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Report to Congressional Requesters

July 2012

COAST GUARD

Legacy Vessels' Declining Conditions Reinforce Need for More Realistic Operational Targets

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Highlights

Highlights of GAO-12-741, a report to congressional requesters

July 2012

COAST GUARD

Legacy Vessels' Declining Conditions Reinforce Need for More Realistic Operational Targets

Why GAO Did This Study

The Coast Guard's legacy vessels are either approaching or have exceeded their designed life expectancies. The Coast Guard is replacing these vessels with a more capable fleet; however, cost and management problems have led to delays in the delivery of new vessels. GAO was asked to study the conditions of the legacy fleet. This report addresses: (1) how the physical condition of the Coast Guard's legacy vessels changed from fiscal years 2005 through 2011, and key actions the Coast Guard has taken related to the physical condition of its legacy fleet; (2) key annual maintenance expenditure trends for the legacy vessel fleet, and the extent the Coast Guard's cost-estimating process has followed established best practices; and (3) the operational capacity of the legacy vessel fleet and the extent the Coast Guard faces challenges in sustaining the legacy vessel fleet and meeting mission requirements. GAO analyzed Coast Guard data from fiscal years 2005 through 2011 on legacy vessels' condition, cost, and operational performance. GAO visited five locations where vessels were based or undergoing maintenance. The results of these visits are not generalizable, but provided insights.

What GAO Recommends

GAO recommends that the Department of Homeland Security (DHS) direct the Coast Guard to ensure its cost estimates conform to best practices and adjust legacy vessel fleet operational hour targets to levels that reflect actual capacity. DHS concurred with the first recommendation but did not concur with the second stating that reducing the operational hour targets would fail to fully utilize those assets not impacted by maintenance issues. GAO believes the recommendation remains valid as discussed in this report.

View GAO-12-741.
For more information, contact Stephen L. Caldwell at (202) 512-8777 or caldwells@gao.gov.

What GAO Found

From fiscal years 2005 through 2011, the physical condition of the Coast Guard's legacy vessels was generally poor; and the Coast Guard has taken two key actions to improve the vessels' condition: reorganizing its maintenance command structure and implementing sustainment initiatives for portions of its legacy vessel fleet. The Coast Guard's primary measure of a vessel's condition is the operational percent of time free of major casualties (a major casualty is a deficiency in mission essential equipment that causes the major degradation or loss of a primary mission). This measure shows that the 378-foot high endurance cutters (HEC), the 210-foot and 270-foot medium endurance cutters (MEC), and 110-foot patrol boats generally remained well below target levels from fiscal years 2005 through 2011. To improve the condition of the vessel fleet, in 2009, the Coast Guard reorganized its maintenance command structure to focus on standardization of practices, and reported it was on schedule to complete sustainment initiatives by fiscal year 2014, which are intended to improve vessel operating and cost performance.

Annual maintenance expenditures for the legacy vessel fleet—such as those associated with scheduled maintenance costs—declined from fiscal years 2005 to 2007 and then rose from fiscal years 2007 to 2011; and the Coast Guard's maintenance cost estimating process does not fully reflect best practices. Scheduled maintenance expenditures rose from $46.1 million to $85.2 million from fiscal years 2008 to 2009, an increase Coast Guard officials attributed to better identifying maintenance needs and receiving supplemental funding. GAO's *Cost Estimating and Assessment Guide* states that a high-quality and reliable cost estimate includes best practice characteristics, three of which are relevant to the Coast Guard's process: well-documented, comprehensive, and accurate. The Coast Guard's process partially meets these characteristics. For example, it is partially comprehensive because it defines the program, among other things, but does not document all cost-influencing ground rules and assumptions (e.g., inflation rate). Annual cost estimates for legacy vessel fleet maintenance that incorporate established best practices would provide better information to inform the Coast Guard's decisions in effectively allocating available resources in the constrained federal budget environment.

The operational capacity of the legacy vessel fleet generally declined from fiscal years 2005 through 2011, contributing to operational capacity targets becoming increasingly unrealistic. For example, the HECs and 210-foot MECs did not meet operational hour targets from fiscal years 2005 through 2011. Coast Guard officials reported that declining operational capacity hindered mission performance. The Coast Guard uses operational hour targets to inform planning decisions, such as setting performance targets. Legacy vessel capacity is declining and expected to continue to decline; nevertheless, the Coast Guard has not revised operational hour targets. Coast Guard officials reported that adjusting operational hour targets would lower its mission performance targets; however, these targets have gone unmet because of declining legacy vessel capacity. Legacy fleet operational hour targets that reflect actual capacity, as evidenced by historic performance, could help the Coast Guard more effectively allocate its resources and ensure it sets achievable performance targets.

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Abbreviations

DHS	Department of Homeland Security
FRC	Fast Response Cutter
HEC	High Endurance Cutter
HTHM	High Tempo/High Maintenance
MEC	Medium Endurance Cutter
MEP	Mission Effectiveness Project
NSC	National Security Cutter
OMB	Office of Management and Budget
OPC	Offshore Patrol Cutter
OpPOTF	Operational Percent of Time Free from Major Casualties
PB	Patrol Boat
SFLC	Surface Forces Logistics Center
SSL	Standard Support Level

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United States Government Accountability Office
Washington, DC 20548

July 31, 2012

Congressional Requesters

The Coast Guard's missions include, among others, protecting our nation's ports, waterways, and coastal areas from security threats; interdicting illegal drugs and migrants; and conducting search and rescue operations. To accomplish these missions, the Coast Guard relies heavily on its legacy vessel fleet.[1] These legacy vessels are capable of conducting operations in the Coast Guard's deepwater area of operations, which may be far from the nation's shores and in rough sea conditions.[2] However, these legacy vessels are either approaching or have exceeded their designated service life expectancies, with many of the vessels having entered service in the 1960s and 1970s. The Coast Guard reports these legacy vessels have become increasingly costly to maintain because of high rates of failure of major parts and systems, and the vessels' degraded condition has negatively affected the Coast Guard's operational capacity to meet mission requirements. For example, in the aftermath of the Haiti earthquake in 2010, the Coast Guard reported that it deployed 12 legacy vessels to Haiti to assist in humanitarian relief operations, and 10 of these vessels suffered severe failures of parts or systems, which diminished their availability to deliver emergency aid and perform medical evacuations.

The Coast Guard is in the midst of a long-term recapitalization plan that could cost more than $29 billion—the largest acquisition program in the Coast Guard's history—to replace legacy vessels and aircraft with a

[1]For the purposes of this report, we use the term "legacy vessels" to refer to four legacy vessel classes, including the 378-foot high endurance cutters, the 210-foot and 270-foot medium endurance cutters, and the 110-foot patrol boats.

[2]The Coast Guard's deepwater area of responsibility is defined as that area beyond the normal operating range of single-crewed shore-based small boats (generally more than 50 miles from shore), where either extended on scene presence, a long transit or forward deployment is required to perform the missions.

modernized and more capable fleet.[3] However, since beginning the program in 1996, the Coast Guard has experienced problems in the areas of costs, management, and oversight that have led to considerable delays in the delivery of new vessels. For example, according to 2007 Deepwater Acquisition Program Baseline projections, the Coast Guard was to have received four vessels—national security cutters—to replace its fleet of 378-foot high endurance cutters by the end of calendar year 2011, but had received only three by that date. Delays in the delivery of the replacement vessels for the 210-foot and 270-foot medium endurance cutters—the offshore patrol cutter—are more substantial. For example, the planned delivery of the offshore patrol cutter has been delayed by 13 years.

Delays in delivery of the replacement vessels have created uncertainties regarding how the Coast Guard will sustain its legacy vessels while meeting its operational requirements. In particular, the Coast Guard projects that delays in the delivery of the replacement vessels will lead to increasingly greater operational capacity shortfalls that it expects to persist until the deliveries of the replacement vessels are completed—an event the Coast Guard's most recent schedule projects will not be until 2034. These operational shortfalls represent a formidable challenge as the Coast Guard must effectively balance resources between its increasingly expensive vessel recapitalization and the need to invest in keeping its legacy vessels operational for longer periods of time than originally planned.

