize on Past and Current Lessons Learned

The surface ship community also has not capitalized on existing and evolving lessons learned to more effectively plan and conduct crew rotations. Capturing and sharing such lessons serve to further institutionalize change by improving its implementation. While the Navy has a formal system to record lessons learned, experiences from current rotational crewing efforts are not being systematically collected and recorded in that system. As a result, the Navy is missing an opportunity to record lessons learned that could be leveraged by crews involved in current and future crew rotation experiences. Further, surface ships and commands have not capitalized on the lessons learned in the system to plan and conduct crew rotations. Consequently, crews experienced similar difficulties to those that the previously recorded lessons learned sought to correct.

Navy Lessons Learned System Created as a Central Repository to Preclude the Loss of Knowledge

The Navy created a lessons learned database in 1991 to provide a system for units to benefit from collective Navy experiences, identify deficiencies, and take corrective measures in all aspects of fleet operations. A lesson learned is defined as information that increases the efficiency of Navy processes and improves the execution of future operations. According to

[29] Examples include classified and hazardous items, security type medical supplies such as narcotics, laptop computers, depot level repairables, and maintenance assistance modules.

the Navy, it should provide value to existing Navy policy, doctrine, tactics, techniques, procedures, organization, training, systems, or equipment.[30]

The Navy Warfare Development Command is responsible for administering the system, and its officials indicated that information for current rotational crewing efforts should be submitted to the system, as it is the best way for lessons to be shared across the Navy community. Anyone in the Navy can submit a lessons learned report through the immediate chain of command. Fleet commands process and validate the proposed report, which is then forwarded to be officially entered into the system. Navy personnel ashore and at sea can access lessons learned contained in the system through a classified Internet site.[31] Use of this central repository would preclude the loss of lessons, such as those lost by the Mine Warfare Command in the late 1990s due to a computer failure.

Surface Ship Commands Have Not Made Systematic Efforts to Collect and Record Lessons Learned for the Navy's Central System

The Naval Surface Force Command recognized the need for a comprehensive list of lessons learned in order to examine the Sea Swap initiative, but the Command has not made a systematic effort to collect or record lessons learned, nor did it task Sea Swap crews to identify and submit them. Aside from 78 lessons learned pertaining to crew rotations that took place in 1999 on Forward Deployed Naval Forces[32] in the Seventh Fleet area of operations, no lessons learned directly related to crew rotations had been posted regarding the Sea Swap destroyers, patrol coastal ships, and HSV *Swift* experiences as of July 30, 2004. Absent guidance, Sea Swap crews' efforts to record lessons learned have been inconsistent. Some crews developed lists of lessons learned that were distributed to other rotational crews and the Command, including some that related to manning, personnel, supply, predeployment maintenance, training, turnover preparations and execution, turnover time, and advance

[30] Criteria for submitting a lesson learned include one or more of the following: (1) identify problem areas, issues, or requirements, and if known, recommend solutions; (2) contribute new information on existing or experimental tactics, techniques, procedures, policy, or doctrine; (3) provide an innovative technique or a procedure that successfully accomplishes the task; and/or (4) provide information of interest in planning, execution, application, or employment of an organization, system, process, or procedure.

[31] The site can be accessed from the Command Web page at www.nwdc.navy.smil.mil.

[32] Ships homeported overseas are considered part of the Forward Deployed Naval Forces. This force structure is negotiated with each respective host nation, with each host nation having ultimate decision authority regarding U.S. vessels assigned to their port. Therefore, if ships on extended deployment were considered homeported overseas, negotiations with the pertinent host nation would be required prior to starting each deployment.

parties. In one case, a Sea Swap ship undertook a concerted effort to document lessons learned prior to deployment, but a majority of those documents were later discarded because the crew wanted to create additional workspace. By not systematically recording and providing valuable experiences from crew rotations to the Navy Lessons Learned System, the Navy is missing an opportunity to more effectively plan and conduct current and future crew rotations.

In response to a Senate Armed Services Committee request on the status of one of the Sea Swap ships,[33] the Command identified a preliminary set of lessons learned as shown in table 2.

[33] S. Rept. No. 108-46, at 309 (2003).

Table 2: Selected Preliminary Lessons Learned Regarding the Material Condition of U.S.S. *Fletcher* during the Sea Swap Destroyer Initiative

Topic	Issue
More efficient forward presence	A standard deployment of a ship from San Diego to the Central Command requires a 40-day period (30 days transiting and 10 days of quality-of-life port calls) at the start and end of a deployment. Given a normal, 180-day deployment, this provides 100 days of overseas presence in the Central Command per crew. The lesson learned was that by employing Sea Swap and conducting only one transit to the Central Command and one return to San Diego, the four crews rotating on the U.S.S. *Fletcher* will provide 518 days of forward presence. To achieve this number with standard deployments, five-plus ships would have had to deploy.
Crew training certifications	Sea Swap crews conducted their predeployment training and achieved their certifications on their own hulls, prior to turnover. These certifications remained with the crew. The lesson learned was that Sea Swap crews met all operational taskings; therefore, the certifications should remain with the crews, not tied to the hull.
Naval cultural issues	There is a sense of ownership that a crew feels for their ship. Sea Swap has personnel leaving their ship for another of the same class. The lesson learned was the need to fully educate the crew on the overall benefits of participating in an experiment such as Sea Swap and ensure a positive attitude of the crew.
Maintenance of the forward-deployed ship	Casualty reports are tracking on both classes of ships involved in Sea Swap and are compared to previous ships of both classes. The numbers of those reports have spiked each time a new crew embarks but have settled following a short period. The lesson learned was that the spikes that occur when a crew assumes the ship are somewhat expected due to new eyes reviewing the equipment.
Follow-on orders for Sea Swap crews	As Sea Swap crews would assume the hull of the crew who had just relieved them, it was necessary to change their code. Detailed coordination was required with the Bureau of Naval Personnel to ensure personnel with incoming orders went to the proper crew as they rotated ships. The lesson learned was that early and detailed coordination is mandatory.

Source: Naval Surface Force Pacific Command.

A final report will be provided to the Committee once the initiative is completed. None of these lessons learned from the Sea Swap initiative have been reported to the Navy Lessons Learned System.

Efforts to gather lessons learned in the patrol coastal community have been inconsistent. Amphibious Group Two similarly did not provide direction to collect and record lessons learned and stated that crews involved in rotations passed on lessons learned to one another. A patrol coastal ship commander stated that crew efforts to gather lessons learned were informal. We identified one lessons learned report sent by a ship commander to the ship's command, Amphibious Group Two, that contained lessons related to maintenance funding, ownership, and maintaining good ship inventories. However, none of these lessons learned had been recorded in the Navy Lessons Learned System as of July 30, 2004.

The Mine Warfare Command directed the HSV-2 *Swift* commanding officers to develop lessons learned reports on five issues. Only two of those lessons learned reports had been posted to the Navy Lessons Learned System as of July 30, 2004, and neither addressed ship crewing issues.

Many Past Lessons Learned Available in Formal System Are Not Being Systematically Leveraged

The surface ship community has not capitalized on the Navy lessons learned database to plan and conduct crew rotations. A Naval Surface Force Pacific Command official told us that the Command did not systematically solicit available lessons learned from the Navy Lessons Learned System to help plan for crew rotations. We found that participants in our focus groups reported experiencing similar problems that several of the formal lessons learned reported by the Forward Deployed Naval Forces in 1999 had addressed. For example, two important lessons not leveraged were

- reviewing the automated process for the transfer of crew identification codes when assigned to a new ship and
- establishing and abiding by a written agreement between both ship commanders that clearly defines transfer and accountability procedures for equipment turnover.

When crews for Forward Deployed Naval Forces were rotated in 1999, the Navy recognized that the ships were not timely in properly updating crewmembers' records to show the ship to which crewmembers were assigned. This resulted in incorrect enlisted master files and the inability to process pay transactions. The lesson learned report stated that the Navy should instantly transfer personnel from one code to another automatically in a timely manner, which is crucial to avoid incorrect master files and the potential loss of certain pay and entitlements. Numerous Sea Swap destroyer, patrol coastal ship, and HSV-2 *Swift* officers and crews we met experienced similar difficulties. They reported that because their respective code was not changed to reflect they had changed ships, some crewmembers experienced problems receiving pay and others were ordered to the wrong ship. Officers and crew from a Sea Swap ship stated that creating codes for each crew would help alleviate similar problems. Assigning crews codes is a standard practice in the ballistic missile submarine community. This practice was also used by the mine warfare community during their crew rotations in the mid-1990s. The systematic use of an effective lessons learned system could have alerted the Navy to the need for a mechanism to ensure the effective transfer of crews and ships from one code to another in a timely and an accurate manner.

