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COAST GUARD

Changes to Deepwater Plan Appear Sound, and Program Management Has Improved, but Continued Monitoring Is Warranted





Highlights of [GAO-06-546](#), a report to congressional requesters.

Why GAO Did This Study

The Deepwater program was designed to produce aircraft and vessels that would function in the Coast Guard's traditional at-sea roles. After the terrorist attacks of September 11, 2001, however, the Coast Guard began taking on additional homeland security missions, and so it revised the Deepwater implementation plan to provide assets that could better meet these new responsibilities. While many acknowledge that the Coast Guard's aging assets need replacement or renovation, concerns exist about the approach the Coast Guard adopted in launching the Deepwater program. The subsequent changes in the program's asset mix and delivery schedules only increased these concerns. This report (1) compares the revised Deepwater implementation plans with the original plan in terms of the assets to be replaced or modified, and the time frames and costs for doing so; (2) assesses the degree to which the operational effectiveness model and other analytical methods used by the Coast Guard to develop the revised Deepwater asset mix are sound and appropriate for such a purpose; and (3) assesses the progress made in implementing GAO's prior recommendations regarding program management.

GAO is not making any new recommendations in this report.

www.gao.gov/cgi-bin/getrpt?GAO-06-546.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Margaret Wrightson at (415) 904-2200 or wrightsonm@gao.gov.

COAST GUARD

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What GAO Found

The revised Deepwater implementation plans change the balance between new and legacy assets, alter the delivery schedule for some assets, lengthen the overall acquisition schedule by 5 years, and increase the projected program cost from \$17 billion to \$24 billion. The higher cost generally relates to upgrading assets to reflect added homeland security mission requirements. Upgrades to vessels account for the single largest area of increase; with upgrades to the command, control, communications and other capabilities being second highest. In contrast, because the revised plans upgrade rather than replace most legacy aircraft and reduce the number of unmanned aircraft, the cost for Deepwater aircraft drops. The revised plans, like the original plan, are heavily dependent on receiving full funding each year. Coast Guard officials state that a shortfall in funding in any year could substantially increase total costs.

The Coast Guard's analytical methods were appropriate for determining if the revised asset mix would provide greater mission performance and whether the mix is appropriate for meeting Deepwater missions. GAO and other independent experts found the Coast Guard's methods were reliable for assessing the effects of changing the asset mix and a Department of Defense review board facilitated accreditation of the Coast Guard's approach. Because the model has proved useful for guiding Coast Guard decisions on the proper asset mix for achieving Deepwater performance goals, the Coast Guard is considering ways to expand the model to guide decisions on meeting its Coast Guard-wide performance goals.

Actions by the Coast Guard and the system integrator have fully implemented three of the eight GAO recommendations that were not fully addressed during GAO's review in 2005, and three more recommendations appear to be nearly implemented. The remaining two have unresolved concerns, but the Coast Guard is taking steps to resolve them. A program of this size, however, will likely experience other challenges beyond those that have emerged so far, making continued monitoring by the Coast Guard important.

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Abbreviations

ASI	Acquisitions Solutions, Inc.
DHS	Department of Homeland Security
DMOES	Deepwater Maritime Operational Effectiveness Simulation
DOD	Department of Defense
GPRA	Government Performance and Results Act
IPT	integrated product teams
MSMP	Modeling and Simulation Master Plan
PGA	performance gap analysis
TOC	total ownership cost

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United States Government Accountability Office
Washington, DC 20548

April 28, 2006

The Honorable Olympia J. Snowe
Chairwoman, Subcommittee on Fisheries
and the Coast Guard
United States Senate

The Honorable Maria Cantwell
Ranking Member, Subcommittee on Fisheries
and the Coast Guard
United States Senate

The nation's new homeland security realities have affected plans for modernizing the Coast Guard's fleet of aircraft and vessels. For about a decade, the Coast Guard has been developing an Integrated Deepwater System (or Deepwater) acquisition program, a long-term plan to replace or modernize this fleet. Many of these legacy assets are at or approaching the end of their estimated service lives.¹ As originally conceived, Deepwater was designed around producing aircraft and vessels that would function in the Coast Guard's traditional at-sea roles, such as interdicting illicit drug shipments or rescuing mariners from difficulty at sea. After the terrorist attacks on September 11, 2001, however, these aircraft and vessels began taking on additional missions related to protection of ports, waterways, and coastal areas. As a result, the Coast Guard began revising the Deepwater implementation plan to provide replacement assets that could better address these added responsibilities. To do so, the Coast Guard used an operational effectiveness model and other methods to help determine what mix of assets it needed and what their capabilities should be.² In August 2005, the Coast Guard issued the revised Deepwater implementation plan detailing the assets it planned to modify or acquire,

¹For purposes of this report, we use the term "legacy assets" to refer to the existing fleet of Deepwater aircraft and vessels. These legacy assets include the HC-130H and HU-25 fixed-wing aircraft, the HH-60 and HH-65 rotary-wing aircraft, the 378-foot high-endurance cutters, the 210-foot and 270-foot medium-endurance cutters, and the 110-foot and 123-foot patrol boats. In addition, three other vessels are generally included as part of the Deepwater fleet—the 213-foot *Acushnet*, the 230-foot *Storis*, and the 282-foot *Alex Haley*.

²"Capacity" models produce a force size and mix of assets designed to meet a specified level of demand based on certain assumptions. The "operational effectiveness" model used by the Coast Guard simulated Deepwater operations and projected the extent to which the asset mix could meet specified program goals.

along with the proposed cost and schedule for doing so. Then, in February 2006, the Coast Guard again updated its Deepwater plan to align with its fiscal year 2007 budget submissions.

While there is widespread acknowledgment that many of the Coast Guard's aging assets need replacement or renovation, concerns also exist about the acquisition approach the Coast Guard adopted in launching the Deepwater program. From the outset, we have expressed concern about the risks involved with the Coast Guard's acquisition strategy, which involves relying on a prime contractor (or system integrator) to identify the assets needed and then using tiers of subcontractors to design and build the actual assets. The subsequent changes in the Deepwater asset mix and delivery schedules only increase these concerns. In 2004 we reported that well into the contract's second year, key components needed to manage the program and oversee the system integrator's performance had not been effectively implemented.³ Accordingly, we made 11 recommendations to address three broad areas of concern: improving program management, strengthening contractor accountability, and promoting cost control through greater competition among potential subcontractors.

This report, prepared at your request, examines the changes the Coast Guard has made in the Deepwater program to address its broader scope, as well as addressing the concerns we raised in 2004. More specifically, it

- compares the revised Deepwater implementation plan issued in August 2005 and the February 2006 updated plan with the original (August 2002) plan in terms of the assets to be replaced or modified, and the time frames and costs for doing so;
- assesses the degree to which the operational effectiveness model and other analytical methods used by the Coast Guard to develop the revised Deepwater asset mix are sound and appropriate for such a purpose; and
- assesses the progress made in implementing our prior recommendations regarding Deepwater program management.

³GAO, *Contract Management: Coast Guard's Deepwater Program Needs Increased Attention to Management and Contractor Oversight*, [GAO-04-380](#) (Washington, D.C.: Mar. 9, 2004).

Our work included extensive reviews and analyses of (1) the original and revised Deepwater implementation plans, (2) the Coast Guard's operational effectiveness models and other analytical tools used for determining the proposed Deepwater asset mix, and (3) documentation provided by the Coast Guard on its progress in addressing our recommendations. We supplemented our document reviews and analyses with extensive discussions with officials at the Deepwater Program Executive Office, as well as with interviews of key Coast Guard operations and maintenance officials, contract monitors, and representatives of the system integrator. We conducted our work between August 2005 and March 2006 in accordance with generally accepted governmental auditing standards. Appendix I describes our objectives, scope, and methodology in greater detail.

Results in Brief

To reflect added homeland security responsibilities based on the terrorist attacks of September 11, 2001, the Coast Guard's August 2005 revision and February 2006 update to the Deepwater implementation plan change the balance between new assets to be acquired and legacy assets to be upgraded and alter the schedule for delivering many of these assets. Overall, the acquisition schedule has been lengthened by 5 years, with the final assets scheduled for delivery in 2027. Further, the revised plans increase overall program costs from the original estimate of \$17 billion to \$24 billion. The higher costs of the revised plans relate generally to upgrading the Deepwater assets to reflect post September 11, 2001 mission requirements and include such things as improved capabilities to operate in conditions of chemical, biological, and radiological contamination; greater antiterrorism weaponry; development of airborne use of force capabilities; improved communications systems; and enhanced flight decks. Costs for enhancing and upgrading the capabilities of the planned Deepwater replacement vessels account for the largest portion of the \$7 billion increase. Specifically, vessels account for \$5.5 billion of the increase in the 2005 plan and for \$5.9 billion in the 2006 plan. Further, upgrades to the command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) and maritime domain awareness capabilities of the Deepwater assets account for the second largest portion of the increase, accounting for an increase of \$1.1 billion in the 2005 revised plan and \$663 million in the 2006 plan. In contrast, because the revised plans call for upgrading many of the legacy aircraft rather than replacing them with new assets, as called for in the original plan, and acquisitions of unmanned aerial vehicles have been scaled back, the overall costs for Deepwater aviation assets have dropped in the revised plans—by about \$600 million in the 2005 plan and by about

\$400 million in the 2006 plan. Affordability, however, continues to be a risk for the Deepwater program. Like the original plan, the revised Deepwater plans are heavily dependent on receiving a sustained level of funding at planned levels over the life of the program. Coast Guard officials stated that a shortfall in funding in any given year—for example, because of competing budget priorities—could cause costs for the Deepwater program to rise substantially.

The operational effectiveness model and other analytical methods the Coast Guard used have proved useful for guiding decisions on the revised Deepwater asset mix. The primary tool the Coast Guard used for determining the revised asset mix was a computer simulation model that projected the operational effectiveness of a variety of potential Deepwater force structures. Using this tool, the Coast Guard determined that the revised asset mix would provide greater mission performance. In performing our review of the Coast Guard's model, we reviewed computer simulation model criteria developed by an authority in the field of simulation modeling and found that the model successfully addressed these criteria. Further, a Department of Defense review board facilitated accreditation of the model and another group with expertise in this type of modeling has studied the Coast Guard's approach and concluded that it is reliable. Because the model has proved useful for guiding Coast Guard decisions on the proper asset mix for enhancing the mission performance of the Deepwater assets, the Coast Guard is considering ways to expand the model to guide decisions on meeting Coast Guard-wide performance goals.