You expressed an interest in the conditions of, and costs for, maintaining the Coast Guard's fleet of legacy vessels, and the challenges the Coast Guard faces in sustaining these vessels longer than planned in an effort to maintain operational readiness. In response to your request, this report evaluates those issues and, in particular, addresses the following three questions:

[3]The Coast Guard's asset recapitalization plan includes projects to build or modernize five classes each of vessels and aircraft, and procurement of other capabilities, such as improved command, control, communications, computers, intelligence, surveillance, and reconnaissance. This report focuses only on the legacy vessel fleet. For more information on the recapitalization effort as a whole, see GAO, *Coast Guard: Action Needed As Approved Deepwater Program Remains Unachievable;* GAO-11-743 (Washington, D.C.: July 28, 2011).

- How has the physical condition of the Coast Guard's fleet of legacy vessels changed from fiscal years 2005 through 2011, and what key actions has the Coast Guard taken related to the physical condition of its legacy fleet?
- What have been the key annual maintenance expenditure trends for the Coast Guard's fleet of legacy vessels, and to what extent does the Coast Guard's cost-estimating process follow established best practices?
- What is the operational capacity of the Coast Guard's fleet of legacy vessels and to what extent does the Coast Guard face challenges in sustaining the legacy vessels and meeting mission requirements given delays in deploying replacement vessels?

To address the first question, we analyzed data the Coast Guard reported it used to determine and track the condition of its legacy fleet of vessels for fiscal years 2005 through 2011. The Coast Guard reported that Operational Percent of Time Free from Major Casualties (OpPOTF) was its primary measure for tracking, capturing, and communicating the condition of the legacy vessel fleet from fiscal years 2005 through 2011. We compared vessel OpPOTF against established Coast Guard standards. We assessed the reliability of these data by reviewing the Coast Guard's data management practices and questioning knowledgeable officials about the data and the systems that produced the data. On the basis of our assessments, we determined the data to be sufficiently reliable for the purposes of this report. We also interviewed relevant Coast Guard headquarters officials to obtain information on the physical condition of the legacy vessels and actions Coast Guard officials reported as key to improving the physical condition of the legacy vessel fleet. We also conducted site visits to five Coast Guard field locations where Coast Guard officials reported the legacy vessels were either homeported or undergoing maintenance, and therefore available for us to observe the condition of the legacy vessels and to interview cognizant maintenance officials, operational commanders, and crew members. Specifically, we visited the following Coast Guard locations: the Pacific Area Command in Alameda, California; the Atlantic Area Command in Portsmouth, Virginia; the Coast Guard Yard in Baltimore, Maryland; district and sector offices in Miami, Florida; and the Coast Guard's district office and Naval Engineering Support Unit in Seattle, Washington. The results of these visits are not generalizable, but provided insights on key maintenance and operational issues.

To address the second question, we obtained Coast Guard data on the total annual depot-level legacy vessel maintenance expenditures,

including scheduled versus unscheduled expenditures, for maintaining the 378-foot high endurance cutters, the 210-foot and 270-foot medium endurance cutters, and the 110-foot patrol boats for fiscal years 2005 through 2011. Senior Coast Guard officials in charge of legacy vessel maintenance confirmed that analyzing these data would be the best way to understand key maintenance expenditure trends. We also analyzed Coast Guard data on budgeted annual maintenance funds for these four vessel classes for the same period of time to identify cost trends and to determine how expendutures for the respective legacy vessel classes compared with planned costs. We interviewed cognizant officials to obtain their perspectives on data trends. We assessed the reliability of these data by reviewing the Coast Guard's data management practices and interviewing knowledgeable officials about the data and the systems that produced the data. On the basis of our assessments, we determined the data to be sufficiently reliable for the purposes of this report. We compared the documentation that the Coast Guard uses to compute its annual legacy vessel maintenance cost estimates against criteria outlined in GAO's *Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs* to determine the extent to which the Coast Guard's process adhered to best practices.[4]

To address the third question, we analyzed Coast Guard vessel data and measures that the Coast Guard reported were key indicators of the relationship between vessel maintenance condition and operational performance—operational hours and lost cutter days—for fiscal years 2005 through 2011. We compared operational hour data with Coast Guard targets for each legacy vessel class across each year. We assessed the reliability of these data by reviewing the Coast Guard's data management practices and interviewing knowledgeable officials about the data and the systems that produced the data. On the basis of our assessments, we determined the data to be sufficiently reliable for the purposes of this report. We also reviewed Coast Guard recapitalization and sustainment plans, and obtained evidence from Coast Guard officials that outlined challenges the Coast Guard faces in sustaining its legacy vessels and meeting mission requirements given delays in deploying the replacement vessels. We evaluated the Coast Guard's actions against guidance in the *Program Assessment Rating Tool Guidance Number*

[4]GAO, *GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs*, GAO-09-3SP (Washington, D.C.: Mar. 2, 2009).

2007-2 from the Office of Management and Budget (OMB).[5] Appendix I provides further details on our scope and methodology.

We conducted this performance audit from September 2011 through July 2012 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

The Coast Guard, within the Department of Homeland Security (DHS), is the principal federal agency responsible for maritime safety, security, and environmental stewardship. According to the Coast Guard, its legacy vessel fleet is essential for meeting its homeland security missions—as well as sustaining other mission areas, such as search and rescue, law enforcement, and environmental protection—some of which are conducted more than 50 miles off the shore of the United States.

The Coast Guard's Legacy Vessel Fleet

The Coast Guard's legacy vessel fleet, as of June 2012, included a total of 77 vessels of various sizes and capabilities, including the 378-foot high endurance cutters (HEC), 270-foot and 210-foot medium endurance cutters (MEC), and 110-foot patrol boats (PB).[6] These vessels are critical for Coast Guard missions, such as defense operations; search and rescue; enforcing fishing laws; securing ports, waterways, and coastal areas; and interdicting illegal drugs and migrants. While the HECs spend up to 30 days at sea without reprovisioning and the MECs spend up to 21 days at sea without reprovisioning during these missions, the smaller PBs may be on-scene for a maximum of 5 days. Figure 1 provides more details on the four legacy vessel classes.

[5]Office of Management and Budget, *Program Assessment Rating Tool Guidance Number 2007-2*, (Washington, D.C.: January 29, 2007).

[6]As of July 2012, the Coast Guard's entire vessel fleet includes 245 vessels.

Figure 1: Information on the Coast Guard's Legacy Vessels, as of June 2012

378-foot high endurance cutter (HEC)

Quantity of vessels	9[a]
Estimated service life	40 years
Average age	42.8 years
Crew	166
Maximum speed	29 knots
Cruising range	14,000 nautical miles[b]
Helicopter operations	Yes

270-foot medium endurance cutter (MEC)

Quantity of vessels	13
Estimated service life	30 years[c]
Average age	25 years
Crew	100
Maximum speed	19.5 knots
Cruising range	9,900 nautical miles
Helicopter operations	Yes

210-foot medium endurance cutter (MEC)

Quantity of vessels	14
Estimated service life	47 years
Average age	45.3 years
Crew	76
Maximum speed	18 knots
Cruising range	6,100 nautical miles
Helicopter operations	Yes

110-foot patrol boat (PB)

Quantity of vessels	41[d]
Estimated service life	20 years
Average age	23.1 years
Crew	16
Maximum speed	28 knots
Cruising range	1,900 nautical miles
Helicopter operations	No

Source: GAO analysis of Coast Guard information. Photographs courtesy of the US Coast Guard.

[a]The Coast Guard operated a fleet of 12 HEC's from 1972 until 2012.The Coast Guard decommissioned 3 of the 12 vessels during fiscal years 2011 and 2012.

[b]According to the Coast Guard, HECs can achieve a 14,000 nautical mile range only if they ballast their fuel tanks once the tanks are depleted, a procedure that is rarely undertaken. HECs have a range of 9,600 nautical miles under normal circumstances.