Establishing and abiding by written agreements between both ship commanders involved in a crew rotation enable both crews early in the planning phase to determine what equipment stays with the ship or the crew and improves accountability for tool equipment transfer. The Navy's lessons learned database identified the need for such agreements. However, despite both ship commanders agreeing during the planning phases of one of the turnovers that each ship's tools, parts, and material would remain with the respective ship and that both crews would review an inventory checklist during turnover, both crews did not follow the agreement. One crew removed many of the tools and other equipment before leaving the ship. As a result, the on-coming crew did not have the needed tools and other equipment to perform maintenance and repairs and had to spend $150,000 to buy the needed tools. Officers and crews from two patrol coastal ships also indicated that absent an agreed-upon written inventory identifying which items stay with the ship and what items stay with the crew, one of the crews took needed ship items back to the United States, in part, to ensure the crew had necessary items on the new ship. Officers from one patrol coastal ship stated that there is a need for a standard set of inventory items that should stay on a ship. Sea Swap and patrol coastal ship officers and crewmembers stated that an independent authority is needed to monitor the turnover process, including an inventory of tools, to hold both crews accountable.

Maintenance Strategies for Alternative Crewing and Potential Impacts Have Not Been Fully Assessed

The impact of ship maintenance on the implementation of rotational crewing has not been fully assessed. This is because the Navy has been focused on demonstrating the feasibility of the practice and allowed ships to use different approaches to conducting maintenance without capturing all needed information and examining all related issues that could impact success. A full assessment of maintenance issues on all ships employing this practice would be important in identifying and addressing possible impediments to effectively implementing rotational crewing. Navy destroyers and patrol coastal ships using rotational crews on extended deployments have faced maintenance challenges to ensure the mission capability of ships while overseas. To help minimize the adverse effects on the material condition of forward-deployed Sea Swap destroyers, the Navy expanded the scope of predeployment maintenance and sent maintenance support representatives in theater to provide additional technical support to crews. Despite concluding that the condition of the returning ship, U.S.S. *Higgins*, was comparable to that of another ship that had recently returned from a deployment, the results of such efforts on maintaining ship material condition are uncertain. The Center recommended that a review of maintenance support might be necessary prior to expanding

Sea Swap to other ships. We found the need for such an analysis was further supported by the experience of patrol coastal ships, which did not receive such focused maintenance and identified several maintenance problems that were not corrected while deployed that could have affected their mission capability. Moreover, both the Center and our focus groups with rotational crews found that increased maintenance tasks contributed to diminished crew morale. Therefore, while the Navy used rotational crews to keep ships on station for up to 24 months, in the absence of a careful analysis of alternative maintenance strategies, the Navy runs the risk that some maintenance approaches will degrade the long-term condition of ships, diminish crew morale, and discourage crew support for using the practice.

Maintaining Ships on Extended Deployment Is a Challenge

Navy vessels using rotational crews on extended deployments have faced maintenance challenges to ensure the vessels' mission capability while overseas. Normally, most ship maintenance and repair is completed between 6-month deployments. For instance, *Arleigh Burke*-class destroyers normally receive continuous maintenance[34] annually and 2-month Selected Restricted Availabilities[35] every 22 months. However, ships employing rotational crews on extended deployments do not return to the United States for periods of 12 or more months, so crews must maintain ship capability while deployed in compliance with law[36] and Navy guidance on overseas maintenance (see appendix III for details on Navy guidance).

According to the Center, each Sea Swap destroyer received more maintenance support and more intensive support than typically received by ships on routine deployments. This support included numerous

[34] Continuous maintenance is surface ship depot level work performed while in port to keep ship systems fully operational between scheduled shipyard maintenance periods.

[35] Selected Restricted Availability is defined as a short, labor-intensive industrial period for the accomplishment of maintenance and selected modernization.

[36] Title 10, United States Code, section 7310(a) restricts repairs of naval vessels outside the United States based on where the ship is homeported and the nature of the repairs to be performed. Specifically, any naval vessel or any other vessel under the jurisdiction of the Secretary of the Navy with its homeport in the United States may not be overhauled, repaired, or maintained in a shipyard outside the United States or Guam, other than in the case of voyage repairs. Under Navy guidance, voyage repairs generally consist of emergency work that is necessary to enable a ship to continue its mission and that can be accomplished without a change to the ship's deployment schedule.

predeployment inspections and maintenance on their power, electrical, steering, combat, and other systems to eliminate many potential required maintenance activities during deployment. For example, the predeployment maintenance on one of the Sea Swap ships, the U.S.S. *Fletcher*, began with the identification of all time-driven maintenance requirements that were scheduled during the extended deployment. Examples included calibration, assessments, and inspections of equipment to renew time-driven certifications. (Such actions are comparable to checking a car's timing belt or inspecting brakes and tires before taking a long trip.) Numerous other inspections were also conducted prior to deployment on selected ship systems and equipment to identify and repair problems and ensure the good working order of the ship. The U.S.S. *Fletcher* and the U.S.S. *Higgins* each received inspections for hull, mechanical, and electrical systems, as well as combat systems. The U.S.S. *Higgins* also received inspections of its Aegis radar system.

Sea Swap destroyers also received overseas maintenance support beyond that available to ships on a typical deployment. The Surface Force Pacific Command sent U.S.-based ship engineering material assessment teams, ranging from 3 to 11 members, to perform maintenance on the Sea Swap destroyers while the ships transited from their operational area of responsibility to overseas locations where crew turnovers occurred. The teams also assisted the crews while the destroyers were in port at the crew turnover city and were comprised of senior-level maintainers capable of performing a variety of maintenance jobs at the ship's organizational[37] and intermediate levels.[38] According to Navy maintenance officials, the team's presence during transit from the theater of operations to the Sea Swap city and in port facilitated the completion of preventative maintenance, particularly repairs associated with ship habitability. Surface Force Pacific Command also assigned a Sea Swap destroyer port engineer to help ship officials develop maintenance plans during port visits, which is not typical for ships on normal deployments.

[37] Organizational (shipboard) maintenance consists of corrective and preventive maintenance, which is performed by the ship's crew on its assigned equipment. Repairs normally consist of inspecting, servicing, lubricating, adjusting, and replacing parts, minor assemblies, and subassemblies.

[38] Intermediate maintenance consists of preventive and corrective maintenance, which is the responsibility of and performed by qualified personnel with specialized facilities such as fleet support activities. Repairs normally consist of calibration, repair or replacement of damaged or unserviceable parts or assemblies, and emergency manufacture of nonavailable parts.

U.S. Naval Forces Central Command[39] officials also noted that Sea Swap destroyers experienced material degradation over time. As a result, both destroyers required maintenance that was not readily supportable during operations. Navy officials said that Sea Swap destroyers were given preference for port visits in support of crew turnovers and maintenance as compared to other ships. They also said that maintaining ships deployed to the U.S. Central Command area of responsibility for long periods would continue to be a challenge.

During our review, we found that patrol coastal ship rotational crews also faced challenges in maintaining ship material condition. Like the Sea Swap destroyers, the patrol coastal ships received system inspections prior to deployment. Patrol coastal port engineers and maintenance support teams checked key systems—such as engines, weapons packages, and the bridge—to hedge against wear and tear the ship would experience on an extended deployment. However, unlike the Sea Swap destroyers, U.S. Naval Forces Central Command officials indicated that patrol coastal ships were not given preferential treatment to support maintenance. The patrol coastal ship community deployed a maintenance support team with the crews in an effort to address overseas maintenance needs, however, these teams are not unique to rotational crewing and typically support any patrol coastal ship deployment. The team consisted of five members located in theater who performed limited maintenance, ordered and stored parts, and provided administrative support. The scope of the maintenance performed by the teams was limited to organizational, intermediate, and select depot-level maintenance.[40]

According to focus groups with patrol coastal ship crews, the maintenance support teams were usually the only personnel in theater capable of rectifying frequently occurring maintenance problems. If a maintenance support team was not available, the crew had to contact a technical

[39] U.S. Naval Forces Central Command supports all naval operations in the U.S. Central Command area of responsibility. This area includes the Arabian Gulf, Red Sea, Gulf of Oman, and parts of the Indian Ocean.

[40] Depot-level maintenance consists of maintenance performed by designated maintenance activities to support organizational- and intermediate-level maintenance activities by the use of more extensive ship facilities, equipment, and personnel of higher technical skill. Repairs may consist of inspection, test, repair, modification, alteration, modernization, conversion, overhaul, and rebuild of parts, assemblies, subassemblies, equipment end items, and weapon systems. Depot-level maintenance is normally accomplished in fixed shops, shipyards, and other shore-based facilities, or by depot field teams.

support representative in the United States for assistance or try to conduct the maintenance itself. Some patrol coastal ship crewmembers indicated that the size of the maintenance support teams was insufficient to support both patrol coastal ships on extended deployments and suggested expanding the maintenance support teams to be comparable to the system used by the Coast Guard. According to patrol coastal ship crews, the Coast Guard had four ships similar to the patrol coastal ships in theater and provided approximately 50 maintenance personnel to perform the same function as the patrol coastal maintenance support team. The increased size of the Coast Guard's maintenance support allowed its crews to stand down and live in barracks during maintenance periods. By contrast, a patrol coastal officer noted that, during maintenance availabilities, maintenance support teams only assisted the crew and did not take over the work effort and the crews remained on board throughout the repair process and performed maintenance.