The Coast Guard, in conjunction with its system integrator, has taken steps to fully implement three of the eight recommendations that were not sufficiently addressed as of our last review in 2005. These deal with putting in place a human capital plan to help ensure adequate staffing for the Deepwater program, improving input from Coast Guard representatives who assess the system integrator's performance to Deepwater program managers, and holding the system integrator accountable for improving the effectiveness of integrated product teams. Three other recommendations appear close to being fully implemented in that the actions taken appear to be sufficient, but results are not yet known or final procedural steps (such as issuing a policy currently in draft form) have not been completed. The remaining two recommendations, both of which deal with implementing effective program management and contractor oversight, remain problematic. For example, effective management of the Deepwater program depends heavily on strong collaboration among the Coast Guard, the system integrator, and the

subcontractors. However, despite a number of Coast Guard actions to facilitate communication to and collaboration with the system integrator and subcontractors, Coast Guard Deepwater performance monitors note that collaboration among subcontractors remains inconsistent. The Coast Guard has initiated the steps needed to address this issue, but it is too early to tell if these will effectively eliminate the problems.

We provided a draft copy of this report to the Department of Homeland Security and the U.S. Coast Guard for review. The U.S. Coast Guard provided technical comments, which have been incorporated where appropriate.

Background

As the lead federal agency for maritime homeland security within the Department of Homeland Security, the Coast Guard is responsible for a variety of missions, including ensuring security in ports and waterways and along coastlines, conducting search and rescue missions, interdicting drug shipments and illegal aliens, enforcing fisheries laws, and responding to reports of pollution. The Deepwater fleet, which currently consists of 186 aircraft and 88 vessels of various sizes and capabilities, plays a critical role in all of these missions.

Some Coast Guard Deepwater vessels were built in the 1960s. Notwithstanding extensive overhauls and other upgrades, a number of the vessels are nearing the end of their estimated service lives. Similarly, while a number of the Deepwater legacy aircraft have received upgrades in engines, operating systems, and sensor equipment since they were originally built, they too have limitations in their operating capabilities. The Integrated Deepwater System acquisition program, which the Coast Guard began developing in 1996, is its major effort to replace or modernize these aircraft and vessels. This Deepwater program is designed to replace some assets—such as deteriorating vessels—with new assets, and to upgrade other assets—such as some types of helicopters—so they can meet new performance requirements.

The Deepwater program represents a unique approach to a major acquisition in that the Coast Guard is using a prime contractor—the system integrator—to identify and deliver the assets needed to meet a set

of mission requirements the Coast Guard has specified.⁴ In 2002, the Coast Guard awarded a contract to Integrated Coast Guard Systems (ICGS), a joint venture of Lockheed Martin and Northrop Grumman, as the system integrator for the Deepwater program. Lockheed Martin and Northrop Grumman, as the two main subcontractors, in turn contract with other subcontractors. Rather than using the traditional approach of replacing classes of ships or aircraft through a series of individual acquisitions, the Coast Guard chose to employ a system-of-systems acquisition strategy that would replace its deteriorating Deepwater assets with a single, integrated package of new or modernized assets. This system-of-systems approach is designed to provide an improved, integrated system of aircraft, vessels, and unmanned aerial vehicles to be linked effectively through systems that provide command, control, communications, computer, intelligence, surveillance, reconnaissance, and supporting logistics. The Deepwater program's three overarching goals are to maximize operational effectiveness, minimize total ownership cost,⁵ and satisfy the customer—the operational commanders, aircraft pilots, cutter crews, maintenance personnel, and others who will use the assets.

We have been reviewing the Deepwater program for several years, pointing out successes as well as difficulties and expressing concern over a number of facets comprising the program. In 2001, we identified several areas of risk for Deepwater.⁶ First, the Coast Guard faced potential risk in the overall management and day-to-day administration of the contract. At the time, we reported on the major challenges in developing and implementing plans for establishing effective human capital practices, having key management and oversight processes and procedures in place, and tracking data to measure system integrator performance. In addition, we expressed concerns about the potential lack of competition during the program's later years and the reliance on a single system integrator for procuring the Deepwater assets. We also reported there was little evidence

⁴The mission requirements include such things as the ability to (1) respond to 90 percent of all distress incidents within 2 hours; (2) detect and track targets of any material such that the probability of detection is at least 90 percent for small targets, such as a person in the water or a single-engine civil aircraft; and (3) respond to National Emergency Response Operations with 48 hours.

⁵Total ownership cost is the sum of all costs associated with the research, development, procurement, personnel, training, operation, logistical support, and disposal of the entire Deepwater system.

⁶GAO, *Coast Guard: Progress Being Made on Deepwater Project, but Risks Remain*, GAO-01-564 (Washington, D.C.: May 2, 2001).

that the Coast Guard had analyzed whether the approach carried any inherent risks for ensuring the best value to the government and if so, what to do about them.

We reviewed the Deepwater program again in 2004 and found many of the same concerns.⁷ Specifically, we reported that key components needed to manage the program and oversee the system integrator's performance had not been effectively implemented. The Coast Guard's primary tool for overseeing the system integrator, integrated product teams (IPT), were struggling to effectively collaborate and accomplish their missions because of changing membership, understaffing, insufficient training, and inadequate communication among members. Also, the Coast Guard had not adequately addressed the frequent turnover of personnel in the program and the transition from existing assets to those assets that will be part of the Deepwater program moving forward. Further, the Coast Guard's assessment of the system integrator's performance in the first year of the contract lacked rigor, and the factors that formed the basis for the award fee were unsupported by quantifiable measures. This resulted in the system integrator receiving an award fee of \$4.0 million out of a maximum of \$4.6 million despite documented problems in schedule, performance, cost controls, and contract administration.

At the time of our 2004 report, the Coast Guard had begun to develop models to measure the extent to which Deepwater was achieving operational effectiveness and had reduced total ownership cost, but it had not made a decision as to which specific models would be used. Further, Coast Guard officials were not able to project a time frame for when the Coast Guard would be able to hold the contractor accountable for progress toward the goals of maximizing operational effectiveness, minimizing total ownership cost, and increasing customer satisfaction. Additionally, the Coast Guard had not measured the extent of competition among suppliers of Deepwater assets or held the system integrator accountable for taking steps to achieve competition. At the time, the Coast Guard's lack of progress on these issues had contributed to our concerns about the Coast Guard's ability to rely on competition as a means to control future programmatic costs. In response to these concerns, we made a number of recommendations to improve Deepwater management and oversight of the system integrator. In 2005, we reported that the Coast

⁷GAO, *Coast Guard: Key Management and Budget Challenges for Fiscal Year 2005 and Beyond*, [GAO-04-636T](#) (Washington, D.C.: Apr. 7, 2004); and [GAO-04-380](#).

Guard had fully addressed three of the recommendations and had actions underway on others.⁸

For the past several years, the Coast Guard has been revising its Deepwater plan to incorporate expanded homeland security requirements it received after the terrorist attacks of September 11, 2001. On May 31, 2005, the Coast Guard submitted a revised implementation plan to the House Subcommittee on Homeland Security, Committee on Appropriations, which included both a 20-year and a 25-year plan. The House Appropriations Committee directed the Department of Homeland Security and the Coast Guard to select a single revised implementation plan to accompany the Deepwater fiscal year 2006 budget request. In compliance with the Committee's direction, the Coast Guard Commandant testified on July 21, 2005 to the 25-year revised Deepwater implementation plan. Further, in February 2006, the Coast Guard submitted an updated Deepwater implementation plan to align with its fiscal year 2007 budget submission. These 2005 and 2006 revised plans are the ones we are using to compare to the Coast Guard's August 26, 2002, original implementation plan.⁹

To reflect added homeland security responsibilities based on the terrorist attacks of September 11, 2001, the August 2005 revision and February 2006 update to the Deepwater implementation plan change the balance of upgraded legacy versus new assets, the delivery schedules, and program costs from the original 2002 plan. For aircraft, the revised plans include upgrading many of the legacy aircraft rather than replacing them with new assets as called for in the original plan. For vessels, the revised plans maintain the original plan's strategy of replacing all of the legacy vessels, but include some changes in the number of small boats being acquired. Overall, the revised plan (1) increases the program length by 5 years, to a total of 25 years; (2) changes the delivery schedules for a number of assets; and (3) increases overall costs to \$24 billion, \$7 billion more than earlier estimates. The program's higher costs largely reflect the Coast Guard's expanded homeland security responsibilities and cover such

⁸GAO, *Coast Guard: Progress Being Made on Addressing Deepwater Legacy Asset Condition Issues and Program Management, but Acquisition Challenges Remain*, [GAO-05-757](#) (Washington, D.C.: July 22, 2005).

⁹For purposes of this report, we will refer to the 2005 revised plan and the 2006 update of the implementation plan as revised plans.

changes as greater weaponry, improved communications systems, and greater operating capabilities. Coast Guard officials caution, however, that this 25-year program is heavily dependent on receiving the anticipated budget amount each fiscal year. If full funding is not available in any given year—for example, because of competing budget priorities—the shortfall could have cascading effects on overall costs for the Deepwater program.

Terrorist Attacks Have Led to Increased Emphasis on Homeland Security and Enhanced Deepwater Asset Capabilities

The original Deepwater plan, while published in 2002, was developed before the terrorist attacks of September 11, 2001. It reflected an emphasis on the Coast Guard's traditional Deepwater missions, such as conducting search and rescue operations at sea, preventing and mitigating oil spills and other threats to the marine environment, inspecting foreign vessels, protecting important fishing grounds, and stemming the flow of illegal drugs and migrants into the United States. After the events of September 11, 2001, the revised plans took into account the increased security threats by incorporating a new mission to provide greater security for ports, waterways, and coastal areas and enhancing the capabilities of the Deepwater assets to better meet the increased threats. In particular, the revised plans call for equipping Deepwater helicopters to provide warning and disabling weapons fire at sea and in ports, waterways, and coastal areas. Further, while the original plan called for assets to have Deepwater interoperability—meaning that all Deepwater aircraft and vessels could communicate with one another—the revised plans call for Deepwater assets to also have interoperability with assets from the Departments of Homeland Security and Defense, as well as with the Coast Guard's Rescue21 (R21) project.¹⁰ According to Coast Guard officials, this increased interoperability involves such things as adding circuits and data transmission capability to allow for more reliable and secure communication. Table 1 provides further information on some of the key differences between Deepwater asset capabilities in the original and revised plans.

¹⁰Rescue-21 is a coastal command and control communication system designed to improve search and rescue efforts and other missions, such as interdiction of drugs and migrants. The program includes very high-frequency-FM radios, communication towers, and communication centers.