[c]The Coast Guard refurbished the fleet of 12 HECs through a service life extension program—known as the Fleet Renovation and Modernization Program—from 1987 to1992. According to Coast Guard documentation, the expected service life extension was 20 to 25 years. The Coast Guard performed a life service extension program on the 210-foot MECs through a program known as the Major Maintenance Availability between 1987 and 1998, for an expected service life extension of 15 years.

[d]The 110-foot PB fleet originally included 49 vessels. The Coast Guard converted 8 of the 110-foot PBs to 123-foot PBs, but discontinued further conversions in 2005 and decommissioned the 123-foot PBs in 2007 because they were experiencing technical difficulties, such as hull buckling, and were not able to meet post-September 11, 2001 mission requirements.

Replacement of the Coast Guard's Legacy Vessel Fleet

Most of the Coast Guard's legacy vessels are nearing or past the end of their estimated service lives, as shown in figure 1, and as part of the largest acquisition in the Coast Guard's history, the Coast Guard is in the process of acquiring new vessels to replace the four classes of legacy vessels. The Coast Guard's new vessel fleet is to include national security cutters (NSC), offshore patrol cutters (OPC), and fast response cutters (FRC), as follows:

- **NSC:** The NSC is to replace the HECs. The NSC is the flagship of the Coast Guard's fleet, with an extended on-scene presence, and a capability for long transits and forward deployment. The vessel and its supporting aircraft and small boats are to operate worldwide. To date, the Coast Guard has commissioned three NSCs and is planning to receive three more by fiscal year 2017.
- **OPC:** The OPC is to replace the 270-foot and 210-foot MECs. The OPC is intended to conduct patrols for homeland security, law enforcement, and search and rescue missions. It is designed for extended on-scene presence, long transits, and operations with aircraft and small boats. The Coast Guard is conducting pre-acquisition design work and plans to award Preliminary & Contract Designs for the OPC in fiscal year 2013.
- **FRC:** The FRC is to replace the 110-foot PBs. The FRC is to have high readiness, speed, and adaptability, and the endurance to perform a wide range of missions. The Coast Guard received the first FRC in March 2012, and is planning to receive six more by the end of fiscal year 2013.

These new vessels are designed to perform the same missions as the legacy vessels they are replacing, but with greater capabilities.[7] For example, the NSC, unlike the HEC, has a secure information system for transmitting classified data. Also, the FRC is designed to operate in

[7]The Coast Guard plans for the NSC and the FRC to be able to perform marine safety missions that the 110-foot PB and HEC cannot perform. Also, the Coast Guard envisions the OPC as a flexible vessel that will be able to perform emergent missions that the MECs cannot perform.

conditions with maximum 13-foot waves, while the PB is designed to operate in conditions with maximum 8-foot waves. Appendix II provides further information comparing each of the four legacy vessel classes with its replacement vessel class.

Replacement Vessel Program's Cost and Schedule Problems

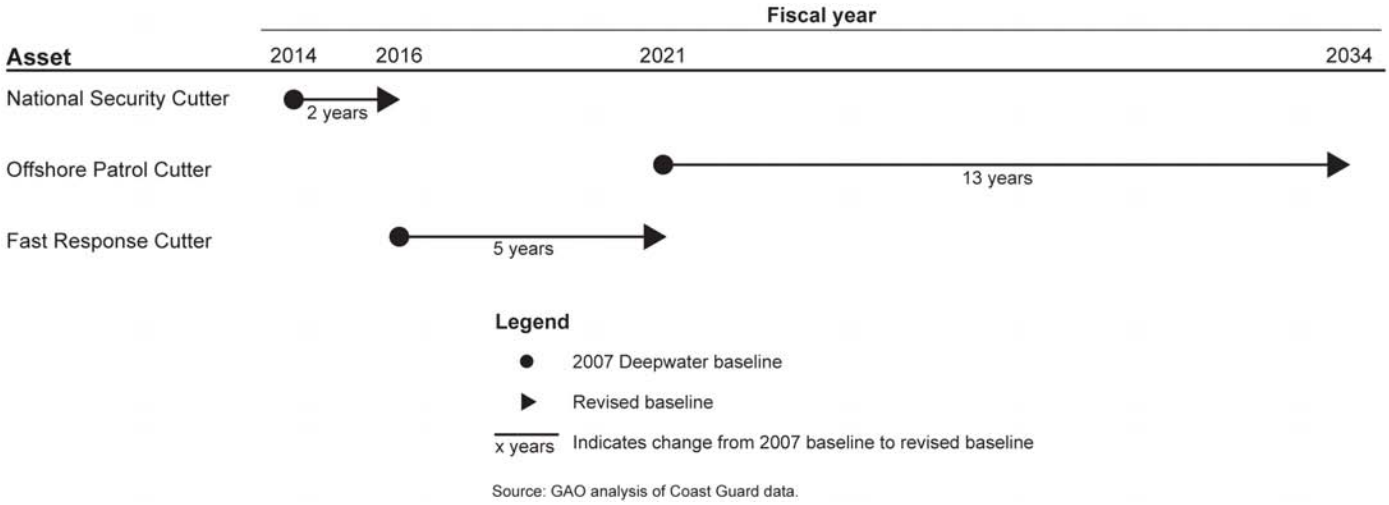
Since 2001, we have reported several times that the Coast Guard's acquisition of replacement vessels for its legacy fleet has experienced serious performance and management problems, such as cost overruns and schedule slippages, despite the Coast Guard having taken more direct responsibility for the program's acquisition strategy and management in recent years.[8] At the start of the program, the Coast Guard chose a system-of-systems strategy that was to replace the legacy assets with an integrated package of assets rather than using a traditional acquisition approach of replacing individual classes of legacy assets through a series of acquisitions.[9] To carry out this acquisition, the Coast Guard awarded a competitive contract to a systems integrator (i.e., prime contractor) that was responsible for designing, constructing, deploying, supporting, and integrating the various assets to meet projected operational requirements of the recapitalization program. We informed Congress, DHS, and the Coast Guard of the risks and uncertainties inherent with such a system-of-systems approach and made recommendations to address them. In May 2007, the Coast Guard acknowledged that it had relied too heavily on contractors and that the government and industry had failed to control costs, and announced its

[8]Since 2001, we have reviewed the Coast Guard's recapitalization program efforts and reported to Congress, DHS, and the Coast Guard on the risks and uncertainties inherent with this program. Recent reports include GAO, *Coast Guard: Better Logistics Planning Needed to Aid Operational Decisions Related to the Deployment of the National Security Cutter and Its Support Assets*, GAO-09-497 (Washington, D.C.: July 17, 2009); *Coast Guard: As Deepwater Systems Integrator, Coast Guard Is Reassessing Costs and Capabilities but Lags in Applying Its Disciplined Acquisition Approach*, GAO-09-682 (Washington, D.C.: July 14, 2009); GAO, *Coast Guard: Deepwater Requirements, Quantities, and Cost Require Revalidation to Reflect Knowledge Gained*, GAO-10-790 (Washington, D.C.: July 27, 2010); and GAO-11-743

[9]The Coast Guard's system-of-systems approach planned to integrate vessels, aircraft, and communication links together as a system to accomplish mission objectives.

intention to take over the role of systems integrator.[10] At that time, the Coast Guard established a $24.2 billion program baseline that included schedule and performance parameters. The Coast Guard has since developed baselines for some assets, most of which have been approved by DHS, that indicate the estimated total acquisition cost could be as much as $29.3 billion, or about $5 billion over the $24.2 billion baseline.[11] Furthermore, the deliveries of the NSCs, OPCs, and FRCs to replace the legacy vessels are years behind schedule, as summarized in figure 2.

Figure 2: Vessel Delivery Dates for the Final National Security Cutter, Offshore Patrol Cutter, and Fast Response Cutter Identified in the 2007 Deepwater and Revised Baselines



Source: GAO analysis of Coast Guard data.