Full Impact of Navy Maintenance Strategy for Destroyers and Other Ships Using Crew Rotations Is Not Clear

The results of the different maintenance strategies used to sustain the two destroyers that were apart of the Sea Swap demonstration project and other ships using rotational crewing are uncertain. While the Center judged that the condition of the U.S.S. *Higgins* was comparable to another ship that had recently returned from a routine 6-month deployment, others in the Navy disagreed based on inspection results. We did not identify any similar effort to determine the impact on the patrol coastal or other ships that would provide the Navy with additional insights into the impact of the extended deployment on their condition.

The Center's judgment was based in part on a total ship readiness assessment conducted by Pacific Fleet maintenance personnel, in which Surface Force Pacific officials judged the U.S.S. *Higgins*' ship material condition after a 17-month deployment to be comparable to the U.S.S. *Decatur*'s. However, officials from the Fleet Technical Support Center Pacific that performed the assessment thought there were some significant differences in the condition between the two ships. These officials found that the U.S.S. *Higgins* had 697 noted deficiencies out of 3,370 items tested (21 percent), whereas the U.S.S. *Decatur* had 465 out of 3,231 items tested (14 percent). While the number of deficiencies alone does not necessarily indicate the significant material differences between the ships, some of the items deficient on the U.S.S. *Higgins* included data links for controlling operations between a ship and an aircraft and another

was the nonoperational extra high frequency communication system[41] on the U.S.S. *Higgins* that was operational on the U.S.S. *Decatur*.

Fleet Technical Support Center Pacific officials also assessed the operational functionality of each ship's equipment and found that the U.S.S. *Higgins* was not as capable. This assessment measured the equipment operational capability[42] of each ship in order to quantitatively determine whether the ship's systems were performing in accordance with Navy requirements. The assessment results showed that the U.S.S. *Higgins* received an overall score of .70, while the U.S.S. *Decatur* received a score of .85. According to the Navy handbook, an equipment operational capability score of 1.0 indicates the equipment is fully capable of performing its function as designed, while a score of 0 indicates the equipment is totally unable to perform its function as designed. The handbook provides that any score between .70 and .80 indicates ship equipment is unable to obtain optimum operational standards, while scores above .80 indicate ship equipment passes all operational tests.

A further breakdown of the scores indicates the U.S.S. *Higgins* may have had problems that were more serious. The .70 score for the U.S.S. *Higgins* was arrived at by assessing two categories of equipment: the combat system-related equipment[43] and the hull, mechanical, and electrical systems-related equipment.[44] The combat system-related equipment score for the U.S.S. *Higgins* was .77, while the U.S.S. *Decatur* received a score of .83. Since the combat system portion of the score was higher than the total for the U.S.S. *Higgins*, the hull, mechanical, and electrical equipment

[41] This communications system connects ships, submarines, and shore facilities. The system enables survivable, worldwide command and control communications to strategic and tactical naval forces through all levels of conflict.

[42] The readiness of ship equipment is quantified with a value called an Equipment Operational Capability score. The score is a number between 0 and 1, which is assigned to the lowest level of equipment being tested and reflects its ability to pass selected planned maintenance system tests and provide functional capability, as perceived by the assessing technician.

[43] Combat system-related equipment consists of command, control, communications, computers, and intelligence systems, detection systems, electromagnetic compatibility systems, guns, launchers, and other fire control systems as well as supporting equipment.

[44] Hull, mechanical, and electrical equipment examples include items related to a ship's engine and propulsion systems, safety equipment, and habitability systems such as air conditioners.

score was at a minimum below .70.[45] According to the handbook, scores above .50 and below .70 indicate that equipment has significantly reduced output or restricted operability. By contrast, we found that the hull mechanical and electrical equipment score for the U.S.S. *Decatur* was at least .85, given an overall score of .85 and a combat system score of .83, which indicated that equipment was fully operable.

Even though it concluded that the U.S.S. *Higgins*' condition was comparable, the Center recognized the importance of maintenance to the success of rotational crewing and proposed the Navy further assess maintenance responsibilities, relationships, and costs. Specifically, the Center suggested that if Sea Swap becomes a more standard practice, "it will be necessary to conduct a holistic review of the overall maintenance process, including technical services and training." This review would assess the responsibilities and interrelationships among the many players, such as the ship's force, ship repair units, port engineers, and ship engineering maintenance teams. In addition, the Center added that the Navy should conduct a careful assessment to determine which maintenance support aspects are essential costs and which are dispensable. As of July 2004, the Navy had not started such an assessment.

We found that the experience of other ships on extended deployments, such as patrol coastal ships, bore out the need for such an analysis. Patrol coastal ships did not receive focused maintenance comparable to Sea Swap destroyers, and ship officials identified several maintenance problems aboard one or more ships (see table 3) that were not corrected while deployed that could have affected their mission capability.

[45] We were able to obtain the combat system-related equipment scores for both ships, however, the Navy did not report a total hull, mechanical, and electrical system score.

Table 3: Examples of Maintenance Problems on Patrol Coastal Ships

Repair needed	Action needed and effect of not receiving repair
Severe hull cracks identified on ships	Hull needed reinforcement. This class of ships is prone to hull cracking in heavy seas. If cracks are repaired quickly, the damage can be mitigated; if not, more severe cracking can cause the ship to break into pieces and sink. Installation of hull strengthening alteration eliminates the cracking problem but requires drydocking.
Ship service diesel generator fuel system clogged	The fuel system, including fuel lines, pumps, and filters, needed industrial cleaning. Excessive biological growth in the fuel tanks due to the environment in which the ships are operating causes the system to clog. The potential impact is the loss of ship service diesel generator control and electrical power.
Rotating crane leaked and operated erratically	The rotating crane needed repairs. A rotating crane is required to launch and recover a ship's rubber hull inflatable boat. Continued loss of the crane's operational capabilities will result in a major degradation to the primary mission area.

Source: U.S. Navy.

Patrol coastal ships on extended deployments did not have extra in-theater maintenance support comparable to Sea Swap destroyers. For instance, patrol coastal ships did not have ship engineering maintenance teams to aid the crew in achieving maintenance. As a result, according to the maintenance support team coordinator for patrol coastal ships, routine continuous maintenance often could not be accomplished and, subsequently, the overall material condition of patrol coastal ships deployed overseas slowly degraded. The official explained that repairs authorized overseas are very narrow in scope and only cover maintenance absolutely necessary for the ship to conduct its mission. As a result, the official commented that organizational- and intermediate-level planned maintenance and preservation work are left to the crew and deployed maintenance support teams to take on over short periods in port, typically 5 days or less. In addition, according to a patrol coastal ship port engineer, each forward-deployed patrol coastal ship had received about 4 weeks of maintenance in port over the last 18 months and added that this level of maintenance does not equal what a traditionally deployed patrol coastal would receive. Port engineers and other maintenance staff noted challenges in keeping the patrol coastal ships operationally ready. For instance, in our focus group discussions with patrol coastal ship crews, they explained that the ship's rotating crane that launches and retrieves the ship's rigid inflatable boats broke down during a patrol and the ship had to rely upon the Coast Guard to help with its repair. A Navy official also explained that the extendedly deployed patrol coastal ships have a very high operational tempo, which also impacts the ability of the ship's force to conduct organizational maintenance and increases the overall degradation of the ship over time. The official stated that onboard maintenance efforts have been able to keep the patrol coastal ships

running, but that the Navy will pay a heavy price once the ships return to homeport for extensive overhauls, since repairs that are more serious will be necessary.

The Challenge of Maintaining Ships on Extended Deployment Contributed to Crew Morale and Quality-of-Life Problems

The Center and we found that crews expressed concern about the extra workload they endured to maintain high ship readiness. Specifically, the Center concluded that while the Sea Swap demonstration showed a benefit for the Navy—saving dollars and increasing forward presence—many sailors spoke of the burdens and loss of traditions. According to the Center, Sea Swap crews performed more work and experienced fewer benefits and traditions than what may have originally drawn them to the Navy. For instance, the Center's report noted that some Sea Swap crewmembers found that the maintenance workload was high throughout the entire deployment. Other complaints were that whenever the Sea Swap ships pulled into an Arabian Gulf port, other ships' sailors left on liberty while the Sea Swap crews remained on board doing maintenance. This intense maintenance schedule was a morale problem and a frequent topic that arose during the Center's crew interviews.

Our focus groups with Sea Swap destroyer crews identified similar concerns. For instance, extra maintenance work related to painting and preserving the ship was left to the ship's crew to accomplish. In addition, Sea Swap officers in our focus groups indicated that unreported work and high workloads disrupted sailor quality of life and that there was no increase in time or resources to get maintenance done. They also told us that more equipment inspections by in-theater support teams were needed while in port. The officers explained that the ship's crew had to inspect and fix different equipment throughout the ship because in-theater support teams were not available. According to the Sea Swap officers and crew, this affected their quality of life since liberty time was reduced to accommodate ship maintenance needs.