Table 1: Key Changes in Asset Capabilities between the Original and Revised Deepwater Implementation Plans

Deepwater asset	Key changes in asset capabilities
Aircraft	
HC-130 Long-Range Surveillance Aircraft	Interoperability expanded to include DOD, DHS, Rescue-21 assets, and local first responders ^a Equipment installed for detecting chemical, biological, and radiological dangers Equipment installed for enhancing maritime patrol surveillance capabilities Increased ability to provide nationwide strategic airlift capabilities
CN-235 Medium-Range Surveillance Aircraft	Interoperability expanded to include DOD, DHS, Rescue-21 assets, and local first responders Equipment installed for detecting chemical, biological, and radiological dangers Equipment installed for enhancing maritime patrol surveillance capabilities
HH-60 Medium-Range Recovery Helicopter	Interoperability expanded to include DOD, DHS, Rescue-21 assets, and local first responders Equipment installed for detecting chemical, biological, and radiological dangers Equipment installed for enhancing maritime patrol surveillance capabilities Upgraded to provide airborne use of force and vertical insertion and delivery capabilities
HH-65 Multi-Mission Cutter Helicopter	Interoperability expanded to include DOD, DHS, Rescue-21 assets, and local first responders Equipment installed for detecting chemical, biological, and radiological dangers Equipment installed for enhancing maritime patrol surveillance capabilities Upgraded to provide airborne use of force and vertical insertion and delivery capabilities
HV-911 Vertical Takeoff and Landing Unmanned Aerial Vehicle	Equipment installed for detecting chemical, biological, and radiological dangers
RQ-4A High-Altitude Endurance Unmanned Aerial Vehicle	No changes from the original plan.
Vessels	
National Security Cutter	Interoperability expanded to include DOD, DHS, Rescue-21 assets, and local first responders Equipment installed for detecting chemical, biological, and radiological dangers Flight deck increased and enhanced to accommodate DOD and DHS helicopters Weapon systems upgraded Improved classified communication capabilities Underwater detection capabilities enhanced

Deepwater asset	Key changes in asset capabilities
Offshore Patrol Cutter	<p>Interoperability expanded to include DOD, DHS, Rescue-21 assets, and local first responders</p> <p>Equipment installed for detecting chemical, biological, and radiological dangers</p> <p>Flight deck increased and enhanced to accommodate DOD and DHS helicopters</p> <p>Weapon systems upgraded</p> <p>Improved classified communication capabilities</p> <p>Cruising speed increased from 22 to 28 knots</p>
Fast Response Cutter	<p>Interoperability expanded to include DOD, DHS, Rescue-21 assets, and local first responders</p> <p>Equipment installed for detecting chemical, biological, and radiological dangers</p> <p>Use of 40-year composite hull rather than steel hull</p> <p>Underwater detection capabilities enhanced</p> <p>Increase in transit speed from 28 to 30 knots</p>
Long-Range Interceptor	<p>Interoperability expanded to include DOD, DHS, Rescue-21 assets, and local first responders</p>
Short-Range Prosecutor	<p>Interoperability expanded to include DOD, DHS, Rescue-21 assets, and local first responders</p>

Source: GAO analysis of documentation provided by the U. S. Coast Guard

^aLocal first responders include police, firefighters, and emergency medical professionals.

Revised Plans Propose Replacing Fewer Aircraft and Adjusting the Mix of Vessels to Be Acquired

The revised plans change the final mix of Deepwater aircraft more significantly than the mix of vessels. For example, the original plan called for replacing all 41 HH-60 Medium-Range Recovery Helicopters with 34 AB-139 helicopters. Under the revised plans, the Coast Guard will upgrade the HH-60s and not purchase any AB-139 helicopters. Coast Guard officials said they elected to retain the HH-60s because they determined that the AB-139 aircraft was unsuitable to meet new requirements for weaponry and for tactical operations. Retaining and upgrading HH-60 helicopters cost \$500 million less than replacing them. Another major change in aircraft involved retaining more HC-130s to meet long-range surveillance, search and rescue, and airlift needs. For vessels, the revised plans retain the original plan's approach of replacing all cutters and patrol boats. The only change to the number of vessels is that the revised plans include nine additional 25-foot short range boats and nine fewer 35-foot long range boats than were included in the original plan. Table 2 compares the number and types of Deepwater assets under the original and revised plans.

Table 2: Number of Deepwater Aircraft and Vessels Currently in Operation Compared to Those Planned under the Original and Revised Deepwater Implementation Plans

Aircraft	Current^a	Under original plan	Under 2005 and 2006 revised plans
HC-130 Long-Range Surveillance Aircraft	27	6	22
HU-25 Medium-Range Surveillance Aircraft	23	0	0
HH-60 Medium-Range Recovery Helicopter	41	0	42
HH-65 Multi-Mission Cutter Helicopter	95	93	95
CN-235 Medium-Range Surveillance Aircraft	0	35	36
AB-139 Medium-Range Recovery Helicopter	0	34	0
HV-911 Vertical Takeoff and Landing Unmanned Aerial Vehicle	0	69	45
RQ-4A High-Altitude Endurance Unmanned Aerial Vehicle	0	7	4
Aircraft totals	186	244	244
Vessels			
378-foot High-Endurance Cutter	12	0	0
425-foot National Security Cutter ^b	0	8	8
270-foot Medium-Endurance Cutter	13	0	0
350-foot Offshore Patrol Cutter ^b	0	25	25
210-foot Medium-Endurance Cutter	14	0	0
140-foot Fast Response Cutter ^b	0	58	58
110-foot and 123-foot Patrol Boats	49	0	0
35-foot Long-Range Interceptor ^b	0	42	33
25-foot Short-Range Prosecutor ^b	0	82	91
Vessel totals	88	215	215

Source: Developed by GAO from data provided by the U.S. Coast Guard.

Note: The number of assets did not change between the 2005 and 2006 revised plans.

^aAs of February 2006.

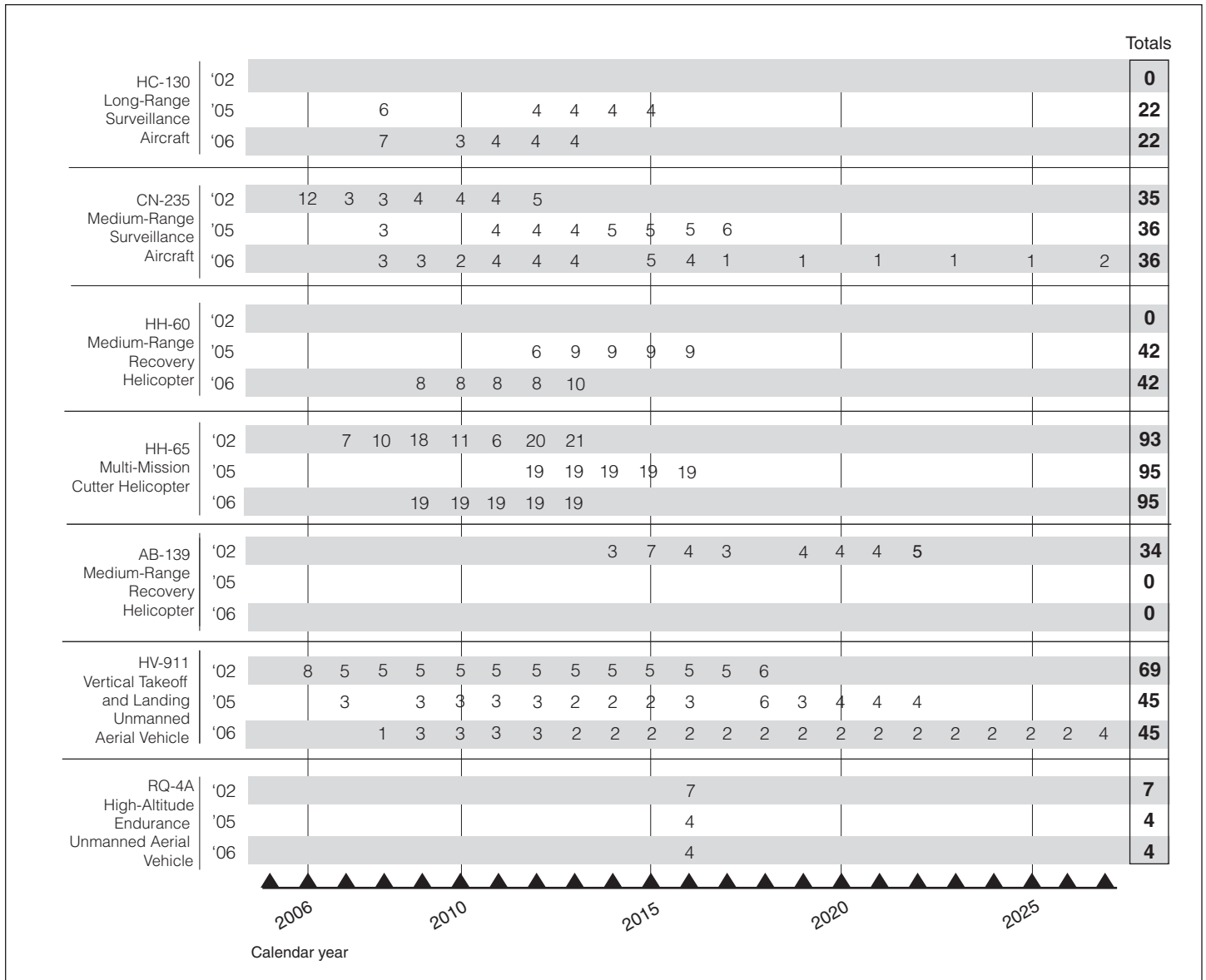
^bThe length of all new vessels is subject to change based on the maturity of the design.

Delivery Schedules for Deepwater Assets Have Changed

Estimated delivery schedules for the Deepwater assets have changed. For some of the aircraft, deliveries have been projected for later years than were estimated in the original plan. For example, the Coast Guard now plans for delivery of its first 3 CN-235 Medium-Range Surveillance Aircraft during calendar year 2008. Under the original plan, the Coast Guard had anticipated delivery of the first 12 in 2006, with a total of 18 delivered by the end of 2008. Final deliveries of the CN-235s under the 2006 revised plan are now scheduled for 2027, as opposed to 2012 under the original

plan. According to the Coast Guard, the delivery schedule for the CN-235 Medium-Range Surveillance Aircraft was delayed because the Coast Guard did not receive the anticipated level of funding in fiscal years 2002 and 2003, which required renegotiations. Figure 1 shows the original and revised delivery schedules for Deepwater aircraft.