Notes: The Coast Guard established the 2007 Deepwater baseline—which included a revised delivery schedule for the NSCs, OPCs, and FRCs—after transferring program management responsibilities from the contractor back to the Coast Guard. Since 2007, the Coast Guard has developed revised baselines for these vessels that indicate that the delivery dates for these replacement vessels are years behind schedule. As we reported in July 2011, the revised baselines for the NSC and FRC may not reflect the most current data and additional delays are likely. See GAO-11-743. For example, according to the NSC Acquisition Program Baseline Breach Remediation Plan, the delivery of the final NSC may not occur until fiscal year 2020.

[10]In March 2004, we recommended the Coast Guard address three broad areas of concern: improving program management and oversight, strengthening contractor accountability, and promoting cost control through greater competition among potential subcontractors. The Coast Guard concurred with GAO's recommendations and has implemented many of them. See GAO, *Contract Management: Coast Guard's Deepwater Program Needs Increased Attention to Management and Contractor Oversight*, GAO-04-380 (Washington, D.C.: Mar. 9. 2004).

[11]GAO-11-743.

Legacy Vessel Fleet's Condition Is Poor and Generally Declining despite Coast Guard Maintenance Efforts

From fiscal years 2005 through 2011, the physical condition of the Coast Guard's legacy vessel fleet, as evidenced by the Coast Guard's primary vessel condition measure, was generally poor. Other evidence, such as our review of vessel condition assessments, shows that the condition of the legacy vessel fleet is also generally declining. The Coast Guard has implemented two key actions to improve the physical condition of the legacy vessel fleet: (1) reorganization of the maintenance command structure and (2) completion of a 10-year, almost half-billion-dollar set of sustainment projects to refurbish PBs and upgrade MECs.

The Legacy Vessel Fleet Did Not Meet Key Physical Condition Targets

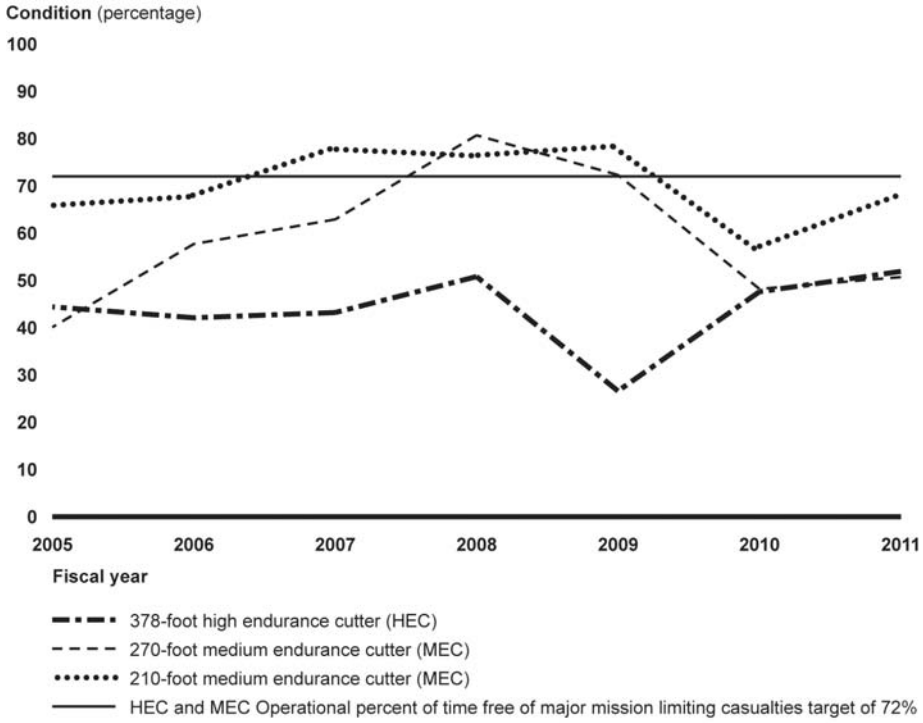
From fiscal years 2005 through 2011, the physical condition of the Coast Guard's legacy vessel fleet, as evidenced by the Coast Guard's primary physical condition measure, was generally poor, with variations by vessel class. A primary Coast Guard summary measure of condition—the operational percent of time free of major casualties—shows the legacy fleet as a whole generally remained well below target levels during fiscal years 2005 through 2011.[12] For example, the Coast Guard has an annual OpPOTF performance target of 72 percent for its major cutters—the 378-foot HEC and the 210-foot and 270-foot MECs—and 86 percent for the 110-foot PBs.[13] According to a yearly scorecard the Coast Guard uses to track vessel condition measures, the Coast Guard classifies performance below target levels as "poor." As figure 3 shows, measured against these standards, the HECs and MECs were generally poor during fiscal years

[12]The Coast Guard maintains a variety of measures or metrics to track the physical condition or performance of the legacy vessel fleet, which it calls Naval Engineering Metrics. Officials responsible for maintaining the legacy vessels reported that OpPOTF is the key measure that conveys the overall condition of the legacy fleet. A casualty is a deficiency in mission-essential equipment; a major casualty causes the major degradation or loss of at least one primary mission. This measure captures the amount of planned operational time with which a vessel experienced a major casualty. The Coast Guard reports casualties on a scale ranging from 1 to 4, with category 3 and 4 reports considered major casualties. OpPOTF is the operational percent of time free from an open casualty 3 or 4 report.

[13]The Coast Guard reports that these targets reflect the need of the major cutters to be ready to conduct all missions for 5 out of every 7 days deployed, and for the 110-foot PB to be available for 6 out of every 7 days deployed. According to Coast Guard guidance, the difference in performance targets is based on differing maintenance philosophies for the major legacy cutters versus the smaller 110-foot PB—and the cutters' respective capability to repair casualties while deployed. For example, PBs must return to homeport for repairs and thus should have a higher OpPOTF since they will not continue to operate with major casualties. In contrast, the Coast Guard's major cutters can remain at sea with serious casualties because they have the capability to perform repairs at sea.

2005 through 2011. In particular, the HECs and the 270-foot MECs were in the poorest condition, as evidenced by the HEC fleet remaining substantially below targets throughout this time period (averaging approximately 44 percent OpPOTF) and the 270-foot MEC class meeting targets in just 2 of the 7 years in the period (averaging approximately 59 percent OpPOTF).

Figure 3: Condition of the High and Medium Endurance Cutters as Measured against the Coast Guard's OpPOTF Target, Fiscal Years 2005 through 2011



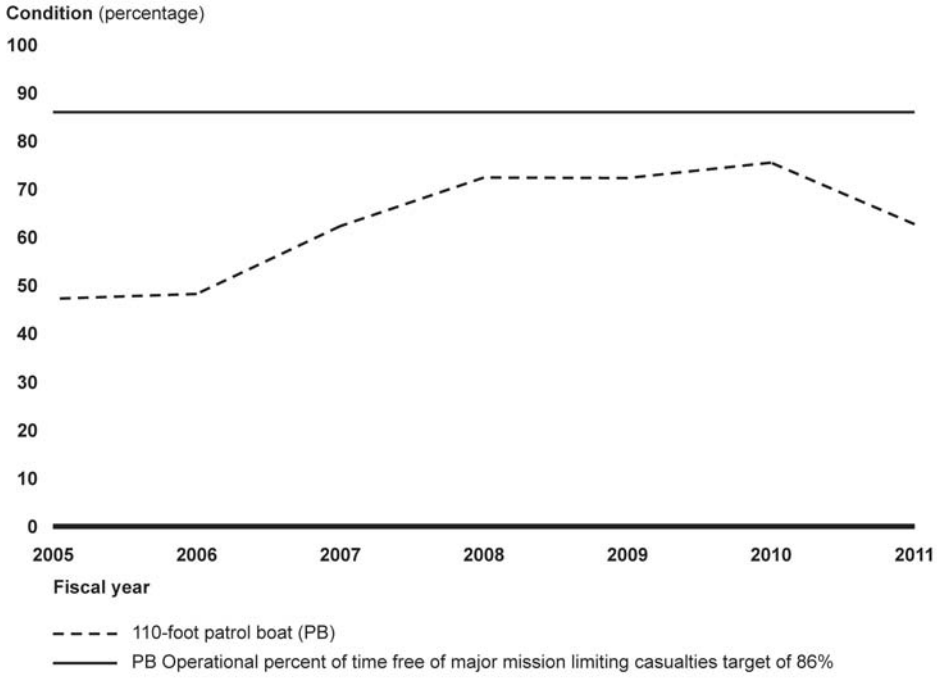
Source: GAO analysis of Coast Guard data.