Our focus groups with patrol coastal ship rotational crews also indicated that increased maintenance tasks and workloads adversely affected crew morale and quality of life. Patrol coastal ship senior chiefs told us that rotational crews had difficulty meeting ship preservation requirements, loading supplies, and documenting ship maintenance logs for non-working items during port visits of 5 days or less. In addition, crewmembers on each rotational patrol coastal ship complained that they received no liberty ports; that all port visits became working ports due to the ship's maintenance needs; and that, given the small size of the ships, they needed time away from other crewmembers to decompress. Furthermore, a patrol

coastal ship commanding officer said that his deployed patrol coastal ship required too many maintenance demands and noted that the ship was maintenance-intensive from the day his crew took over.

Conclusions

Rotating crews aboard surface ships on extended deployments appears to be a feasible alternative to the traditional way the Navy operates that could enhance its effectiveness. Successfully overcoming issues that could impede using this alternative and to gain support for implementing this change require knowledge of the various rotational options and their impact on operational requirements, ship condition, and crew morale. However, the Navy has not taken several key steps that could help it better plan, manage, and monitor the implementation of this crewing approach and therefore may not realize its full potential. For example, the Navy has not established the analytical framework to evaluate all rotational crewing options and related costs. In the absence of formal measurable goals, objectives, and metrics for assessing feasibility, cost, and other factors, including crew quality of life, the Navy does not have clear criteria for deciding when to use rotational crewing and which option best fits the situation. Furthermore, until the Navy more systematically collects data on current and potential surface ship rotational crewing options, including complete and accurate cost data for cost-effectiveness analyses, it will lack valuable information for making informed decisions about the potential for applying rotational crewing to current and future ships as well as whether it can get maximum return on investment and offset billions of dollars in future total ownership costs.

The Navy's implementation of crew rotations also lacks effective guidance to ensure oversight and accountability. For example, the Navy does not provide guidance that specifies standard policies and procedures for rotating crews to ensure consistent management of and accountability for ship operations during crew rotations. Until it does, crews may continue to have problems consistently documenting ship condition and accounting for ship inventories during ship turnover, which could lead to additional work burdens on the on-coming crew and potentially affect readiness. Furthermore, without more formal guidance built on systematically collected, recorded, and disseminated lessons learned from all rotational experiences that specify standard policies and procedures, the Navy may repeat mistakes.

Finally, the Navy does not know enough about the implications of maintenance on ships using rotational crews as a means to extend their deployments. The Center for Naval Analyses noted in its report on the

Sea Swap demonstration that if that option is to become a more standard practice, the Navy needs to further review the overall maintenance process. However, until the Navy fully assesses the additional maintenance demands and related crew quality-of-life issues experienced by all ships implementing this crewing approach, and evaluates alternative maintenance strategies, it runs the risk that it will degrade the long-term condition of ships and discourage crew support for rotational crewing.

Recommendations for Executive Action

To ensure that the nation's multibillion-dollar investment in Navy ships yields the greatest possible benefits at the lowest possible total cost, we recommend that the Secretary of Defense direct the Secretary of the Navy to take the following four actions:

- Systematically evaluate the feasibility and cost-effectiveness for current and potential application of several rotational crewing alternatives for its surface forces by
  - establishing formal measurable goals, objectives, and metrics for assessing feasibility, costs, and other factors, including crew quality of life, and
  - systematically collecting and developing complete and accurate cost data, including ship total ownership costs, in order to perform accurate cost-effectiveness analyses.
- Provide guidance that specifies standard policies and procedures for rotating crews to ensure consistent management of and accountability for ship operations during the rotation.
- Systematically collect, record, and disseminate lessons learned pertaining to rotational crewing in the Navy Lessons Learned System to enhance knowledge sharing.
- Conduct a study of the maintenance processes used for all ships involved in rotating crews and examine, as part of the study, opportunities to mitigate the crews' concerns about maintenance workload to improve their quality of life.

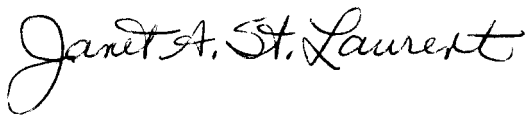
Agency Comments

In written comments on a draft of this report, DOD agreed with the recommendations and cited actions it will take to implement the recommendations.

DOD's comments are presented in their entirety in appendix IV.

We are sending copies of this report to interested congressional committees, the Secretary of Defense, the Secretary of the Navy, and the Director, Office of Management and Budget. We will make copies available to others upon request. In addition, the report will be available at no charge on the GAO Web site at http://www.gao.gov.

If you or your staff have any questions about this report, please call me at (202) 512-4402 or e-mail me at stlaurentj@gao.gov. Key staff members that contributed to this report are listed in appendix V.



Janet St. Laurent
Director, Defense Capabilities
and Management

List of Committees

The Honorable James L. Talent
Chairman
The Honorable Edward M. Kennedy
Ranking Minority Member
Subcommittee on Seapower
Committee on Armed Services
United States Senate

The Honorable Joel Hefley
Chairman
The Honorable Solomon P. Ortiz
Ranking Minority Member
Subcommittee on Readiness
Committee on Armed Services
House of Representatives

The Honorable John M. McHugh
Chairman
The Honorable Vic Snyder
Ranking Minority Member
Subcommittee on Total Force
Committee on Armed Services
House of Representatives

The Honorable Roscoe G. Bartlett
Chairman
The Honorable Gene Taylor
Ranking Minority Member
Subcommittee on Projection Forces
Committee on Armed Services
House of Representatives

Appendix I: Ships Included in Our Evaluation

Ohio-Class Ballistic Missile Submarine

Nuclear-powered *Ohio*-class ballistic missile submarines, also known as Trident submarines, provide the sea-based leg of the triad of U.S. strategic deterrent forces and the most survivable nuclear strike capability. There are 14 *Ohio*-class ballistic missile submarines in the fleet, homeported in Kings Bay, Georgia, and Bangor, Washington. Each submarine has about 15 officers and 140 enlisted personnel. The average procurement unit cost for each *Ohio*-class ballistic missile submarine is $2 billion (in fiscal year 2004 dollars).

To maintain a constant at-sea presence, a Blue-Gold rotational crewing concept is employed on these submarines. Each ship has a "Blue" Crew and a "Gold" Crew, each with its own respective ship command. The ship deploys with one of these crews for 77 days, followed by a 2- to 3-day crew turnover and a 35-day maintenance period. For example, after a Blue Crew deployment, the Gold Crew takes command of the boat after a 3-day turnover process. The Blue Crew assists the Gold Crew in conducting maintenance repairs. During the Gold Crew's patrol, the Blue Crew stands down and enters a training cycle in its homeport.

Figure 1: U.S.S. *Nevada*, an *Ohio*-Class Ballistic Missile Submarine

Source: U.S. Navy.

Spruance-Class Destroyer

The DD-963 *Spruance*-class destroyer has multimission offensive and defensive capabilities, and it can operate independently or as part of other naval formations. These ships were developed for the primary mission of antisubmarine warfare. Many of these ships were subsequently modernized with a vertical launch system[1] and a Tomahawk cruise missile capability that greatly expanded the role of the destroyer in strike warfare.[2] The crew consists of 30 officers and 352 enlisted personnel. The average procurement unit cost is $489.6 million (in fiscal year 2004 dollars).

The Pacific Fleet conducted Sea Swap rotational crewing with four ships of this class, with the U.S.S. *Fletcher* being the forward-deployed unit. The three other destroyers were decommissioned coincident with the crew exchange. That is, each on-coming crew decommissioned its ship prior to swapping with the off-going crew of the U.S.S. *Fletcher*. As a result, after their 6-month deployment, the off-going crewmembers dispersed to a variety of new assignments, just as if their own ship were being decommissioned. Further, the *Spruance*-class destroyer swap rotation was initially planned on three ships but was extended by adding a fourth destroyer. As a result, the U.S.S. *Fletcher* remained deployed for over 22 months. All of the *Spruance*-class destroyers will be decommissioned by the end of fiscal year 2006.

[1] A vertical launch system is a missile storage and firing system aboard a ship that enables the vessel to perform multiple warfighting capabilities, including antiair warfare, antisubmarine warfare, ship self-defense, strike warfare, and antisurface warfare.

[2] Strike warfare is the use of tactical aircraft and/or cruise missile strikes against land targets in an offensive power projection role.

Figure 2: The U.S.S. *Fletcher*, a *Spruance*-Class Destroyer

Source: U.S. Navy.

Arleigh Burke-Class Guided Missile Destroyer

The DDG-51 *Arleigh Burke*-class guided missile destroyers—first commissioned in July 1991, with primary homeports in San Diego and Norfolk—provide multimission offensive and defensive capabilities, operating independently or as part of other naval formations. The DDG-51 is equipped with the Aegis combat system, a vertical launching system for launching antiaircraft and Tomahawk missiles, and an advanced antisubmarine warfare system. Each destroyer crews 23 officers and 300 enlisted personnel, and has a procurement average unit cost of $976 million (in fiscal year 2004 dollars).