Figure 1: Comparison of the Delivery Schedules for Aircraft under the Original (2002) and the 2005 and 2006 Revised Deepwater Implementation Plans

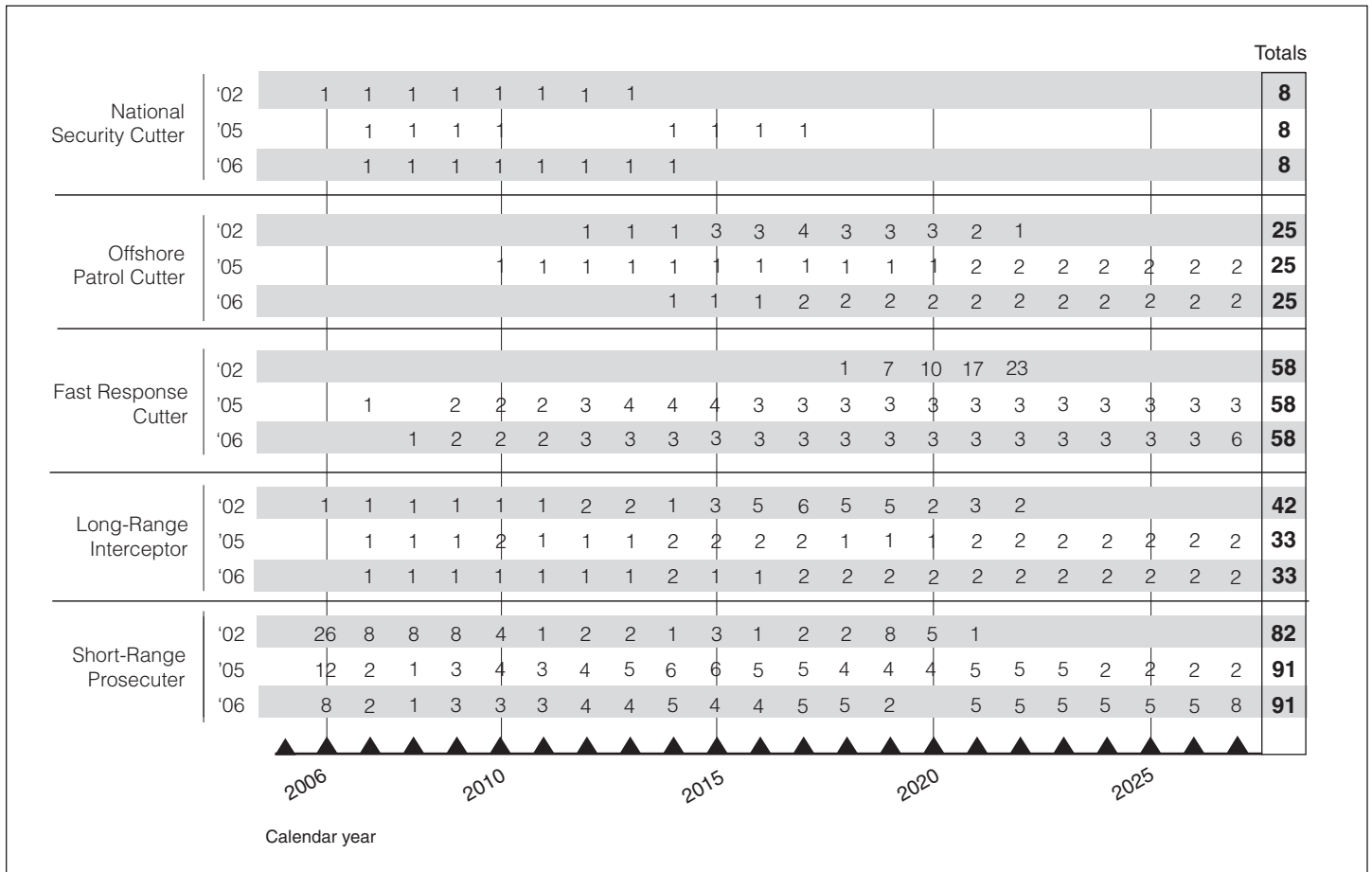


Source: GAO (analysis), U.S. Coast Guard (data).

For vessels, the revised plans generally spread out deliveries of each class of vessel over a larger number of years, as shown in figure 2. For example, the original plan called for delivery of 58 of the 140-foot Fast Response Cutters between 2018 and 2022. The revised plans call for delivering the

first Fast Response Cutter in 2007 or 2008, with additional cutters being delivered every year from 2009 through 2027—a span of 21 years. The Coast Guard originally planned to convert its legacy 110-foot patrol boats to 123-foot patrol boats and, beginning in 2018, replace the 123-foot patrol boats with 140-foot Fast Response Cutters. However, the patrol boat conversion project was halted after the first 8 patrol boats because the 123-foot patrol boats could not meet post September 11, 2001 mission requirements and were experiencing technical difficulties. Because of this, the Coast Guard needed to advance the delivery of the Fast Response Cutters.

Figure 2: Comparison of the Delivery Schedules for Vessels under the Original (2002) and the 2005 and 2006 Revised Deepwater Implementation Plans



Source: GAO (analysis), U.S. Coast Guard (data).

Estimated Cost of Revised Deepwater Plans is \$7 Billion Higher, Largely Reflecting Increased Homeland Security Mission Requirements

The total estimated cost of the revised Deepwater plans increased by \$7 billion over the original plan—from \$17 billion to \$24 billion. According to the Coast Guard, most of the \$7 billion increase is due to enhanced homeland security mission requirements brought about by the events of September 11, 2001. In particular, data provided by the Coast Guard show that most of the \$7 billion increase is attributable to costs for enhancing and upgrading the capabilities of the planned Deepwater replacement vessels. More specifically, as shown in table 3, upgrades to the Deepwater

vessels account for about \$5.5 billion of the increase in the 2005 plan, and \$5.9 billion in the 2006 update.

Beyond the increases related solely to vessels, upgrades to the C4ISR and maritime domain awareness capabilities to improve interoperability between the Coast Guard and other Department of Homeland Security components, as well as with the Department of Defense, account for the second largest category of cost increases—increasing by \$1.1 billion in the 2005 revised plan, and by \$663 million in the 2006 plan. In contrast, because the revised plans include upgrading the HC-130 aircraft and the HH-60 helicopter rather than replacing them as called for in the original plan and for scaling back on the number of unmanned aerial vehicles to be acquired, costs for Deepwater aircraft decreased from the original plan to the revised plan. Overall, costs for Deepwater aircraft were reduced by about \$600 million in the 2005 plan and by about \$400 million in the 2006 plan from the amount included in the original plan.

Table 3: Summary of Cost Differences between the Original Deepwater Implementation Plan and the 2005 and 2005 Revised Plans

Deepwater asset Aircraft	FY 2002 original plan^a	FY 2005 revised plan	Change from original plan	FY 2006 revised plan	Change from original plan
HC-130 Long-Range Surveillance Aircraft	48.1	\$392.6	\$344.5	\$380.5	\$332.4
CN-235 Medium-Range Surveillance Aircraft	1,270.4	1,590.2	319.8	1,637.7	367.3
AB-139 Medium-Range Recovery Helicopter	896.6		(896.6)		(896.6)
HH-60 Medium-Range Recovery Helicopter	100.1	446.1	346.0	454.0	353.9
HH-65 Multi-Mission Cutter Helicopter	1,140.3	575.0	(565.3)	560.6	(579.7)
HV-911 Vertical Takeoff and Landing Unmanned Aerial Vehicle	624.8	503.3	(121.5)	521.0	(103.8)
Airborne Use of Force (HH-60/HH-65)	^b	^b	90.2	90.2	
Aircraft subtotals			(\$0.6 billion)		(\$0.4 billion)
Vessels					
National Security Cutter	\$1,838.1	\$2,875.1	\$1,037.0	\$2,875.9	\$1037.8
Offshore Patrol Cutter	4,204.2	7,055.7	2,851.5	7,228.0	3,023.8
110-foot to 123-foot patrol boat conversion	363.3		(363.3)	178.5	(184.8)
Fast Response Cutter	1,496.3	3,226.3	1,730.0	3,297.7	1,801.4
Small boats (Long-Range Interceptor and Short-Rang Prosecutor)	130.3	78.9	(51.4)	80.0	(50.3)
Legacy Cutter Sustainment	26.3	338.0	311.7	315.2	288.9
Vessels subtotals			\$5.5 billion		\$5.9 billion
Other					
Technology Obsolescence Prevention	1,106.1	1,630.6	524.5	1,642.6	536.5
C41SR Capability/Maritime Domain Awareness	748.0	1,847.5	1,099.5	1,411.4	663.4
Integrated Logistics System	343.5	430.7	87.2	452.0	108.5
Systems Engineering and Integration	1,209.7	1,397.6	187.9	1,069.5	(140.2)
Government Program Management	1,441.4	1,526.1	84.7	1,810.1	368.7
Other subtotals			2.0 billion		1.5 billion
Totals	17.0 billion	23.9 billion	6.9 billion	24.0 billion	7.0 billion

Source: GAO analysis based on documentation provided by the U. S. Coast Guard.

Notes: All costs are in millions of dollars unless otherwise noted.

The RQ-4A High-Altitude Endurance Unmanned Aerial Vehicle is not included in this table since this aircraft is not being acquired as a capital investment; rather the Coast Guard plans to procure the surveillance data that the aircraft will provide.

^aThe costs for the fiscal year 2002 plan reflected in this table were updated in fiscal year 2004 dollars to reflect the lack of funding enacted in fiscal years 2002 and 2003.

^bThe costs shown for Airborne Use of Force (\$75.2 million) were included as part of the total costs for the HH-60 and HH-65 helicopters.

According to the Coast Guard, the primary elements of the enhanced homeland security mission requirements that contributed to the \$7 billion increase include the following:

- **Chemical, biological, and radiological detection and defense.** For this element, the additional capabilities included in the revised plans vary by asset. The most extensive are for the National Security Cutter, which is to have a sealed section within which crew can operate the ship in a contaminated environment for limited time periods. In the event an area is contaminated, such as from a terrorist attack, the crew can use radar, heat-seeking sensors, and other equipment to determine what is occurring—such as whether engines are operating, vessels are being moved, or people are alive. Other Deepwater vessels and aircraft are to be equipped with exposure suits and storage for those suits.
- **Antiterrorism and force protection.** The revised plans call for more powerful weapons for National Security Cutters, Offshore Patrol Cutters, and Fast Response Cutters. Manual gun mounts on cutters will be replaced with selected sensor-integrated, remote-operated, and semi-automated gun systems. This weaponry is to give the Coast Guard enhanced capabilities to protect its own cutters and other high value assets by, for example, providing cutters with the ability to stop terrorists who have taken control of a ship by disabling that ship's propulsion with precision fire.
- **Airborne use of force and vertical insertion and delivery.** The revised plans call for the Deepwater helicopters to be fitted with weapons and equipment that will enable armed teams to land on a vessel, such as in the event a hostile group has taken over the vessel. Crew members can use machine guns to provide cover while a team travels by rope from the hovering helicopter to the vessel's deck. Additionally, for certain terrorist and criminal scenarios, the helicopter can use disabling fire to stop an illegally operated boat. In the event of a terrorist attack and the right circumstances, the disabling fire can be changed to deadly fire if necessary to stop terrorists.

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- **Interoperability with the Departments of Defense and Homeland Security, as well as Rescue-21 equipment.** All Deepwater vessels and aircraft are to receive C4ISR enhancements that make them interoperable with other DHS entities, DOD assets, and local first responders. These enhancements include added circuits and equipment that provide full voice communication and limited data communications between these entities.
 - **Extended/enhanced flight deck.** The flight decks of the National Security Cutter and Offshore Patrol Cutter are to be enlarged so that helicopters from other Department of Homeland Security components and from DOD can land on the cutters.