Note: While remaining far below the target, HEC performance raised slightly during the time period with the exception of a steep drop in fiscal year 2009, which Coast Guard officials attributed to increased frequency of major casualties, particularly failures to main propulsion systems and diesel engines. Coast Guard officials reported that the steep decline in MEC performance between 2009 and 2010 was due to major casualties experienced by 10 of 12 MECs deployed during response operations to the 2010 Haiti earthquake, including severe, mission-affecting casualties to main propulsion, propeller, and communications systems.

Coast Guard data show the 110-foot PBs did not meet the 86 percent OpPOTF target in any year during fiscal years 2005 through 2011, as shown in figure 4. While remaining below target levels, Coast Guard data show the 110-foot PBs generally improved from fiscal years 2006 through

fiscal year 2010, with the OpPOTF rising from approximately 47 percent to 63 percent.[14]

Figure 4: Condition of the 110-Foot Patrol Boats as Measured against the Coast Guard's OpPOTF Target, Fiscal Years 2005 through 2011



Source: GAO analysis of Coast Guard data.

Note: This analysis includes Coast Guard data covering 35 of the 41 PBs currently in the PB fleet. It does not include 6 PBs that the Coast Guard has deployed overseas in support of Operation Iraqi Freedom. Coast Guard maintenance officials reported that they could not directly attributed the rise to one event, but noted that contributing factors may include improved consistency in maintenance practices and the effects of vessel sustainment projects, both of which we discuss later in this report.

[14]Coast Guard maintenance officials attributed the respective variations in the OpPOTF of the legacy vessel fleet to two primary factors. First, officials reported that the HEC and MEC vessels were the oldest with respect to designated service life and thus in the poorest condition. Second, officials noted that the larger HECs and MECs have more numerous and complex operating systems vulnerable to casualty than do the 110-foot PBs.

Other Evidence Shows the Legacy Vessel Fleet's Condition Is Declining

Our review of vessel physical condition assessments, discussions with Coast Guard maintenance and operational personnel, and site visits to various Coast Guard field units further point to a Coast Guard legacy vessel fleet that is in overall poor condition and is generally declining. For example, Coast Guard vessel condition assessments provide details regarding the legacy fleet's deteriorating and obsolete systems and equipment. The Coast Guard conducts a variety of assessments and inspections of the legacy fleet's condition as part of its efforts to identify and address maintenance needs and guide vessel decommissioning decisions. According to these condition assessments, critical operating systems on the legacy vessels have been increasingly prone to mission-degrading casualties. For example, the Coast Guard's Surface Forces Logistics Center and Office of Naval Engineering have tracked the annual major mission degraders and cost drivers for each of the legacy vessel fleet classes.[15] Among the list of fiscal year 2011 top five mission degraders and cost drivers were main gas turbines for the 378-foot HECs and, as a mission degrader, the Reverse Osmosis Desalination Plant for the 210-foot and 270-foot MECs.[16] While the list of key mission degraders and cost drivers varies by vessel class, main diesel engines were listed as common top major mission degraders and cost drivers across the legacy fleet in fiscal years 2010 and 2011.

In addition, Coast Guard senior maintenance officials and vessel crew we interviewed at the five locations we visited where legacy vessels were homeported or undergoing maintenance noted the increased maintenance challenges facing the legacy vessels because of their age. In particular, the maintenance managers for both the HECs and MECs reported that with the vessels past or nearing the end of their estimated service lives, the performance of critical systems has become increasingly unpredictable, and refurbishments of systems that have had a relatively high rate of failure have brought limited returns on investments. For example, according to these program managers, in 2009 and 2010, the Coast Guard spent about $200,000 per vessel to rebuild several HEC main diesel engines. However, these officials said

[15]Coast Guard maintenance officials reported that these lists are prepared by the Surface Forces Logistics Center on a yearly basis and are summarized by the Office of Naval Engineering to (1) track vessel condition; (2) identify, prioritize, and address maintenance needs; and (3) guide planning and budgetary decisions.

[16]A Reverse Osmosis Desalination Plant converts seawater to freshwater. See appendix III for a list of fiscal year 2011 legacy vessel key mission degraders and cost drivers.

that some of these diesel engines broke down within a short period of time because other parts of the engines that were not included in the rebuild failed. These officials told us that investing in main diesel engine replacements—because the engines are outdated, are failing at high rates, and have obsolete parts—would be important to sustaining the aging HECs and MECs. However, the officials told us that main diesel engine replacements for the HECs and MECs may be too costly in the current fiscal environment given the need for the Coast Guard to balance legacy vessel maintenance needs with its ongoing acquisition of replacement vessels. Consequently, for the HECs and MECs, Coast Guard maintenance program managers reported that they expect the main diesel engines in these vessels will continue to fail at high rates until the cutters are replaced by the NSCs and OPCs, respectively.

Maintenance officials and vessel crew members we interviewed at the five locations we visited also reported that they have had to devote increasing amounts of time and resources to troubleshoot and resolve maintenance issues on the legacy vessels. In particular, these officials said that because the systems and parts are outdated compared with current technology and equipment, it can be challenging and time consuming to diagnose a maintenance issue and find parts or determine what corrective actions to take. According to maintenance program managers, some parts needed to maintain the legacy vessels are obsolete and, as a result, the Coast Guard has had to reengineer these parts or find a supplier who can manufacture the obsolete parts—efforts that can be time consuming and costly. For example, during our tour of the HEC *Midgett*, the vessel's engineering officer discussed challenges he had faced in diagnosing and replacing a failed small boat davit system component—which he attributed to the time Coast Guard engineers needed to troubleshoot, identify, and procure a replacement system from a vendor.[17]

The Coast Guard Has Taken Actions to Improve the Condition of the Legacy Vessel Fleet

The Coast Guard has implemented two key actions to improve the condition of the legacy vessel fleet: (1) reorganization of the maintenance command structure and (2) completion of the Mission Effectiveness Projects (MEP), a 10-year, almost half-billion-dollar set of sustainment projects to refurbish PBs and upgrade MECs.

[17]A davit is a mechanical system used for launching and recovering small boats.

Reorganization of the maintenance command structure. In 2009, the Coast Guard reorganized its maintenance command structure with a focus on standardization of practices. Previously, Coast Guard vessel maintenance was overseen by one of the Coast Guard's two area Maintenance and Logistics Commands, and management of a vessel was generally determined by whether its homeport location was in the Coast Guard's Atlantic or Pacific Area Command rather than by its class. Under this reorganization, the Coast Guard eliminated its two Maintenance and Logistics Commands and replaced them with a centralized command structure—the Surface Forces Logistics Center (SFLC)—whereby a single manager oversees the maintenance of an entire class of vessels.[18] For example, a single manager now oversees maintenance of all 27 MECs, whereas previously maintenance responsibility was decentralized amongst the area commands and the vessel operators. Coast Guard SFLC officials reported that this change was made to enable better oversight of the condition of entire classes of the vessel fleet, reduce the workload on vessel crews by providing centralized support for procurement of replacement parts, and implement centralized maintenance plans to address commonly occurring casualties.[19] A key part of this effort is a prioritization of preventive maintenance practices by completing scheduled maintenance in a timely manner and better identifying maintenance trends—which officials said could ultimately help the Coast Guard better predict maintenance and funding needs.[20]

[18]The Coast Guard established the SFLC under which Coast Guard vessels are grouped into five product lines whose mission support, maintenance procedures, priorities, and funds are overseen by a single product line manager. The product lines are the (1) Long Range Enforcer (which includes the HEC and NSC), (2) Medium Endurance Cutter; (3) Ice Breaker, Buoy Tender and Construction Tender; (4) Patrol Boat (which includes the PB and FRC); and (5) Small Boat.