Navy plans call for a force of 62 *Arleigh Burke*-class guided missile destroyers. At the end of fiscal year 2004, this force will total 43 ships. The Navy is conducting a Sea Swap rotational crewing system to rotate entire crews from one hull to another on selected ships in the Naval Surface Force Pacific Command's fleet of *Arleigh Burke*-class destroyers.

Figure 3: The U.S.S. *Benfold*, an *Arleigh Burke*-Class Guided Missile Destroyer, with a Rigid Hull Inflatable Boat Passing in the Foreground

Source: U.S. Navy.

Cyclone-Class Patrol Coastal

The *Cyclone*-class patrol coastal ships are small Navy vessels used to conduct surveillance and shallow-water interdiction operations in support of maritime homeland security operations and coastal patrol of foreign shores. The *Cyclone*-class patrol coastal ship first entered into service in 1993. The patrol coastal force consists of 13 ships—4 stationed in San Diego, California, and 9 in Little Creek, Virginia. The crew consists of 4 officers and 24 enlisted personnel. The procurement average unit cost is $19.4 million (in fiscal year 2004 dollars).

The Navy is using a crew swap model in which the entire crew of 28 crewmembers rotates from one hull to another. The rotations are occurring between patrol coastal ships in the United States and those deployed in the Arabian Gulf to increase operation days and reduce transit times. Operational requirements have delayed the decommissioning of 8 ships and the transfer of 5 ships equipped with loading ramps to the Coast Guard.

Figure 4: The U.S.S. *Firebolt*, a *Cyclone*-Class Patrol Coastal

Source: U.S. Navy.

High Speed Vessel Two (HSV-2) *Swift*

The HSV-2 *Swift* is a high speed (almost 50 knots), wave-piercing aluminum-hulled catamaran that was acquired as an interim mine warfare command and support ship and a platform for conducting joint experimentation, including Marine Corps sea basing.[3] The Navy leased and accepted delivery of the catamaran from the builder, Incat Australia, in Australia, in August 2003. The *Swift* was leased for 1 year at a cost of $27 million, with a 4-year option ($58 million).

The *Swift* employs two crews of 41 members each and uses the Blue-Gold crewing option. The Gold Crew is based out of the Naval Amphibious Base Little Creek, Norfolk, Virginia. It operates the ship as a joint experimental platform with Marine Corps troops embarked, testing experimental and near-shore combat ship concepts. It also conducts special operations warfare.[4] The Blue Crew is based out of Naval Station, Ingleside, Texas. This crew operates the ship as a mine warfare command and control ship. The Mine Warfare Command is in charge of coordinating overall mission scheduling for the ship and crews. The crews are responsible for the ship, but not its mission equipment. Each command that brings modules aboard ship must supply personnel to operate the modules. The *Swift* operates on a nominal 117-day cycle (plus or minus 10 days), including a 3-to-4 day turnover between crews, with a 4-month on/4-month off cycle. Crew exchanges take place in the crews' respective homeports or at overseas locations.

[3] Sea basing is the concept of placing capabilities critical to joint and coalition operational success, such as offensive and defensive firepower, maneuver forces, command and control, and logistics, at sea.

[4] The five principal mission areas of special operations are unconventional warfare, direct action, special reconnaissance, foreign internal defense, and combating terrorism.

Figure 5: The High Speed Vessel Experimental Craft, HSV-2 *Swift*

Source: U.S. Navy.

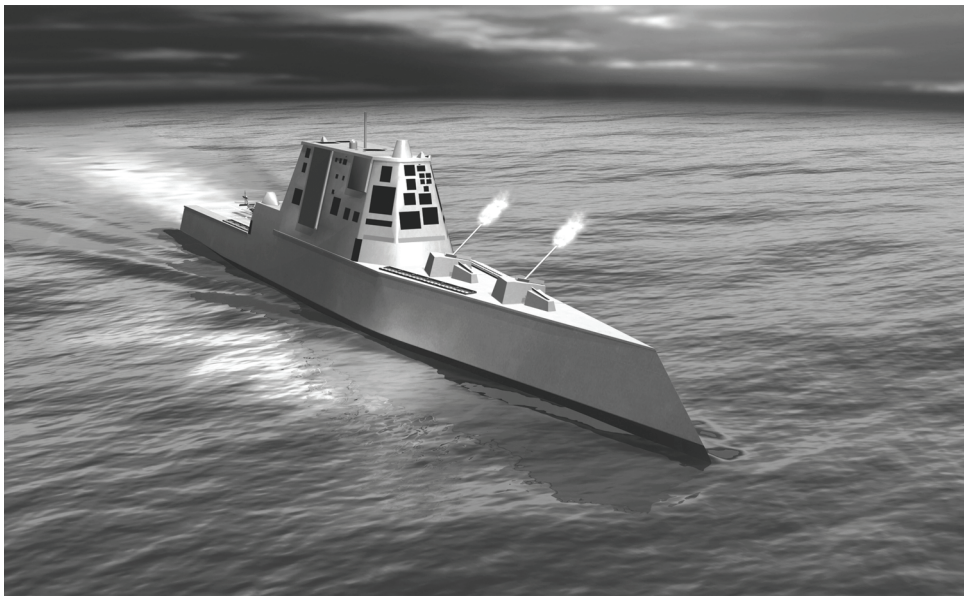
Next Generation Guided Missile Destroyer, the DD(X)

The DD(X) is a next generation, multimission surface combatant ship tailored for land attack that has not been built. The Navy intends to operate the DD(X) independently or as part of other naval formations. The DD(X) is expected to provide precision firepower at long ranges in support of forces ashore using two 155-mm advanced gun systems and 80 vertical-launch system tubes for the Tomahawk cruise missiles and other weapons.

For fiscal year 2005, the Navy is requesting $221 million to begin building the first DD(X) and $1.2 billion for research and development for the program. The first ship is planned for delivery to the Navy in 2012. The Navy estimates that the first DD(X) will cost about $2.8 billion, including about $1.0 billion in detailed design and nonrecurring engineering costs for the class. The Navy earlier indicated it was planning to procure 24 DD(X) vessels through fiscal year 2017, before shifting to procurement of the next generation cruiser in fiscal year 2018. Recently, however, the Navy indicated it might accelerate the start of the cruiser procurement to sometime between fiscal year 2011 and 2014 and reduce the number of DD(X) destroyers it intends to buy to between 10 to 16.

Current DD(X) design planning anticipates a crew size of 125 to 175 persons. The procurement contract establishes the requirement to consider deploying ships up to 3 years and requires the design agent to conduct and complete an analysis of crewing options that would support extended forward deployments, including standard, Sea Swap, Horizon, and Blue-Gold crewing options. The contract also requires the design agent to ensure that the DD(X) system can be effectively operated with an optimized crew and provide the crew with the highest quality of life, while minimizing total ownership cost.

Figure 6: Design Depiction of the Navy's Next Generation Destroyer, DD(X)



Source: U.S. Navy.

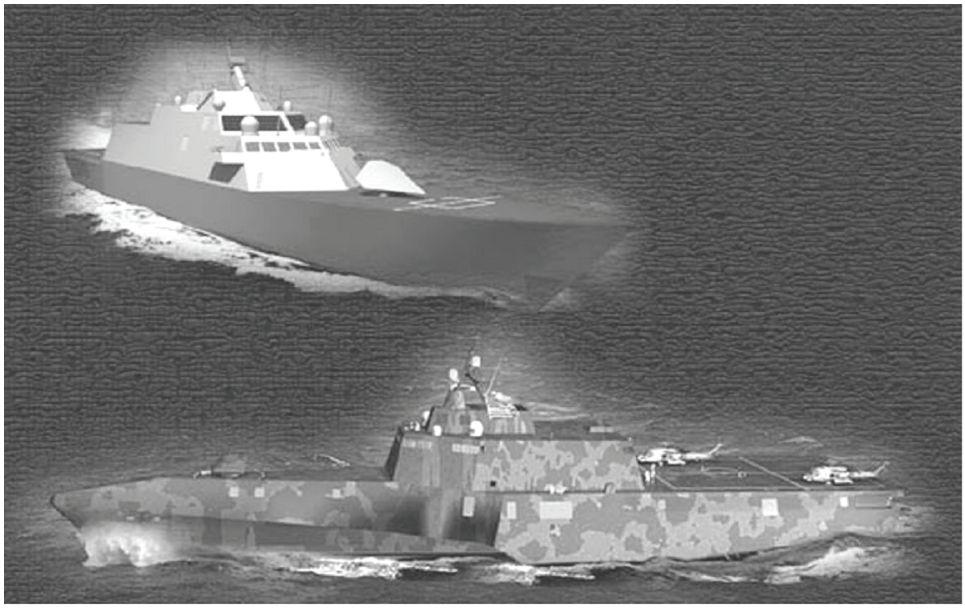
Littoral Combat Ship

The littoral combat ship—a new class of Navy surface combatants and the smallest member in the DD(X) family of next generation surface combatant ships—is intended to be fast, agile, stealthy, affordable, and tailored for specific missions, such as antisubmarine, antisurface, or mine warfare in heavily contested littoral, or near-shore, waters, and it will use interchangeable mission modules[5] tailored for specific missions. The Navy's goal is to develop a platform that can be fielded in relatively large numbers to support a wide range of joint missions, with reconfigurable mission modules to assure access to the littorals for the Navy forces in the face of threats from surface craft, submarines, and mines. It is also expected to have the capability to deploy independently to overseas littoral regions and remain on station for extended periods either with a battle group or through at-sea replenishment. Baseline ship planning is for a single crew; rotational crewing concepts are being explored as a secondary option. Crew size is expected to range between 15 to 50 core crewmembers, which do not include the crew for the mission package.