Deepwater Costs Could Rise if Funding Deviates from Levels Called For in the Plans

In May 2001, we reported that affordability was the biggest risk for the Deepwater program because the Coast Guard's contracting approach depends on a sustained level of funding each fiscal year over the life of the program.¹¹ For the 2005 revised implementation plan, these funding levels average over \$1 billion per year and range from \$650 million to over \$1.5 billion per year through fiscal year 2026. According to Coast Guard officials, any significant or sustained deviation from the planned funding levels would be costly to the Coast Guard in the short term and set off ripples affecting the acquisition of Deepwater equipment for years to come. The officials added that significant shortfalls would likely result in increased costs, late delivery of equipment, and degradation of Deepwater asset performance.

Model Used to Determine Revised Asset Mix Is Reliable, and the Coast Guard Hopes to Expand Its Use

In revising the Deepwater asset mix to meet new mission demands, the Coast Guard undertook a series of analyses that used a computer simulation model to project the operational effectiveness of a variety of potential Deepwater force structures or asset mixes. We found that this model contains reliable information and is useful for guiding decisions on the revised Deepwater asset mix. Further, a Department of Defense review board facilitated accreditation of the model and another group with expertise in this type of modeling has studied the Coast Guard's approach and concluded that it is reliable. Through use of this model, the Coast Guard projects that the Deepwater asset mix in the \$24 billion revised implementation plan will provide greater mission performance than the

¹¹GAO, *Coast Guard: Actions Needed to Mitigate Deepwater Project Risks*, GAO-01-659T (Washington, D.C.: May 3, 2001).

asset mix in the original plan. Other factors beyond this model, such as decisions of internal working groups and projected funding, also contributed to the adoption of the revised Deepwater asset mix. Because the model has proved useful for guiding Coast Guard decisions on the proper asset mix for enhancing the mission performance of the Deepwater assets, the Coast Guard is considering ways to expand the model to guide decisions on meeting its Coast Guard-wide Government Performance and Results Act (GPRA) performance goals.¹²

Computer-Based Model Used in Analyzing Capacity Gaps Is Credible

After the events of September 11, 2001, the Coast Guard undertook a series of analyses intended to determine what capability and capacity gaps would exist if the asset mix in the original Deepwater plan were applied to the revised Deepwater missions. To conduct this analysis, the Coast Guard projected the performance of a variety of asset mixes using a computer-based operational effectiveness simulation model known as the Deepwater Maritime Operational Effectiveness Simulation (DMOES).¹³ Using three different capacity models, the Coast Guard generated three different versions of the asset mix needed to meet Coast Guard performance targets.¹⁴ The resulting force structures were then modeled in DMOES to

¹²Government Performance and Results Act of 1993, Pub. L. No. 103-62: 107 Stat. 285 (1993).

¹³Simulation is a technology that allows the analysis of complex systems through statistically valid means. Through a software interface, the user creates a computerized version of a design or process, otherwise known as a “model.” DMOES is a multi-mission “campaign-plus” level model. “Campaign” level models are used by the Department of Defense to tie together all aspects of a battlefield for a defined period of time. DMOES, as a “campaign-plus” level model, simulates Deepwater operations for a full year under multiple demand levels and is used to translate asset and capability contributions into system operational effectiveness. The model used program targets compiled in the Coast Guard’s Modeling and Simulation Master Plan (MSMP). These targets were developed specifically for the purpose of judging effectiveness of the modeled force structures and, ultimately, operational effectiveness of the Deepwater asset mix acquisition. The MSMP targets are based on, but not identical to, the Coast Guard’s GPRA targets and business plan goals. The Coast Guard has cited two reasons for setting different targets in the MSMP: (1) The MSMP targets project 25 to 40 years out and anticipate some performance growth, whereas the actual targets are revised year to year; and (2) because DMOES is a Deepwater-specific model and does not leverage non-Deepwater asset contributions reflected in Coast Guard-wide GPRA targets, the target values account for Deepwater asset contribution only.

¹⁴Capacity models produce a force size and mix designed to meet a specified level of demand, based on certain assumptions. The three capacity models, each with their own strengths and weaknesses, incorporated Coast Guard analyses of current and forecast performance capability and capacity gaps to develop proposed force structures for three levels of demand, using the capabilities of the asset types in the original Deepwater implementation plan.

project their operational effectiveness. The results of this assessment led the Coast Guard to change the asset mix for its revised Deepwater plan.

We found that DMOES, which provided important evidence for Deepwater operational effectiveness analyses, contains reliable information for decision making. Specifically, our review of various statistical aspects of DMOES indicates that the parameters used in the DMOES model—the targets, missions, weather events, and probability of target detection present in the Deepwater environment—appear to be the result of a thorough and rigorous process that enhanced the model’s credibility. In performing our review of DMOES, we reviewed computer simulation model criteria developed by an authority in the field of simulation modeling and found that the DMOES model successfully addressed these criteria.¹⁵ For example, the parameters used were derived from historical events (e.g., target detection or weather events), which helped satisfy the criterion that interactions between the modeled system and the outside environment be considered. To ensure use of valid and current data for its major updates of DMOES, Coast Guard gathered updated historical data and compared these data to data from past events. Further, because the Coast Guard modeled target detection capabilities for the assets at less than their full potential, the asset’s target detection capabilities do not appear to be overstated.

In addition, independent authorities, in their reviews of DMOES, have assessed the model and have accredited it for force structure planning. For example, the MITRE Corporation, in an independent analysis of the performance gap analysis process (of which DMOES was a key component), found that the process and the resulting analytic results were “likely the most complete and comprehensive campaign-level study conducted by any uniformed service in recent times.”¹⁶ Further, the Coast Guard submitted DMOES to a verification, validation, and accreditation¹⁷ review monitored and facilitated by the Joint Accreditation Support

¹⁵Jim Ledin, Simulation Engineering, CMP Media (Lawrence, Kansas: September 2001).

¹⁶MITRE, Center for Enterprise Modernization, Independent Assessment of U.S. Coast Guard Deepwater Performance Gap Analysis Process (McLean, Virginia: March 30, 2004). MITRE is a not-for-profit organization with expertise in systems engineering, information technology, operational concepts, and enterprise modernization, chartered to work in the public interest.

¹⁷The simulation modeling criteria defines “verification and validation” as confirming that the model has been correctly implemented.

Activity.¹⁸ The DMOES Accreditation Review Board, consisting of Coast Guard officials and external experts in the field of military force structure determinations and capability-based planning, conducted the actual review and accredited the DMOES model for acquisition support and force structure planning.

Other Factors Also Affected Revised Deepwater Asset Mix

While the capability and capacity gaps identified in the performance gap analysis process were a key input into the decisions leading to the revised Deepwater asset mix, they were not the only factor. The Coast Guard also shaped the Deepwater asset mix based on budget considerations and information developed by an internal working group. In particular:

- Coast Guard officials stated that affordability was a key factor in shaping the revised Deepwater asset mix. According to the officials, Deepwater was never intended to be an unconstrained acquisition program, and the \$24 billion force structure was determined through a process of modeling performance of anticipated asset mixes, weighed against expected funding levels over the life of the program, to come up with an optimal balance of performance and affordability. As a result, the revised Deepwater asset mix was developed to maximize the system's capabilities and capacities within this \$24 billion budget. The officials added that while the \$24 billion budget may not allow for all desired capabilities on each asset, capabilities are being designed for later refit, if applicable.
- Further, in April 2004, the Assistant Commandant for Operations Capability commissioned an Aviation Legacy Alternatives Working Group to analyze possible alternatives to the aviation force structure in the original Deepwater plan.¹⁹ This working group provided key data used to enhance the performance gap analysis process. For example, as a result of the working group's analyses, the Coast Guard decided to convert and upgrade two of its four legacy aircraft (HC-130 and HH-60) and replace

¹⁸A Department of Defense resource that provides such services for modeling and simulation activities.

¹⁹This work was commissioned because, according to the Coast Guard, the original plan's asset mix would fall short in meeting the Coast Guard's minimum mission requirements for organic lift capability, maritime domain awareness, and search and rescue treaty coverage for fixed-wing aircraft, and airborne use of force, vertical insertion, and Federal Aviation Administration icing standards for rotary-wing aircraft. All alternative solutions considered by the working group would meet these requirements. GAO did not assess any of the analyses prepared by the working group.

only the HU-25. This strategy was deemed by the Coast Guard to be the most cost-effective solution for meeting Deepwater mission requirements.

According to the Coast Guard, other alternatives added significant capacity, but at a greater cost.²⁰

Model Indicates That the Revised Asset Mix Will Provide Improved Mission Performance over the Original Plan

The most recent DMOES runs conducted by the Coast Guard, published in October 2005, project that the revised Deepwater asset mix will provide “a significant improvement in traditional Coast Guard mission performance” compared to the original Deepwater asset mix.²¹ This marked the first time that the Coast Guard used DMOES to model the operational effectiveness of the revised Deepwater asset mix. According to the Coast Guard, the projected improvement in the overall mission performance of the revised asset mix is due mainly to increased maritime surveillance aircraft and, more specifically, to the converted HC-130, which will be present in greater numbers and with greater capabilities than the comparable long-range surveillance aircraft from the original Deepwater plan. Table 4 provides a brief summary of the results of our analysis of the latest DMOES modeling in terms of how the revised asset mix is projected to improve performance for the Coast Guard’s various Deepwater missions. Appendix I provides more details on our analysis of the latest DMOES modeling.

²⁰For example, one alternative reviewed involved aligning the Deepwater aircraft mix with capacity and capability levels identified in the performance gap analysis (PGA) process. This alternative would have contained greater capacity and capability than the selected alternative but, according to the Coast Guard, was not adopted because it would be too costly. This is an example of how potential solutions identified in the PGA process informed, but did not dictate, the Coast Guard’s decision in adopting its asset mix.

²¹MicroSystems Integration, Inc., United States Coast Guard Integrated Deepwater System Capability and Capacity Performance Gap Analysis (PGA) IV Part 4 (Pawcatuck, Connecticut: October 17, 2005).