[19]According to the Coast Guard, vessel crews themselves had previously been responsible for managing procurement of replacements for minor casualties. According to officials, doing so could be time consuming for crews. Under the reorganization, the SFLC manages a greater share of the procurement of replacement parts and systems to both reduce the workload of crews and provide better oversight across the vessel fleet. Additionally, the new organization is structured to provide a single point of accountability (the Product Line Manager) for all maintenance, system upgrades, and supply functions for an asset class.

[20]Although we interviewed Coast Guard officials, it was outside the scope of this review to assess the impact the reorganization has had to date on Coast Guard maintenance practices and costs.

Completion of MEPs. The Coast Guard is nearing completion of the MEPs for its MECs and PBs. Begun in fiscal year 2005 and scheduled for completion in fiscal year 2014, these sustainment projects are intended to improve the legacy vessels' operating and cost performance by replacing obsolete, unsupportable, or maintenance-intensive equipment that had been key sources of degraded performance. The project scope of sustainment work varies considerably for the PB and MEC classes, with the PBs being overhauled and the MECs having far more limited upgrades. For example, the Coast Guard is almost completely refurbishing those PBs included in the MEP, which includes 17 of the 41 PBs in the fleet. For the PBs going through the MEP, the Coast Guard is removing major portions of the interior and replacing them with new and upgraded equipment, such as overhauled main diesel engines, a new generator and electrical systems, and also identifying and correcting structural deterioration in the vessels' hulls. In contrast, for the MECs, the MEP includes the entire fleet of 270-foot and 210-foot MECs, and constitutes an upgrade of selected systems rather than the almost complete overhaul that the PBs received. For example, MEC work includes replacement of primary sources of degraded equipment, such as the main propulsion control and monitoring system, small boat davits, and air conditioning systems, but does not involve replacement of main diesel engines. As of July 2012, Coast Guard officials reported the Coast Guard was on schedule for the MEP and had completed work on all 14 210-foot MECs.[21] The Coast Guard estimates total costs for the MEC and PB projects to be $453.5 million.[22] Table 1 provides an overview of the MEPs' costs and completed work as of May 2012.

[21]The Coast Guard completed the MEP for the 210-foot MEC class in fiscal year 2010, expects to complete work on the final PB in July 2012, and plans to complete the remainder of the 270-foot MEC class by the end of fiscal year 2014.

[22]The Coast Guard reported that total MEP costs covering both the 270-foot and 210-foot MECs are projected to be $279.75 million and 110-foot PB costs are projected to be $163.5 million for a total cost of $443.25 million for the fiscal years 2005 through 2014 projects. These projections do not include the Coast Guard's fiscal year 2013 budget request for MEP, which was an additional $13 million to complete work on the 270-foot MECs.

Table 1: Costs and Implementation Schedule for the MEPs Conducted for MECs and PBs, as of May 2012

Vessel class	Work status	Actual or expected completion date	Average Cost per hull	Total expenditures	Total appropriations
210-foot MEC	14 of 14 completed	September 2010	$7.2 million	$101.27 million	$279.75 million[a]
270-foot MEC	6 of 13 completed[b]	August 2014	$14.1 million	$105.9 million	
PB	16 of 17 completed	July 2012	$8.4 million	$137.2 million	$163.5 million
Total	**37 of 44**				**$443.25 million**

Source: GAO analysis of Coast Guard data.

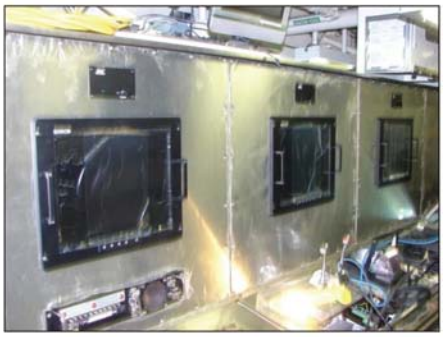
[a]As of May 2012, the Coast Guard had received a total of $279.75 million for completing MEP work on both 210-foot and 270-foot MECs. These funds were appropriated as a lump sum and not per MEC class. These projections do not include the Coast Guard's fiscal year budget request for MEP, which was an additional $13 million to complete work on the 270-foot MECs.

[b]This number includes only 270-foot MECs that have completed their entire 11-month availability for MEP, or—if done in phases—6 to 7-month availabilities.'

Figure 5 shows selected photographs of an MEC undergoing a MEP.

Figure 5: Mission Effectiveness Project Upgrades on Medium Endurance Cutters

Source: GAO.



Source: Photographs courtesy of US Coast Guard.

Note: The top photograph is of an MEC undergoing an upgrade at the Coast Guard Yard. The bottom left photograph shows an old propulsion control console from an MEC and the photograph on the bottom right shows the propulsion control console installed on a 270-foot MEC during an upgrade.

Depot-Level Maintenance Expenditures for the Legacy Vessel Fleet Have Recently Increased, and the Coast Guard's Process for Estimating Related Costs Does Not Fully Reflect Best Practices

The Coast Guard's expenditures to maintain its legacy vessels declined from fiscal year 2005 to fiscal year 2007, and then rose from fiscal year 2007 to fiscal year 2011. The Coast Guard's process for estimating related legacy vessel maintenance costs does not fully reflect relevant best practices, which state that cost estimates should be comprehensive, well documented, and accurate.

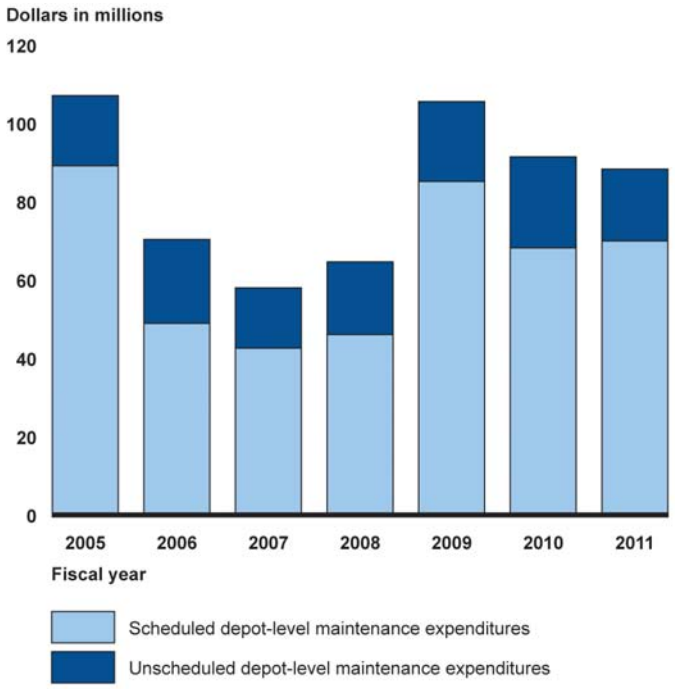
Depot-Level Expenditures to Maintain the Legacy Vessels Rose from Fiscal Years 2007 to 2011

Expenditures for the two key types of legacy vessel annual depot level maintenance—scheduled and unscheduled maintenance—declined from fiscal year 2005 to fiscal year 2007, and then rose from fiscal year 2007 to 2011.[23] While scheduled maintenance activities are planned and are based on the historical maintenance needs of the vessel class, unscheduled maintenance activities are performed in response to mission-limiting equipment or system casualties (i.e., failures). Figure 6 shows how the scheduled and unscheduled maintenance expenditures changed across the four legacy vessel classes from fiscal years 2005 through 2011. See appendix III for more specific maintenance expenditure information for the HECs, MECs, and PBs.[24]

[23]Depot-level maintenance is vessel maintenance that is beyond the capability of the operating units. This report analyzes depot-level maintenance funds spent through the Naval Engineering Allotment Fund Control Code, which represents 85 to 95 percent of all legacy vessel maintenance expenditures from fiscal years 2005 through 2011.