The Navy has plans to build 56 ships, with the first to be delivered in fiscal year 2007 for an estimated cost of $20 billion. Each sea frame hull has an average unit cost of $147.5 million to $216.4 million (in fiscal year 2004 dollars). The mission modules' average procurement cost is $177 million (in fiscal year 2004 dollars) per ship set. The resulting average cost for a littoral combat ship platform is $324.6 million to $393.4 million (in fiscal year 2004 dollars).

[5] Mission packages would provide the main warfighting capability and functionality for specific missions and would consist of a combination of manned and unmanned off-board vehicles, deployable sensors, and mission manning detachments. A mission module would be used in multiple mission packages and, conversely, several mission modules would constitute a mission package. Mission modules are typically used to transport, support and house mission components (sensors or weapons), which would, in turn, be deployable or stationary aboard the ship.

Figure 7: Design Depictions of the Littoral Combat Ship



Source: U.S. Navy.

Appendix II: Scope and Methodology

To assess whether the Navy has systematically evaluated the feasibility and cost-effectiveness of rotational crewing concepts for existing and future classes of surface ships, we interviewed Department of Defense (DOD) and Navy Headquarters and fleet officials, met with cost analysis experts in the government and the private sector, reviewed key acquisition documents and crew employment plans, and reviewed rotational crewing studies performed for and by the Navy. Studies we reviewed included

- "Future Force Operational Plan," Executive Summary of the Horizon Concept Generation Team, Chief of Naval Operations Strategic Studies Group XVI (June 1997);
- "Crew Rotation: The MCM-1 Experience," Center for Naval Analyses (May 1998);
- "Alternative Naval Crew Rotation Operations," Center for Naval Analyses (October 2001)
- "Task Force Sierra Force Structure For The Future Phase One," Naval War College (undated);
- "Alternative Approaches to Meet New Operational Commitments," Briefing by the Deep Blue Team, Chief of Naval Operations (undated);
- "Sea Swap," Warfare Analysis & Research Department, Naval War College (June 2003); and
- "Sea Swap Assessment," Center for Naval Analyses (September 2004).

We also conducted meetings with several of the commanding and executive officers of the Sea Swap destroyers, the HSV-2 *Swift*, and selected patrol coastal ships and strategic ballistic missile submarines.

To assess whether the Navy has effectively managed rotational crewing on surface ships and leveraged lessons learned, we visited Naval Surface Force Command, U.S. Pacific Fleet, San Diego, California; Submarine Group Nine Command, Bangor, Washington; Mine Warfare Command, Corpus Christi, Texas; and Amphibious Group Two Command, Norfolk, Virginia. We also met with officials from the Deputy Chief of Naval Operations for Naval Warfare (Plans, Policies, and Operations; Surface Warfare; and Submarine Warfare) to review Navy guidance and plans for conducting crew rotations. We also conducted over 40 focus group meetings with Navy officers and crews involved in crew rotations on the guided missile destroyer U.S.S. *Higgins*, selected ballistic missile submarines, the HSV-2 *Swift*, and selected patrol coastal ships (see page 58 for more information on the objective, scope, and methodology of the focus groups). Further, we reviewed Navy Lessons Learned System instructions and visited the Navy Warfare Development Command,

Newport, Rhode Island, to query the Navy Lessons Learned System to determine recorded lessons learned pertaining to crew rotations.

To assess how ship maintenance may impact implementation of rotational crewing, we reviewed relevant laws and Navy regulations pertaining to maintenance of U.S. Navy ships. We discussed ship material condition and associated sailor workload in over 25 focus groups with crews from the Sea Swap guided missile destroyers and from selected patrol coastal ships that had participated in crew rotations. We also obtained ship material condition assessments, called Total Ship Readiness Assessments, for the U.S.S. *Higgins* and the U.S.S. *Decatur*. We discussed the methodology and results of the assessments with officials from the Fleet Technical Support Center, San Diego, California; the Southwest Regional Maintenance Center, Commander Pacific Fleet, San Diego, California; the Naval Surface Warfare Center, Corona Division, Corona, California; and the Naval Surface Force Pacific, San Diego, California. We met with and obtained maintenance guidance and reports from Navy officials at Combined Fleet Forces Command, Norfolk, Virginia; Surface Force Atlantic, Norfolk, Virginia; Surface Force Pacific, San Diego, California; Commander U.S. Pacific Fleet, Honolulu, Hawaii; Amphibious Group Two Command, Little Creek, Virginia; and maintenance experts in the Offices of the Assistant Secretary of the Navy (Research, Development and Acquisition) and the Chief of Naval Operations, Washington, D.C. We also obtained written responses to our questions from U.S. Naval Forces Central Command. In addition, we reviewed the Center for Naval Analyses's Sea Swap Assessment report and discussed the report's findings with officials from the Center.

To compare reenlistment rates for crews on Sea Swap guided missile destroyers and non-Sea Swap guided missile destroyers in the U.S. Pacific Fleet, we obtained *Unit Honor Roll* reports, derived from the Enlisted Master File, from the Commander, U.S. Pacific Fleet, Honolulu, Hawaii. We did not analyze *Spruance*-class destroyer data for two reasons: (1) we did not conduct focus groups with these crews and (2) the rotational crewing experience was not as complete or complicated as that experienced by crews on *Arleigh Burke*-class guided missile destroyers. Based upon discussions with Pacific Fleet officials we also excluded selected ship crews from our non-Sea Swap guided missile ship analysis because we wanted the ships we analyzed to reflect the standard ship and crew option as closely as possible. The ships and crews we excluded were: (1) precommissioning crews because of their small sample sizes and nondeployed status, (2) the U.S. *Milius* and its crew because it was an optimal manning experiment ship, and (3) the U.S. *Paul Hamilton*

because this crew was on an extended, 10-month deployment. We compiled reenlistment averages for the ships we analyzed in 6-month blocks that roughly corresponded with Sea Swap guided missile destroyer program and crew deployments, beginning November 1, 2001, and ending on April 30, 2004, and that included pre-deployment, deployment and post-deployment data for these crews.

While we did not validate the casualty report and sailor reenlistment data used in this report, we discussed the data with DOD officials to determine that the data were sufficiently reliable for our analysis. We did validate the Navy Lessons Learned System data and determined the data were sufficiently reliable for our analysis. We conducted our review from July 2003 through July 2004 in accordance with generally accepted government auditing standards.

Focus Groups with Crews on Rotational Crewing Ships

We conducted focus group meetings with Navy submarine and ship officers and enlisted personnel who were involved in crew rotations. Focus groups involve structured small group discussions designed to gain more in-depth information about specific issues that cannot easily be obtained from single or serial interviews. As with typical focus group methodologies, our design included multiple groups with varying group characteristics but some homogeneity—such as rank and responsibility—within groups. Each group involved 7 to 10 participants. Discussions were held in a structured manner, guided by a moderator who used a standardized list of questions to encourage participants to share their thoughts and experiences. Our overall objective in using a focus group approach was to obtain views, insights, and feelings of Navy submarine and ship officers and enlisted personnel involved in crew rotations.

Scope of Our Focus Groups

To gain broad perspectives, we conducted over 40 separate focus group sessions with multiple groups of Navy ship officers and enlisted personnel involved in crew rotations on the guided missile destroyer U.S.S. *Higgins*, selected ballistic missile submarines, the HSV-2 *Swift*, and selected patrol coastal ships. Table 4 identifies the composition of the focus groups on each of the vessels. Across focus groups, participants were selected to ensure a wide distribution of officers, enlisted personnel, seniority, and ship departments. GAO analysts traveled to each naval station to conduct the majority of the focus groups. Six of the focus groups were conducted on board the U.S.S. *Higgins* while it transited to its homeport after its extended deployment.