Table 4: Projected Performance of the Asset Mix from the Revised Implementation Plans Compared to the Asset Mix from the Original Deepwater Plan Based on Latest DMOES Modeling

Deepwater mission	GAO assessment of the impact of the revised asset mix on Deepwater mission performance
Maritime Safety	
Search and rescue	Little improvement projected: Increased availability of fixed- and rotary-wing aircraft to provide event response
International ice patrol	No improvement projected: International ice patrol missions were not modeled because the assets did not change between the original and revised Deepwater plans
Maritime security	
General law enforcement	Little to some improvement projected: Increased availability of fixed- and rotary-wing aircraft to provide event response, though performance could be decreased in the western United States because of the relocation of major cutters to other patrol areas and missions.
Alien migrant interdiction operations	Some to moderate improvement projected: Increased availability of fixed- and rotary-wing aircraft to provide tactical surveillance and increased prosecution capabilities
Drug interdiction	Little to some improvement projected: Increased availability of fixed- and rotary-wing aircraft to provide tactical surveillance and increased prosecution capabilities
Living marine resources enforcement-exclusive economic zones	Moderate to good improvement projected: Increased availability of fixed- and rotary-wing aircraft to provide tactical surveillance and to conduct intercepts of identified targets of interest. Mission performance could be decreased in Alaska, however, because of a lack of strategic surveillance capability
Maritime homeland security	Moderate improvement projected: Increased availability of fixed- and rotary-wing aircraft to provide tactical surveillance as well as increased naval operational capabilities, such as the increased speed, endurance, and improved flight decks of the new cutters. This mission may have to be performed by non-Deepwater assets in some locations, however, because of competing priorities for the Deepwater assets
Protection of natural resources	
Living marine resources enforcement (domestic)	Little to some improvement projected: Increased fixed-wing surveillance capacity and increased prosecution capabilities. This mission may be negatively affected in some western locations, however, because of the reallocation of major cutter patrols, as well as the change in type and number of rotary-wing assets available to cover high-threat areas.
Foreign vessel inspection	No improvement projected. This mission is largely served by non-Deepwater assets, so the impact of the Deepwater asset mix is limited under either plan.
Lightering zone enforcement	Some improvement projected: Increased rotary-wing aircraft availability

Deepwater mission	GAO assessment of the impact of the revised asset mix on Deepwater mission performance
Maritime pollution enforcement and response	No improvement projected. This mission is largely served by non-Deepwater assets, so the impact of the Deepwater asset mix is limited under either plan.
National defense	
General defense operations Maritime Intercept operations Marine environmental response operations Port operations security and defense Coastal sea control operations	Good improvement projected: Improved naval operational capabilities, such as increased speed, endurance, and improved flight decks of the new cutters.
Theater security cooperation	Good improvement projected: Improved naval operational capabilities, such as increased speed, endurance, and improved flight decks of the new cutters
Non-Deepwater aviation demand/Maritime domain awareness	
Non-Deepwater aviation demand	No improvement projected. The data used to represent this mission demand in the model was not complete enough to truly capture all elements of demand; U.S. Coast Guard projects that more robust data in future model runs will show greater projected performance under the revised asset mix.
Maritime domain awareness	Some improvement projected: Increased availability of fixed-wing aircraft to provide surveillance.

Source: GAO analysis of data provided by the U.S. Coast Guard.

Notes: The categories of projected improvement of the revised Deepwater asset mix compared to the original Deepwater asset mix are based on GAO analysis of U.S. Coast Guard data and are as follows:

- 0% chance of improvement projected = No improvement projected
- 25% chance of improvement projected = Little improvement projected
- 50% chance of improvement projected = Some improvement projected
- 75% chance of improvement projected = Moderate improvement projected
- 100% chance of improvement projected = Good improvement projected.

"Improvement" in this context indicates performance of the revised Deepwater asset mix that is one full standard deviation greater than that of the original Deepwater asset mix, as presented by the U.S. Coast Guard.

Coast Guard Is Exploring Options for Applying Further Modeling for Projecting Coast Guard-wide Performance Capabilities

Though DMOES was an accredited, rigorous simulation model effective in supporting Deepwater force structure planning, it does not capture the impact of non-Deepwater asset contributions and, therefore, does not provide a means for the Coast Guard to estimate the extent to which its entire fleet of aircraft and vessels will allow it to meet Coast Guard-wide GPRA performance targets. The Coast Guard is aware of this limitation and is exploring options for expanding DMOES to encompass all Coast Guard assets—both Deepwater and non-Deepwater—in an effort to provide for a true analysis of Coast Guard-wide mission performance capabilities. While this has not yet occurred, Coast Guard officials told us they were reasonably confident that the cumulative effect of merging the

revised Deepwater assets with its non-Deepwater assets would allow the Coast Guard to meet GPRA targets for those missions involving Deepwater aircraft and vessels. In the interim, the Coast Guard has taken steps to measure the impact of Deepwater assets on Deepwater-related metrics. Since 2002, the Coast Guard has annually reviewed—and plans to continue reviewing—the most recent complete year’s worth of data and estimates the Deepwater-only contribution toward meeting performance goals for seven particular performance metrics. These performance metrics and results for the most recent year available are shown in table 5.

Table 5: Deepwater Missions, Performance Metrics, and Assessment Results from Fiscal Year 2004

		Performance goal	Performance results
Search and rescue	Percentage of lives saved after Coast Guard notification in cases with Deepwater participation	93.0	92.6
Cocaine seizure rate	Percentage of cocaine shipped through transit zone that is seized by Deepwater assets	6.5	Not determined
Illegal or undocumented migrant interdiction	Percentage of total migrant flow interdicted with Deepwater assets	32.0	41.9
Foreign fishing vessel interdiction	Percentage of foreign fishing vessels detected in U.S. Economic Enforcement Zone interdicted with Deepwater assets.	6.7	4.5
Protection of living marine resources	Percentage of Deepwater living marine resources law enforcement boardings without significant violations.	97	94.8
National defense/military readiness	Maintain 100 percent combined readiness of high-endurance cutters and patrol boats to support Department of Defense requirements	100.0	99.3
International ice patrol	Maintain 95 percent accuracy of all limits of all known ice broadcasts ^a	98.0	97.8

Source: Analysis by GAO based on data provided by the U.S. Coast Guard.

^aThe Coast Guard regularly collects data on ice conditions whenever icebergs threaten primary shipping routes between Europe and the United States and Canada. The Coast Guard uses this information to predict the drift of icebergs along these shipping routes and broadcasts this information for the benefit of all vessels transiting the North Atlantic. These messages are referred to as the "limit of all known ice broadcasts."

Disaggregating performance data to reflect Deepwater-only contributions provides an estimate of the extent to which the Deepwater fleet is helping the Coast Guard meet these key targets on an annual basis. For example, as a result of these efforts, the Coast Guard determined that Deepwater assets saved 92.6 percent of lives at risk after Coast Guard notification in fiscal year 2004, which is slightly below the Deepwater asset target value of 93 percent.

Progress Continues in Making Recommended Improvements

Our past concerns about the Deepwater program have been in three main areas—ensuring better program management and contractor oversight, ensuring greater accountability on the part of the system integrator, and creating sufficient competition to help act as a control on costs—and we made a total of 11 recommendations to address these concerns. During our 2005 review, we determined that the Coast Guard had addressed and

fully implemented 2 of these 11 recommendations. The Coast Guard disagreed with and declined to implement a separate recommendation that pertained to updating its cost baseline to determine whether the Deepwater acquisition approach is costing more than a conventional acquisition approach. While we stand behind our original recommendation, we decided not to pursue it further because the Coast Guard determined that the cost to implement this recommendation was excessive. Thus, at the time we began our current review, 8 of the 11 recommendations were not yet fully implemented. On the basis of information we gathered for this review, we consider 3 of these 8 recommendations to be fully implemented. The Coast Guard is in the process of taking actions to implement 3 more recommendations, but full implementation is dependent on seeing results or completion of actions that are not yet in final form. The 2 remaining recommendations, both relating to overall program management and oversight, remain problematic. One relates to improving the effectiveness of integrated product teams, the other to providing field personnel with guidance and training on transitioning to new Deepwater assets. In each case, the Coast Guard has taken actions, but our review of program reports and our discussions with program and field personnel indicate the problems still remain. In all cases, however, the steps needed to fully implement these recommendations seem relatively clear.

Table 6 provides an overview of the 11 recommendations. The sections below discuss the recommendations made in each of the three areas of concern, describing the initial issue that led to the recommendation, the steps taken to date to address it, and our rationale for considering the recommendation as being fully implemented or not. Where we make a determination that a recommendation has not yet been implemented, we indicate what actions are needed.

Table 6: Status of GAO Recommendations to the U.S. Coast Guard Regarding Management of the Deepwater Program

Areas of concern	Recommendations to the U.S. Coast Guard	Recommendation status
Key components of management and oversight are not effectively implemented	Put in place a human capital plan to ensure adequate staffing of the Deepwater program	Implemented
	Improve integrated product teams responsible for managing the program by providing better training, approving charters, and improving systems for sharing information between teams	Partially implemented
	Provide field personnel with guidance and training on transitioning to new Deepwater assets	Partially implemented
Procedures for ensuring contractor accountability are inadequate	Develop measurable award fee criteria consistent with guidance from the Office of Federal Procurement Policy	Implemented ^a
	Provide for better input from U.S. Coast Guard performance monitors	Implemented
	Hold the system integrator accountable for improving effectiveness of the integrated product teams	Implemented
	Establish a baseline for determining whether the acquisition approach is costing the government more than the traditional asset replacement approach	Will not be implemented
	Establish a time frame for putting steps in place to measure contractor's progress toward improving operational effectiveness	Partially implemented
Control of future costs through competition remains at risk because of weak oversight.	Establish criteria to determine when to adjust the project baseline and document the reasons for change	Partially implemented
	For subcontracts over \$5 million awarded by the system integrator to the two major subcontractors, require notification to the Coast Guard about decision to perform the work in-house rather than contracting it out	Implemented ^a
	Develop a comprehensive plan for holding the system integrator accountable for ensuring adequate competition among suppliers	Partially implemented

Source: GAO analysis.

^aDetermined to be implemented during work performed in 2005 for [GAO-05-757](#).

Coast Guard's Efforts to Improve Oversight and Program Management Show Mixed Results

We continue to see mixed results in the Coast Guard's efforts to improve oversight and management of the Deepwater program. The Coast Guard has put in place a human capital plan to help ensure adequate staffing of the Deepwater program and has taken actions to improve the effectiveness of integrated product teams. However, subcontractor collaboration and provision of guidance on transitioning to new Deepwater assets to field personnel, particularly as it pertains to maintenance and logistics responsibilities, continue to need additional attention.

Put in Place a Human Capital Plan to Ensure Adequate Staffing of the Deepwater Program

Original issue: As early as 2001, we noted that difficult human capital challenges would need to be addressed, including the need to recruit and train sufficient staff to manage and oversee the Deepwater contract.²² Reviewing this matter again in 2004, we found that the Coast Guard had not funded the number of staff requested by the Deepwater program and had not adhered to the processes outlined in its human capital plan for addressing turnover of Deepwater officials, particularly Coast Guard personnel.²³ These staffing shortfalls contributed to problems in making timely decisions and keeping pace with the workload.

Steps taken: The Coast Guard took several steps to address this issue. Its initial steps involved hiring contractors to assist with program support functions, shifting some positions from being staffed by military personnel to civilian personnel to mitigate turnover risk, and identifying the hard-to-fill positions and developing recruitment plans specifically for them. Subsequent to these changes, the Deepwater program's executive officer (1) approved a revised human capital plan in February 2005 emphasizing workforce planning and (2) is developing ways to leverage institutional knowledge as staff rotate out of the Deepwater program. The Coast Guard plans to review the human capital plan annually to ensure continual alignment between human capital management and actual program performance. The Coast Guard has also placed added emphasis on staffing when formulating the program's budget request—for example, in adding contracting officers and specialists. Finally, the Coast Guard has worked closely with the Department of Homeland Security and the Defense Acquisition University to provide training for Deepwater personnel.