[24]In fiscal year 2010, the Coast Guard developed a new metric called Maintenance Cost per Operational Hour. According to senior Coast Guard maintenance officials, this metric will enable the Coast Guard to make a long-range comparison of vessel costs and may be used for budgeting decisions once the Coast Guard has acquired 4 years-worth of data.

Figure 6: Scheduled and Unscheduled Depot-Level Maintenance Expenditures for the Legacy Vessel Fleet from Fiscal Years 2005 through 2011



Source: GAO analysis of Coast Guard data.

Note: Scheduled and unscheduled depot level maintenance expenditure data have been adjusted for inflation and are stated in fiscal year 2012 dollars.

Coast Guard data show that scheduled annual maintenance expenditures generally rose across all legacy vessel classes from fiscal years 2007 to 2011. For example, scheduled maintenance expenditures rose from $46.1 million in fiscal year 2008 to $85.2 million in fiscal year 2009—an increase of 85 percent—and then dropped to approximately $69 million in both fiscal years 2010 and 2011. Senior Coast Guard vessel maintenance officials attributed the rise in scheduled maintenance expenditures to two primary factors. First, the SFLC implemented new maintenance practices since its establishment in fiscal year 2009, which officials report have allowed the Coast Guard to better identify maintenance needs for the vessel fleet, as well as place a higher priority on completing 100 percent of scheduled maintenance each year. Second, the Coast Guard received supplementary funding to support rising maintenance costs. For example,

in fiscal years 2010 and 2011, the Coast Guard dedicated $93.85 million of supplemental funding from Congress to the maintenance of legacy vessels.[25] The officials noted that this funding has been critical in enabling the Coast Guard to better address maintenance items that would otherwise have to be deferred.[26] For example, in fiscal year 2009 deferred maintenance for the legacy vessels was $68.5 million, which then declined to $39.2 million in fiscal year 2011.

While unscheduled maintenance expenditures varied by vessel class from fiscal years 2005 through 2011, Coast Guard data show that the HEC fleet incurred the greatest share of unscheduled maintenance expenditures. Of the four legacy vessel classes, the Coast Guard consistently spent more on unscheduled maintenance for the HECs than for any of the other three legacy vessel classes. For example, in fiscal year 2011, the Coast Guard spent $8.5 million of the $18.4 million unscheduled maintenance funds (or 46 percent) on the HECs. In comparison, in fiscal year 2011, the Coast Guard spent $4.0 million for the 270-foot MECs, $4.6 million for the 210-foot MECs, and $1.3 million for the 110-foot PBs. Further, unscheduled maintenance consistently represented a greater portion of total maintenance expenditures for the HECs than for any of the other legacy vessel classes. For example, in fiscal year 2011, unscheduled maintenance represented 41 percent of total maintenance expenditures for the HECs. In comparison, in fiscal year 2011, unscheduled maintenance expenditures represented 20 percent of total maintenance expenditures for the 270-foot MECs, 24 percent for the 210-foot MECs, and 5 percent for the PBs. Coast Guard officials reported that the comparatively high unscheduled maintenance expenditures for the HECs were generally due to the HECs being the

[25]In fiscal year 2010, the Coast Guard was appropriated $10 million of supplemental funding for maintenance of the HECs and dedicated $19.75 million of additional supplemental funding, available through fiscal year 2012, to the legacy vessel fleet. See Pub. L. No. 111-32, 123 Stat. 1859, 1881 (2009); Pub. L. No. 111-212, 124 Stat. 2302, 2315 (2010). The Coast Guard also reported receiving $25.2 million in fiscal year 2010 and $38.9 million in fiscal year 2011 of Overseas Contingency Operations funding for maintenance of HECs and PBs, and the occasional 270-foot MECs assigned to the Department of Defense's Africa Command.

[26]Deferred maintenance is the amount of scheduled maintenance on a vessel that must be postponed in order to pay for unscheduled maintenance. Such deferrals can occur when the Coast Guard does not have enough money to absorb unexpected maintenance expenditures and still perform all of its scheduled maintenance, thus creating a backlog.

oldest and largest legacy vessels in the fleet, and thus having the greatest number of systems prone to failure.[27]

Budgeted depot level maintenance funds. From fiscal years 2005 through 2011, annual depot-level maintenance expenditures often exceeded the Coast Guard's budgeted funds for depot-level maintenance—known as Standard Support Levels—for the legacy vessels. The Standard Support Levels have generally remained unchanged over decades and do not reflect the rising costs to maintain the legacy vessels as they have aged.[28] According to Coast Guard data, annual depot-level maintenance expenditures exceeded Standard Support Levels for all legacy vessel classes in fiscal year 2005, and from fiscal years 2009 through 2011. Furthermore, in the case of the HECs and PBs, actual depot-level maintenance expenditures far exceeded Standard Support Levels each year from fiscal years 2005 through 2011. For example, actual depot-level maintenance expenditures for the HECs were 3.6 times higher than Standard Support Levels in fiscal years 2009—$55.5 million compared with $15.5 million. Senior Coast Guard vessel maintenance officials cited this funding gap as a management challenge, noting that supplemental funding had been critical to enable the Coast Guard to fund necessary maintenance for the legacy vessel fleet. Appendix III includes a further comparison of depot-level maintenance expenditures with Standard Support Levels for each legacy vessel class, which shows the widespread discrepancy between the Standard Support Levels and the actual expenditures for the HECs and PBs in particular.

[27]Coast Guard officials told us that major casualties on three HECs—the *Chase, Dallas* and *Gallatin*—contributed disproportionately to these expenditures in fiscal years 2010 and 2011. The Coast Guard has since decommissioned the *Chase* and *Dallas*.

[28]According to the Coast Guard, Standard Support Levels are established when a vessel class enters service or undergoes a service life extension program. For example, the Coast Guard reset the Standard Support Level for the HECs after conducting a service life extension program between 1987 and 1992—the Fleet Renovation and Modernization Program—but has not reset the Standard Support Levels for the MECs or PBs. The Coast Guard indicated that it increases Standard Support Levels using non-pay inflation, but it has not done so every year. Standard Support Level data in this report have been adjusted for inflation and are stated in fiscal year 2012 dollars.

The Coast Guard's Process for Estimating Annual Legacy Vessel Maintenance Costs Does Not Fully Reflect Best Practices

The Coast Guard's Process for Estimating Legacy Vessel Maintenance Costs

Cost estimates are a vital factor for sound management decision making and they aid in the formation of a project's budget. The Coast Guard uses cost estimates, in part, to justify Operations and Expenses budget requests and determine whether vessel maintenance projects can proceed. Coast Guard vessel maintenance officials told us that they estimate vessel maintenance costs following a set process, as summarized below.

Scheduled maintenance. The Coast Guard uses maintenance plans for each cutter class to document (1) scheduled maintenance items, (2) who should perform them, and (3) the frequency at which they should be performed.[29] The Coast Guard also uses these maintenance plans to develop a vessel-specific list of maintenance items to be accomplished during a designated period.[30] The Coast Guard imports the maintenance items from this vessel-specific list into the Fleet Logistics System database, which assigns rough cost estimates to each maintenance item.[31] Project managers are then to review the rough cost estimate for each maintenance item and adjust these estimates, if necessary, using project-specific knowledge. Once the Coast Guard is ready to move a scheduled maintenance item into the acquisition phase, a naval engineer is to construct a detailed cost estimate.[32]

Unscheduled maintenance. The Coast Guard cannot assign cost estimates specific to unscheduled maintenance items within the Fleet Logistics System because it cannot know which maintenance items will

[29]These plans are called Class Maintenance Plans.

[30]These vessel-specific lists are called Naval Engineering Project Lists.

[31]These rough cost estimates are derived from historical costs documented in Contract Workbook, a database that tracks costs for each ongoing or completed maintenance contract.