Table 4: Number of Focus Groups by Personnel Group and Platform

Personnel groups	Strategic submarines	*Arleigh Burke*-class destroyers	Patrol coastal ships	HSV-2 *Swift*	Total groups
Junior enlisted personnel	3	6	3	2	**14**
Lead petty officers	4	3	-	1	**8**
Chief petty officers	1	3	-	1	**5**
Senior enlisted personnel	1	-	2	1	**4**
Officers	2	3	3	1	**9**
Advanced party	-	3	-	-	**3**
Total	**11**	**18**	**8**	**6**	**43**

Source: GAO.

Methodology for Our Focus Groups

A guide was developed to assist the moderator in leading the discussions. The guide helped the moderator address several topics related to crew rotations: training, maintenance, infrastructure and operations, management and oversight, readiness, crew characteristics, quality of life, lessons learned, and overall satisfaction with the rotational crewing experience. Each focus group discussion began with the moderator describing the purpose of our study and explaining how focus groups work. Participants were assured anonymity of their responses, in that names would not be directly linked to their responses in write-ups of the sessions and that all of the responses for the session would be summarized. The participants were then asked open-ended questions about the impact of crew rotations on each of the topics. All focus group questions were moderated by a GAO analyst who was assisted by a GAO subject matter expert, while two assistants took notes.

Content Analysis

We performed a systematic content analysis of the open-ended responses in order to categorize and summarize participants' experiences with crew rotations. Based on the primary topics developed in the focus group guide, individual GAO analysts reviewed the responses from one of the crews and created their own respective lists of subcategories within each of the primary focus group topics. The analysts then met collectively to generate a proposed list of topic primary categories and subcategories.

To ensure inter-rater reliability, one of our analysts reviewed the responses from each vessel type and assigned each comment to a corresponding category. Another analyst also reviewed each response and independently assigned the same comment to a corresponding category.

Any comments that were not assigned to the same category were then reconciled and adjudicated by the two analysts, which led to the comments being placed into one or more of the resulting categories. Agreement regarding each placement was reached between at least two analysts. All initial disagreements regarding placement into categories were discussed and reconciled. The responses in each category were then used in our evaluation of how the Navy's experiences with rotational crewing have been effectively managed and the effect of maintenance overseas on ships homeported in the United States during extended deployments.

Limitations of Focus Groups

Methodologically, focus groups are not designed to (1) demonstrate the extent of a problem or to generalize results to a larger population, (2) develop a consensus to arrive at an agreed-upon plan or make decisions about what actions to take, or (3) provide statistically representative samples or reliable quantitative estimates. Instead, they are intended to generate in-depth information about the focus group participants' reasons for the attitudes held toward specific topics and to offer insights into the range of concerns and support for an issue.

The projectability of the information produced by our focus groups is limited for several reasons. First, they represent the responses of Navy ship officers and enlisted personnel from more than 40 selected groups. Second, while the composition of the groups was designed to assure a distribution of Navy officers, enlisted personnel, seniority, and ship departments, the groups were not randomly sampled. Third, participants were asked questions about their specific experiences with crew rotations. The experiences of other Navy ship officers and personnel involved in crew rotations, who did not participate in our focus group, may have varied.

Because of these limitations, we did not rely entirely on focus groups, but rather used several different methodologies to corroborate and support our conclusions to objectives two and three.

Appendix III: Summary List of Department of the Navy Guidance Implementing 10 U.S.C. 7310

Department of the Navy guidance related to the implementation of Title 10, United States Code, section 7310(a) restrictions on overseas maintenance, or that define terms used in the law, is noted below.

Chief of Naval Operations

Chief of Naval Operations Instruction 4700.7K (July 2003), "Maintenance Policy for U.S. Navy Ships," defines voyage repairs as "corrective maintenance of mission- or safety-essential items necessary for a ship to deploy or to continue on its deployment."

Naval Sea Systems Command

Naval Sea Systems Command *Fleet Modernization Program Management and Operations Manual* (June 2002, Rev. 2), SL720-AA-MAN-010, Glossary, defines voyage repairs as "emergency work necessary to repair damage sustained by a ship to enable the ship to continue on its mission and which can be accomplished without requiring a change in the ship's operating schedule or the general streaming notice in effect."

Military Sealift Command

Commander Military Sealift Command Instruction 4700.15A (February 2, 2000), "Accomplishing Ship Repair in Foreign Shipyards," states that voyage repairs include

- corrective maintenance on mission or safety essential items necessary for a ship to deploy, to continue on its deployment, or comply with regulatory requirements;
- scheduled maintenance, only to the extent that said maintenance is absolutely necessary to ensure machinery and equipment operational reliability or comply with regulatory requirements; and
- voyage repairs do not include corrective maintenance actions that may be deferred until the next scheduled regular overhaul and drydocking availability in the United States or Guam without degrading operational readiness, habitability standards, or personnel safety, or adversely impacting regulatory compliance.

Appendix IV: Comments from the Department of Defense

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

PERSONNEL AND READINESS

OFFICE OF THE UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-4000

OCT 25 2004

Ms. Janet Laurent
Director, Defense Capabilities and Management
U.S. Government Accountability Office
441 G Street, N.W.
Washington, DC 20548

Dear Ms. Laurent:

This is the Department of Defense (DoD) response to the GAO draft report, "FORCE STRUCTURE: Navy Needs to Fully Evaluate Options and Provide Standard Guidance for Implementing Surface Ship Rotational Crewing," dated September 23, 2004 (GAO Code 350383/GAO-05-10).

DoD concurs with the draft report. Responses to the four GAO recommendations and additional comments to the draft report are contained in Enclosure (1).

Sincerely,

Paul W. Mayberry
Deputy Under Secretary of Defense
(Readiness)

Enclosure:
1. Department of Defense Comments To The Recommendations

Note: Page numbers in the draft report may differ from those in this report.

GAO DRAFT REPORT – DATED SEPTEMBER 23, 2004
GAO CODE 350383/GAO-05-10

"FORCE STRUCTURE: Navy Needs to Fully Evaluate Options and Provide Standard Guidance for Implementing Surface Ship Rotational Crewing"

DEPARTMENT OF DEFENSE COMMENTS TO THE RECOMMENDATIONS

RECOMMENDATION 1: The GAO recommended that the Secretary of Defense direct the Secretary of the Navy to systematically evaluate the feasibility and cost-effectiveness for current and potential application of several rotational crewing alternatives for it surface forces by:

- Establishing formal measurable goals, objectives, and metrics for assessing feasibility, costs and other factors, including crew quality of life;
- Systematically collecting and developing complete and accurate cost data, including ship total ownership costs, in order to perform accurate cost-effectiveness analysis. (Page 41/GAO Draft Report)

DoD RESPONSE: DoD concurs with this recommendation. The Navy should systematically evaluate the feasibility and cost effectiveness of various alternative crewing schemes prior to making decisions that will impact force structure. Established metrics, along with a systematic process to collect and assess program objectives, will allow for the accurate analysis of alternative rotational crewing options.

RECOMMENDATION 2: The GAO recommended that the Secretary of Defense direct the Secretary of the Navy to provide guidance that specifies standard policies and procedures for rotating crews to ensure consistent management of and accountability for ship operations during the rotation. (Page 41/GAO Draft Report)

DoD RESPONSE: DoD concurs with this recommendation. Standard policies and procedures are required to ensure consistent management and accountability for ships during crew rotations. The Sea Swap Experiment facilitated the collection of data and lessons learned to develop and validate the policies and procedures to be used in rotational crewing. It also demonstrated the ability to conduct Sea Swap over a long period in an operational environment. Commander, Naval Surface Force Atlantic is in the process of developing these for the ongoing Patrol Craft (PC) Sea Swap program as well as the upcoming Guided Missile Destroyer (DDG) Sea Swap.

RECOMMENDATION 3: The GAO recommended that the Secretary of Defense direct the Secretary of the Navy to systematically collect, record, and disseminate lessons learned pertaining to rotational crewing in the Navy Lesson Learned System in order to enhance knowledge sharing. (Page 41/GAO Draft Report)

DoD RESPONSE: DoD concurs that capturing Lessons Learned is an important process for any new initiative. Commander, Naval Surface Force has collected Lessons Learned and is in the process of collating them into the Navy Lessons Learned Data Base. These Lessons Learned have been "pushed" to ships involved in future Sea Swaps.

RECOMMENDATION 4: The GAO recommended that the Secretary of Defense direct the Secretary of the Navy to conduct a study of the maintenance processes used for all ships involved in rotating crews, and examine as part of the study opportunities to mitigate the crews' concerns about maintenance workload to improve their quality of life. (Page 41/GAO Draft Report)

DoD RESPONSE: DoD concurs with this recommendation. The Navy is continuing its review of ship rotational crewing, to include all maintenance processes used to support deployed Surface Force units in support of voyage repairs, requirements to comply with Title 10 USC and other governing directives and maintenance workload. To-date, Commander, Naval Surface Force experience with Sea Swap hulls has proven implemented maintenance processes were and are sufficient to support the continuance of a successful Sea Swap program.

DoD Additional RESPONSES:

See comment 1.