Recommendation status: The steps the Coast Guard has taken appear sufficient to address matters related to adequately staffing the Deepwater program and mitigating turnover, and therefore we consider this recommendation to be fully implemented.

Strengthening Integrated Product Teams

Original issue: Effective management of the Deepwater program depends heavily on strong collaboration among the Coast Guard, the system integrator, and the subcontractors. Integrated product teams (IPTs), the Coast Guard's primary tool for managing the Deepwater program, overseeing contractor activities, and ensuring collaboration have experienced difficulty from the outset. IPTs, which are generally chaired

²²GAO-01-564.

²³GAO-04-380.

by a subcontractor representative and consist of members representing the subcontractors and the Coast Guard, are responsible for overall program planning and management, asset integration, and overseeing delivery of specific Deepwater assets. In 2004, we reported these teams were struggling to carry out their missions because of four major issues: lack of timely charters to provide authority needed for decision making, inadequate communication among team members, high turnover, and insufficient training.

Steps taken: In 2005, we found that all IPTs had charters and their members had received entry-level training. Decision making, however, continued to be largely compartmented. Since then, the Coast Guard has established domain management teams to serve as oversight and conflict resolution entities for the IPTs. According to Coast Guard officials, these teams are also to enhance collaboration on issues that cut across several IPTs. Monthly assessments show IPTs have continued to improve their effectiveness across all performance measures.

Recommendation status: While the Coast Guard has taken some actions, we do not believe the actions are sufficient to consider the recommendation to be fully implemented because there are indications that collaboration among subcontractors remains inconsistent. Last year we pointed out that ICGS's two major subcontractors, Lockheed Martin and Northrop Grumman, were operating under their own management systems and that this approach could lessen the likelihood that a system-of-systems outcome would be successfully achieved. During our current review, Coast Guard performance monitors and the program's executive officer reported that collaboration among the subcontractors continues to be problematic and that ICGS wields little influence to compel decisions among them. For example, when dealing with proposed design changes to assets under construction, ICGS submits the changes as two separate proposals from both first-tier subcontractors rather than coordinating the separate proposals into one coherent plan. According to Coast Guard performance monitors, this approach complicates the Coast Guard's review of the needed design change because the two proposals often carry overlapping work items, thereby forcing the Coast Guard to act as the system integrator in these situations.

The Coast Guard has undertaken efforts to address these problems. Coast Guard officials said they have improved communication with ICGS in this area so that requirements are more easily discernable. Further, the Coast Guard is beginning to take steps to collaborate with the system integrator

Providing Field Personnel with
Guidance and Training on
Transitioning to New
Deepwater Assets

and the first-tier subcontractors with greater frequency, but it is too early to tell if these will effectively eliminate the problems

Original issue: In 2004, we found the Coast Guard had not effectively communicated decisions on (1) how new Deepwater and existing assets are to be integrated during the transition and (2) whether Coast Guard or contractor personnel (or a combination of the two) will be responsible for maintenance of the Deepwater assets. For example, Coast Guard field personnel, including senior-level operators and naval engineering support command officials, said they had not received information about how they would be able to continue accomplishing their missions using existing assets while also being trained on the new assets.

Steps taken: The Coast Guard has taken some steps to improve the level of communication between the Deepwater program and field operators and maintenance personnel. A November 2004 analysis of the Deepwater program's communication process, conducted in coordination with the National Graduate School, found that the communication and feedback process was inadequate. Since then, the Coast Guard has placed more emphasis on outreach to field personnel, including surveys, face-to-face meetings, and presentations. More recently, officials from the Atlantic and Pacific Area Commands, Maintenance and Logistics Commands, and the Aircraft Repair and Supply Center agreed that Deepwater program officials have significantly improved the frequency and types of information flowing from the program office to the field. In addition, field personnel are members of several IPTs and working groups, and ICGS has placed liaisons at several field locations.

Recommendation status: While the Coast Guard has taken some actions, there are indications that the actions are not yet sufficient to consider the recommendation to be fully implemented. In particular, our review of relevant documents and our discussions with key personnel make clear that field operators and maintenance personnel are still concerned that their view are not adequately acknowledged and addressed, and have little information about maintenance and logistics plans for the new Deepwater assets. For example, though the first National Security Cutter is to be delivered in August 2007, field and maintenance officials have yet to receive information on plans for crew training, necessary shore facility modifications, or how maintenance and logistics responsibilities will be divided between the Coast Guard and ICGS. According to Coast Guard officials, many of these decisions need to be made and communicated very soon in order to allow for proper planning and preparation in advance of the cutter's delivery.

More Time Needed to Determine Adequacy of Steps Taken to Improve System Integrator Accountability

Unlike actions on the previous recommendations, Coast Guard actions to provide better input from Coast Guard performance monitors and to hold the system integrator more accountable for performance appear to be largely sufficient. We cannot determine whether the Coast Guard has implemented several of our recommendations in this area, however, until more Deepwater assets are delivered and the results of these actions can be assessed.

Providing Better Input from Coast Guard Performance Monitors

Original issue: In 2004, we reported that the Coast Guard's award fee evaluation of the first year of ICGS's performance was based on unsupported calculations and relied heavily on subjective judgments. Rating procedures used by Coast Guard performance monitors were inconsistent, as were procedures for calculating scores, leading to questions about whether the award fee decision was well supported.

Actions taken: The Coast Guard has provided additional guidance and training to performance monitors, better allowing them to link their comments with specific examples within their respective areas of responsibility. The Coast Guard has also improved the consistency of the format that performance monitors use to provide input about the system integrator's performance and revised assessment criteria to more clearly differentiate between objective measures (that is, developed using automated tools and compared against defined standards) and subjective evaluations. Weights have been assigned to each set of evaluation factors, and the Coast Guard continues to adjust these factors to achieve an appropriate balance between automated results and eyewitness observations.

Recommendation status: The Coast Guard's efforts to provide better guidance and training, improve the consistency of the format for performance monitors' input, and clarify performance assessment criteria appear sufficient for addressing the issue, and therefore we consider this recommendation to be fully implemented.

Holding the System Integrator Accountable for Improving Effectiveness of the Integrated Product Teams

Original issue: In 2004, we found that the system integrator, whose subcontractors chaired the IPT working groups, was not being held accountable for IPT effectiveness in its performance assessments. **Actions taken:** The Coast Guard changed award fee measures to place additional emphasis on the system integrator's responsibility for making the IPTs effective. Award fee criteria now incorporate the administration, management commitment, collaboration, training, and empowerment of these teams.

Establishing a Time Frame for
Putting Steps in Place to
Measure Contractor's Progress
toward Improving Operational
Effectiveness

Recommendation status: With IPTs' performance now included in the criteria for measuring the system integrator's performance, we consider this recommendation to be fully implemented.

Original issue: In 2001, the Coast Guard set a goal of developing measures, within 1 year after contract award, to conduct annual assessments of the system integrator's progress toward achieving the three overarching goals of the Deepwater program, including increased operational effectiveness. In 2004, we found that the time frame for the first review of the contractor's performance against the Deepwater goals had slipped. The former Deepwater chief contracting officer told us that he anticipated that the metrics would be in place in the fourth year of the contract, the same year the Coast Guard would decide whether or not to extend the contract.

Steps taken: The Coast Guard has since developed modeling capabilities—namely the DMOES model discussed earlier—to simulate the effect of the new assets' capabilities on the Coast Guard's ability to meet its missions. Coast Guard officials told us that they are now beginning to track the operational effectiveness of the Deepwater program using both the DMOES model and actual mission performance data. Further, at the Coast Guard's request, the Center for Naval Analyses developed a tool to measure the "presence" of Deepwater assets—that is the number of square miles of ocean in which Deepwater aircraft and vessels can detect, identify, and prosecute targets. In addition, Coast Guard officials have also begun using mission performance data from 2004, the most recent year of complete information, to measure the contribution provided by Deepwater systems or assets in seven mission areas: search and rescue, cocaine seizure rate, illegal or undocumented migrant interdiction, foreign fishing vessel interdiction, protection of living marine resources, national defense/military readiness, and international ice patrol. Coast Guard officials acknowledge that this is difficult, though, because the data on mission results and accomplishments do not differentiate between Deepwater assets and non-Deepwater assets. Coast Guard officials said doing so should become easier as more Deepwater assets come on line and as analytical tools are refined.

Recommendation status: Although the models have been developed and are being refined to measure operational effectiveness, there are too few Deepwater assets currently in operation to effectively measure the system integrator's actual performance in improving operational effectiveness. As a result, we do not consider this recommendation to be fully implemented.

Establishing Criteria to Determine When to Adjust the Project Baseline and Document the Reasons for Change

We recognize, though, that as more Deepwater assets and systems come on line, the amount of data will increase and the analytical tools will be more refined so that the Coast Guard should be in a better position to (1) discern the Deepwater program's contribution to operational effectiveness and (2) fully implement this recommendation.

Original issue: Establishing a solid baseline against which to measure progress in lowering total ownership cost (TOC) is critical to holding the system integrator accountable. However, during our 2004 review, we found that the Coast Guard's Deepwater TOC baseline had been significantly changed from what had been originally envisioned and that further changes could be made as a result of variables such as fuel costs or vessels' operating tempo. At the time, Coast Guard officials explained that proposed changes to the baseline would be approved by the program executive officer on a case-by-case basis, though the Coast Guard had not developed criteria for potential upward or downward adjustments to the baseline.

Steps taken: In response to our concerns, the Coast Guard began using criteria from its Major Systems Acquisition Manual as the basis for adjusting the TOC baseline. These criteria allow the baseline to be adjusted based on significant changes in mission requirements, schedule changes, or project funding, or for specific congressional actions. Coast Guard officials also told us that they have also added criteria for making changes to the baseline, such as:

- insufficient program funding or inflationary pressure that exceeds the assumptions and
- natural disasters or periods of national emergency that require a deviation from the baseline's cost, schedule, or performance parameters.

Coast Guard officials said that approval of revisions to the program's overall baseline must come through approved decision memorandums from the Agency Acquisition Executive, who is the Vice Commandant of the Coast Guard. The Deepwater Program Executive Officer still has authority to approve baseline revisions at the asset and domain level. Depending on their severity, baseline changes now are also subject to review and approval by the Department of Homeland Security (DHS), the Coast Guard's parent agency. The Coast Guard is required to submit Deepwater program baseline information to DHS on a quarterly basis, and the project is subject to an annual review by the DHS Investment Review Board. According to DHS officials, a baseline breach of 8 percent or more

would require that the Coast Guard provide information on the causal factors and propose corrective actions to rectify the breach.²⁴ The officials added that, if the baseline breach is considered significant, the Office of Management and Budget is to be notified that the program will have to undergo a rebaselining and its funding profile will need to be altered. Further, as a result of its latest review of the Deepwater program, the DHS Investment Review Board has asked that, in addition to overall program baseline information, the Coast Guard also provide baseline information for each of the Deepwater assets. This will provide DHS with more insight into the program's cost, schedule, and performance.

Recommendation status: The Coast Guard's steps, combined with DHS's oversight requirements, should be sufficient to resolve this issue. At present, however, DHS's policy directive is only in draft form. We will consider this recommendation to be fully implemented when the management directive is finalized.²⁵

Effects of Steps Taken to Control Future Costs through Competition Will Take Time to Assess

Developing a Plan for Holding the System Integrator Accountable for Ensuring Adequate Competition among Suppliers

The Coast Guard has taken a number of actions to address the remaining recommendation in this area, which relates to holding the system integrator accountable for ensuring competition among subcontractors. However, until the effects of these actions are more apparent, we are not able to consider the recommendation as being implemented.

Original issue: Competition is a key component for controlling costs in the Deepwater program and a guiding principle for DHS's major acquisitions. In 2004, we found that beyond the initial 5-year contract period, the Coast Guard had no way to ensure competition was occurring because it did not have mechanisms in place to measure the extent of competition or to hold the system integrator accountable for steps taken to achieve competition. Shortly before, the system integrator had adopted Lockheed Martin's "open business model" as a corporate policy to help

²⁴According to DHS officials, a baseline breach occurs when a cost or schedule threshold is exceeded or when a performance threshold cannot be met.

²⁵According to the Coast Guard, DHS considers this interim document final; however, because the documentation that supports the policy directive is still in draft form, we do not consider it to be final.

ensure competition and keep costs under control.²⁶ However, the open business model is not a formal policy involving specific decision points to ensure that competition will be considered. Further, the first-tier subcontractors, Lockheed Martin and Northrop Grumman, have largely continued to follow their own procurement procedures and guidance for determining whether competition will occur and the suppliers who will be invited to compete for Deepwater assets.

Steps taken: To address our recommendation about ensuring out-year competition among second-tier suppliers, the Coast Guard contracted with Acquisitions Solutions, Inc. (ASI), to assess the amount of second-tier competition conducted by ICGS during 2004. ASI issued a report in May 2005 that, among other things, found that the open business model had not been fully embraced by Northrop Grumman despite its being an ICGS corporate policy.²⁷ The report made nine recommendations aimed at improving competition throughout the Deepwater program. According to Deepwater officials, ICGS developed a plan to adopt all nine recommendations by March 1, 2006, and is providing training on use of the open business model to Northrop Grumman personnel working on the Deepwater program. Further, Coast Guard officials reported that competition will be assessed as a part of the award fee assessment subjective criteria for the fifth year of the contract and the Coast Guard will specifically examine the system integrator's ability to control costs by assessing the degree to which competition is fostered at the major subcontractor level during the award term decision process later this year.²⁸

Recommendation status: While steps already under way appear to be sufficient to resolve our concerns, we cannot consider this recommendation as being fully implemented until the Coast Guard has

²⁶The open business model is to encourage second-tier suppliers to remain innovative and competitive by directing the first-tier subcontractors to (1) generally avoid the use of teaming agreements with suppliers and prohibit teaming agreements based on guaranteed work share, (2) defer second-tier supplier decisions as long as practicable so that changes in the market place can be considered, and (3) actively solicit market information and new suppliers.

²⁷U.S. Coast Guard, Program Executive Office, Integrated Deepwater System Program, *Competition Assessment*, as prepared by Acquisitions Solutions, Inc., May 27, 2005.

²⁸During the award term process, the Coast Guard will decide whether to award the first five-year contract option.

addressed the ASI recommendations and results of the next award term assessment are known.

Concluding Observations

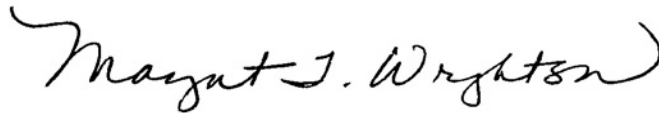
The Coast Guard has done a commendable job of adapting the Deepwater program to post-September 11 realities. Our analysis shows that Coast Guard officials used sound analytical methods to assess the revised needs for aircraft and vessels. Coast Guard officials have also taken strong efforts to address concerns about program management and contract performance and have largely implemented or are in the process of implementing steps that would help mitigate these concerns. We agree that the Coast Guard would be well served to continue developing ways to use its computer modeling to establish clear relationships between its mix of assets—aircraft and vessels—and its Deepwater and agency-level performance goals. We have pointed out in past reports that the Coast Guard lacks clear measures of how its resources are linked to achieving performance goals, so these steps should help resolve this concern. We realize that this ongoing effort will likely take some time to complete. While the Coast Guard has made good progress in addressing our recommendations, there are aspects of the Deepwater program that will require continued attention. First, the Deepwater program continues to face a degree of underlying risk, in part because of the unique approach involving a system-of-systems approach with the contractor acting as overall integrator, and in part because it is so heavily tied to precise year-to-year funding requirements over the next two decades. Further, a project of this magnitude will likely continue to experience other concerns and challenges beyond those that have emerged so far. It will be important for Coast Guard managers to continue careful monitoring of contractor performance and to continue addressing program management concerns as they arise.

Agency Comments

We requested comments on a draft of this report from the Department of Homeland Security and the U.S. Coast Guard. The U.S. Coast Guard provided technical comments, which have been incorporated into the report as appropriate.

We are providing copies of this report to the Secretary of the Department of Homeland Security, the Commandant of the U.S. Coast Guard, and interested congressional committees. The report will also be made available to others upon request. In addition, the report will be available at no charge on GAO's Web site at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me on (415) 904-2200 or wrightsonm@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in appendix II.



Margaret T. Wrightson
Director, Homeland Security
and Justice Issues

Appendix I: Objectives, Scope, and Methodology

This report, which focuses on the Coast Guard's Deepwater management challenges, provides details on three issues: (1) a comparison of the revised Deepwater implementation plan issued in August 2005 with the original (August 2002) plan in terms of cost, time frames, and the balance of legacy and replacement assets; (2) an assessment of the degree to which the operational effectiveness model and other analytical methods used by the Coast Guard to develop the revised Deepwater asset mix are sound and appropriate for such a purpose; and (3) an assessment of the progress made in implementing our prior recommendations regarding Deepwater program management.

To compare the revised Deepwater implementation plans issued in August 2005 and February 2006 with the original (August 2002) Deepwater implementation plan in terms of cost, time frames, and the balance of legacy and replacement assets, we analyzed the original and revised Deepwater implementation plans and related guidance. We also reviewed and analyzed relevant Coast Guard documentation on changes in missions, costs, asset mix, asset capabilities, and asset delivery schedules. We supplemented the documentation reviews and analyses with discussions with officials from the Deepwater Program Executive Office. Finally, we discussed the risks associated with the Deepwater program's reliance on a sustained level of funding through 2027 and the implications of these risks.

To assess the degree to which the operational effectiveness models and other analytical methods used to develop the revised Deepwater asset mix are sound and appropriate for such a purpose, we reviewed the capacity and operational effectiveness models used in determining the current Deepwater asset mix to ensure that the approach was sound and that appropriate assumptions were made in the models' use. This review involved assessing Coast Guard documentation on how its models were developed and executed, determining the views of knowledgeable independent parties on the Coast Guard's operational effectiveness model, and interviewing cognizant Coast Guard officials. These interviews also included discussions of how these models, and other factors, were used in developing the current Deepwater asset mix, as well as whether the Coast Guard has developed an approach for determining the extent to which the Deepwater asset mix will allow it to meet its performance targets.

In assessing the Coast Guard's modeling and other analytical methods used for developing the revised Deepwater asset mix, we paid particular attention to the most recent performance gap analysis (PGA) study (PGA IV), which compared the projected performance of the revised Deepwater asset mix to that of the original Deepwater asset mix—so that we could

gain a better understanding of how these results were used in developing the revised Deepwater asset mix. Specifically, we reviewed the report's methodology and requested additional clarifying information to help determine if the analytic work supported the report's conclusions. As part of our assessment, we developed an analysis that departs from what the Coast Guard describes in its report in two important ways. First, and most important, the Coast Guard assigned a linear scale ranging from 1 to 5 to five statistical categories describing the distribution of the analysis data. This range assigned numerical values to the degree to which the revised asset mix was projected to outperform (or underperform) the original asset mix, with 1 representing projected performance two or more standard deviations below that of the original asset mix, up to 5, representing projected performance two or more standard deviations above that of the original asset mix. It is our opinion that this type of linear scale is not appropriate for capturing the variations in projected performance. Accordingly, we used a weighting scheme for these categories (known as z-scores) that better reflects the relationship among these categories. The z-scores take into account the statistical property that being two standard deviations away from the mean value is almost five times more difficult than being one standard deviation away from the mean. Second, we compared our calculated performance measure weights to a standard in order to assess if our weighting scheme would affect the study's conclusions. Since the methodology identified three mission significance categories and four regional mission priority categories, we compared our recalculated weights based upon the z-score with the weights we would expect to see if all mission performance measures across all mission priorities for the four modeled regions had exceed one standard deviation above the mean in improvement. Despite the different methodologies used, our results generally aligned with what the Coast Guard reported in PGA IV.

To determine the status of the Coast Guard's implementation of our prior recommendations for improving program management, strengthening contractor accountability, and controlling costs, we reviewed and analyzed briefings and relevant documentation provided by the Deepwater Program Executive Office on actions taken to address our concerns. We reviewed and analyzed documentation on the Coast Guard's assessment of the contractor's system integration and management performance in the first period of the fourth year of the contract, including written comments by the performance monitors. We also reviewed and analyzed information on Deepwater integrated product teams, including membership lists and briefings provided by the Coast Guard on measures of effectiveness for the teams. We analyzed the Coast Guard's plans to increase communications

to field operators, and documentation from field operators and maintenance personnel regarding these communications. Further, we analyzed the February 2005 Deepwater revised Human Capital Plan to identify changes that have been made and discussed Deepwater Program Office staffing plans with Coast Guard officials. To supplement our analyses of the relevant documentation, we held several meetings with the Deepwater Program Executive Officer, the Deputy Program Executive Officer, and a number of Deepwater staff, including contracting officials and representatives from the system integrator. We also held discussions with Coast Guard Deepwater performance monitors to discuss their written comments to the latest award fee assessment. We also held discussions with officials from the Pacific Area Command and Pacific Area Maintenance and Logistics Command in Alameda, California; the Atlantic Area Command and Atlantic Area Maintenance and Logistics Command in Norfolk, Virginia; and the Aircraft Repair and Supply Center in Elizabeth City, North Carolina. Further, we reviewed acquisition guidance and spoke with officials from the Department of Homeland Security regarding their oversight of the Deepwater acquisition program baseline.

We performed our review from August 2005 to March 2006 in accordance with generally accepted government auditing standards.

Appendix II: GAO Contacts and Staff Acknowledgments

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Staff Acknowledgments

In addition to the contact named above, Steven Calvo, Christopher Conrad, Adam Couvillion, Christine Davis, Art James, Julie Leetch, Michele Mackin, Stan Stenersen, and Linda Kay Willard made key contributions to this report.

GAO Related Products

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