Pages 8/20: The statement "while the Navy did not assess the rates for participants in rotational crewing, we found that reenlistments were generally lower on the Sea Swap destroyers compared to comparable Pacific Fleet ships" and the reenlistment data collected by Center for Naval Analyses (CNA) is only for the period of deployment and does not tell the whole story. The Office of the Secretary of Defense (OSD) has not seen the reenlistment data collected by GAO and would welcome its delivery for comparative review. This data is significantly different from that analyzed by Commander, Naval Surface Force for retention on Sea Swap ships. Commander, Naval Surface Force did collect Zone A reenlistment data from all seven destroyer Sea Swap crews as well as all Pacific Fleet destroyers that deployed during the same time as the Sea Swap. This data covered the entire deployment period, as well as six months immediately following deployment. The results were: Destroyer Sea Swap Crews: 124 sailors reenlisted out 199 sailors eligible for a total Zone A reenlistment rate of 62.3%. Pacific Fleet destroyers deploying during the Destroyer Sea Swap period (USS DECATUR, USS MILIUS, USS LASSEN, USS OKANE, USS HOPPER, and USS FITZGERALD) had 129 sailors reenlist out of 212 eligible for a total Zone A reenlistment rate of 60.8%. This data is per the Navy Enlisted Master File. Also of note is that the CNA study found the retention statistics inconclusive and struck it from its final report.

See comment 2.

Page 17: With regards to the returning material condition between USS HIGGINS and USS DECATUR, concur that this data must be further examined to see what lessons learned are available to improve maintenance strategies. This study should be conducted in close coordination with Naval Sea Systems Command (NAVSEA).

See comment 3.

Page 18: With regards to the upcoming January 2005 Board of Inspection and Survey (INSURV) inspection of USS HIGGINS, when compared to other Sea Swap ships, particular attention must be focused on when the inspection is conducted, and results weighed accordingly. The process of reviewing the material condition of Sea Swap ships must be standardized, ensuring that same type equipment are inspected to obtain better comparisons between ships of the same class.

See comment 4.

Page 33: The increased maintenance received by Sea Swap ships prior to deployment is not unreasonable, however, a clearly defined process must be established to delineate those increased requirements above what a normal deployer receives and not an adhoc process. Additionally, the increased maintenance requirement must be properly identified and budgeted for.

See comment 5.

Nonconcur with the statement "Moreover, both the Center and our focus groups with rotational crews found that increased maintenance tasks contributed to diminished crew morale." There are many other factors beside organizational level maintenance workload which contribute to a decline in Sailors' morale. The connection between increased workload and crew morale do not justify the overall conclusion drawn in the draft report.

See comment 6.

Page 34: There is no reason to revise Title 10 requirements to restrict repairs for naval vessels outside the United States based on where the ship is home ported and the nature of the repairs to be performed. Current and evolving maintenance strategies are adequate to meet operational commitments.

See comment 7.

Page 39: Crew's concerns over quality of life impacts due to Sea Swap driven maintenance workload are not well quantified but are a continued area of interest for the Commander, Naval Surface Force Maintenance community. As a mitigating factor during the FLETCHER and HIGGINS Sea Swap experiments, Commander, Naval Surface Force Pacific opted to "push" limited equipment grooming and assessment CONUS teams in-theater to assist ship's force. The tasks of these teams were to assist in both identifying maintenance issues and accomplishing ship's force maintenance actions. (Hence, improve the quality of life of ship's force personnel from the perspective of maintenance workload.) During the evolution of this experiment, select commanding officers elected to cancel these support visits due to confidence in their crews to be self-sufficient in these matters. Both approaches achieved satisfactory results in meeting operational requirements. Due to this lesson learned, Commander, Naval Surface Force approach to future Sea Swap events will be to shift from a "push" to a "pull" process and allow the respective crew to take the lead in identifying the requirement for such assistance.

See comment 8.

Page 44: Appendix I, Paragraph 1: The report indicates the "average unit procurement cost for each *Ohio*-class ballistic missile submarine is $2 Billion (in Fiscal Year 2004 dollars)." The report does not state that the average unit procurement cost for the each *Ohio*-class SSBN is based on the initial acquisition cost inflated to FY2004 dollars. In the data submission for the report, NAVSEA SEA017 indicated, "The inflated initial acquisition cost is not to be interpreted as a replacement cost. A replacement value for the specific ship would have to take into account changes in productivity, specifications, legislative, and contracting environment."

See comment 9.

Page 45: Appendix I, Paragraph 1: The report indicates that the "average unit procurement cost for a *Spruance*-class destroyer is $489.6 million (in Fiscal Year 2004 dollars)." The report does not state that the average unit procurement cost for a *Spruance*-class destroyer is based on the initial acquisition cost inflated to FY2004 dollars. In the data submission for the report NAVSEA SEA017 indicated that "The inflated initial acquisition cost is not to be interpreted as a replacement cost. A replacement value for the specific ship would have to take into account changes in productivity, specifications, legislative, and contracting environment."

See comment 10.

Page 46: Appendix I, Paragraph 1: The report indicates that the *Arleigh Burke*-class destroyer "has a procurement average unit cost of $976 million (in Fiscal Year 2004 dollars)." In the data submission for the report, NAVSEA SEA017 indicated that the DDG 51 Program Office required the $976M DDG Program AUC be implied with the statement "Program Average Unit Costs estimates have been base-lined in FY04 dollars for comparison purposes."

See comment 11.

Page 47: Appendix I, Paragraph 1: The report indicates that the "procurement average unit cost is $19.4 million (in Fiscal Year 2004 dollars)" for a *Cyclone*-class patrol coastal ship. The report does not state that the average unit procurement cost for a *Cyclone*-class PC is based on the initial acquisition cost inflated to FY2004 dollars. In the data submission for the report, NAVSEA SEA017 indicated, "The inflated initial acquisition cost is not to be interpreted as a replacement cost. A replacement value for the specific ship would have to take into account changes in productivity, specifications, legislative, and contracting environment. "

GAO's Comments

The following are GAO's comments on the Department of Defense's letter dated October 25, 2004.

1. We have added a discussion of the methodology we used in our Sea Swap destroyer reenlistment analysis. See appendix II.

2. No change needed in report.

3. No change needed in report.

4. We agree that expanded scope predeployment inspections and maintenance for ships scheduled for extended deployments are prudent. We also agree that ships scheduled for extended deployments would benefit from a clearly defined process to delineate those increased requirements.

5. Our report noted that increased maintenance tasks contributed to diminished crew morale. We agree with DOD's comment that many other factors also contributed to the diminished morale for sailors crewing on rotational crewing ships.

6. Our report did not recommend revising Title 10 requirements.

7. No change needed in report.

8. No change needed in report.

9. No change needed in report.

10. No change needed in report.

11. No change needed in report.

Appendix V: GAO Contact and Staff Acknowledgments

GAO Contact

Janet St. Laurent, (202) 512-4402

Acknowledgments

Jim Bancroft, Kelly Baumgartner, Larry Bridges, Lee Cooper, Corrie Dodd-Burtch, Joseph Kirschbaum, Kate Lenane, Elizabeth Morris, Richard Payne, Charles Perdue, Terry Richardson, Roderick Rodgers, Bill Russell, Rebecca Shea, Jennifer Thomas, Julie Tremper, John Van Schaik, and R.K. Wild made key contributions to this report.

GAO's Mission

The Government Accountability Office, the audit, evaluation and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents at no cost is through GAO's Web site (www.gao.gov). Each weekday, GAO posts newly released reports, testimony, and correspondence on its Web site. To have GAO e-mail you a list of newly posted products every afternoon, go to www.gao.gov and select "Subscribe to Updates."

Order by Mail or Phone

The first copy of each printed report is free. Additional copies are $2 each. A check or money order should be made out to the Superintendent of Documents. GAO also accepts VISA and Mastercard. Orders for 100 or more copies mailed to a single address are discounted 25 percent. Orders should be sent to:

U.S. Government Accountability Office
441 G Street NW, Room LM
Washington, D.C. 20548

To order by Phone: Voice: (202) 512-6000
TDD: (202) 512-2537
Fax: (202) 512-6061

To Report Fraud, Waste, and Abuse in Federal Programs

Contact:

Web site: www.gao.gov/fraudnet/fraudnet.htm
E-mail: fraudnet@gao.gov
Automated answering system: (800) 424-5454 or (202) 512-7470

Congressional Relations

Gloria Jarmon, Managing Director, JarmonG@gao.gov (202) 512-4400
U.S. Government Accountability Office, 441 G Street NW, Room 7125
Washington, D.C. 20548

Public Affairs

Susan Becker, Acting Manager, BeckerS@gao.gov (202) 512-4800
U.S. Government Accountability Office, 441 G Street NW, Room 7149
Washington, D.C. 20548

United States
Government Accountability Office
Washington, D.C. 20548-0001

Official Business
Penalty for Private Use $300

Address Service Requested

Presorted Standard
Postage & Fees Paid
GAO
Permit No. GI00