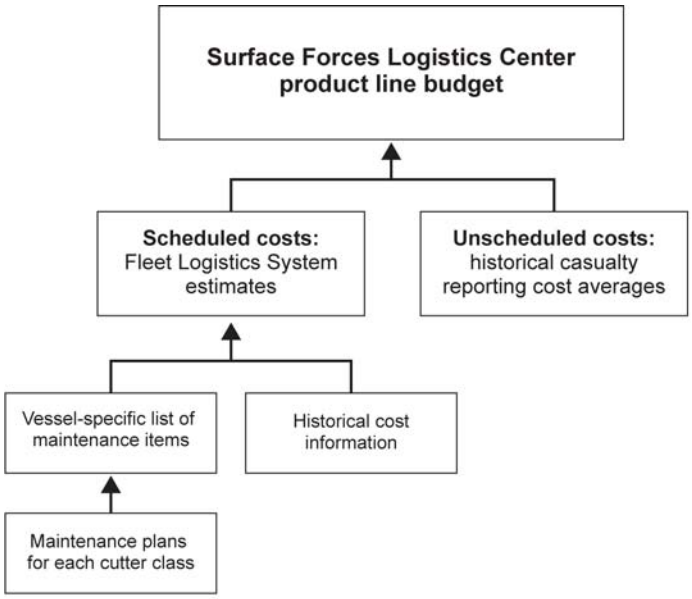
[32]These detailed cost estimates are referred to as Independent Government Estimates.

occur in a given year. Consequently, Coast Guard maintenance officials plan for unscheduled maintenance needs using funds budgeted for casualty repairs by the relevant SFLC product line. The amount of funding is based on historical costs for casualty repairs and is equal to approximately 20 percent of each product line's total budget. Once the Coast Guard is ready to perform unscheduled maintenance, it develops a more specific cost estimate. For unscheduled maintenance that is expected to cost more than $150,000, naval engineers are to construct a detailed cost estimate. For unscheduled maintenance under this threshold, naval engineers are to ensure that the estimated costs are reasonable.[33]

The cost estimates from the Fleet Logistics System for scheduled maintenance and the historical costs of casualty repairs for unscheduled maintenance comprise estimated legacy vessel maintenance costs for each product line. SFLC product line managers are to use this estimate—along with estimates of overhead, electronics, and reimbursable costs related to vessel maintenance—to produce a budget request for each product line. Figure 7 provides a graphical summary of this process.

[33]Naval engineers ensure the cost estimates are reasonable by completing what is referred to as a market research form. The Coast Guard uses a market research form to document market research in a manner appropriate to the size, complexity, and urgency of an acquisition. It can include information such as research techniques and information sources, relevant products and companies, a description of the commercial marketplace, prevalent business practices, and pricing and market issues.

Figure 7: The Coast Guard's Process for Estimating Annual Legacy Vessel Maintenance Costs, by Product Line



Source: GAO analysis of Coast Guard information.

The Coast Guard's Cost Estimating Process Does Not Fully Reflect Best Practices

The Coast Guard's process for estimating annual legacy vessel maintenance costs reflects some features of best practices, but it does not fully reflect best practices. The ability to generate reliable cost estimates is a critical function that is necessary to support OMB's capital programming process. GAO's *Cost Estimating and Assessment Guide* states that a high-quality and reliable cost estimate includes best practice characteristics—it should be (1) well documented, (2) comprehensive, and (3) accurate.[34] Following these best practices is a key step in successfully managing a project within cost and affordability guidelines. Moreover, GAO's cost guide establishes 10 steps that, if followed, should result in high-quality cost estimates.[35] As shown in table 2, the Coast

[34]GAO-09-3SP. Since the cost estimate is for the maintenance of Coast Guard legacy vessels rather than an acquisition type cost estimate, we have determined that the fourth best practice characteristic identified in GAO's *Cost Estimating and Assessment Guide*—"credible"— is not appropriate for this assessment.

[35]Since we determined that the fourth best practice characteristic—"credible"—is not appropriate for this assessment, we did not assess two steps related to the "credible" characteristic as identified in GAO's *Cost Estimating and Assessment Guide*.

Guard's process for estimating the annual costs for maintaining its legacy vessel fleet partially meets the three characteristics for producing a high-quality, reliable cost estimate as established by best practices. Appendix IV shows the relationship between these best practice characteristics and each step of a high-quality cost estimate, and also provides more details on the extent to which the Coast Guard's cost estimating process meets the three best practices characteristics.

Table 2: GAO Assessment of the Extent to Which the Coast Guard's Annual Legacy Vessel Fleet Maintenance Cost Estimating Process Reflects Best Practices

Best practice	Best practice description	Assessment
Comprehensive	Cost estimates should include government and contractor costs over the program's full life cycle, from program inception through design, development, deployment, and operation and maintenance to retirement. They should provide an appropriate level of detail to ensure that cost elements are not omitted or double counted and document all cost-influencing ground rules and assumptions.	Partially met
Well documented	Cost estimates should have clearly defined purposes and be supported by documented descriptions of key program or system characteristics. The estimates should capture in writing such things as the source data used and their significance, the calculations performed and their results, and the rationale for choosing a particular estimating method. Moreover, this information should be captured in such a way that the data used to derive the estimate can be traced back to, and verified against, their sources. The cost estimate should be reviewed and accepted by management.	Partially met
Accurate	Cost estimates should provide for results that are unbiased and not overly conservative or optimistic. The estimates should be updated regularly to reflect material changes in the program, and steps should be taken to minimize mathematical mistakes and their significance. The estimate should be grounded in a historical record of cost estimating and actual experiences on comparable programs.	Partially met

Source: GAO analysis of U.S. Coast Guard information.

Note: "Not met": The Coast Guard provided no evidence that satisfies any portion of the criterion.

"Minimally met": The Coast Guard provided evidence that satisfies a small portion of the criterion.

"Partially met": The Coast Guard provided evidence that satisfies about half of the criterion.

"Substantially met": The Coast Guard provided evidence that satisfies a large portion of the criterion.

"Met": The Coast Guard provided evidence that completely satisfies the criterion.

Our assessment showed that the Coast Guard's legacy vessel maintenance cost estimating process partially met the three characteristics, as follows:

Partially comprehensive. The Coast Guard's process for estimating costs is partially comprehensive because it defines the program, reflects the current schedule, is technically reasonable, is product-oriented, is traceable to the statement of work and objectives, and contains an appropriate level of detail to ensure that cost elements are not omitted or

double-counted. However, the process is not fully comprehensive because it does not document all cost-influencing ground rules and assumptions, such as the inflation rate used in the cost estimate.[36] Unless ground rules and assumptions are clearly defined, the cost estimate will not have a basis to identify and mitigate areas of potential risk. Further, the Coast Guard did not provide documentation showing a link between the work breakdown structure and costs.[37] Doing so would allow the program to track costs by defined deliverables, which in turn allows a program manager to more precisely identify which components are causing cost overruns and to more effectively mitigate the root cause of the overruns.

Partially well documented. The Coast Guard's process for estimating costs is partially well documented because it discusses the technical baseline description and the data in the baseline are consistent with the estimate. However, the process is not fully well documented because the Coast Guard did not provide documentation that discusses how the data were normalized or the reliability of the cost estimate data.[38] Further, the Coast Guard did not provide documentation that (1) verifies the validity of the estimating approach or the link between the primary cost-estimating data sources and actual cost estimate, or (2) describes step by step how the cost estimate was constructed. For example, although the Coast Guard has guidance that outlines how to implement the maintenance process, develop budgets, and allocate resources within the SFLC, Coast Guard officials told us that similar guidance does not exist for how to construct cost estimates. Specifically, Coast Guard officials told us that cost estimation processes for unscheduled maintenance items are undocumented. Without developing a well-documented cost estimate,

[36]Ground rules are a set of estimating standards that provide guidance and minimize conflicts in definitions. Assumptions are judgments about past, present, or future conditions that may affect the estimate.

[37]A work breakdown structure shows the requirements and what must be accomplished to develop a program and provides the basis for identifying resources and tasks for developing a program cost estimate. It provides a basic framework for estimating costs, developing schedules, identifying resources, determining where risks may occur, and providing the means for measuring program status.

[38]The purpose of data normalization is to make a given data set consistent with and comparable to other data used in the estimate. Since data can be gathered from a variety of sources, they are often in different forms and need to be adjusted before being used for comparison analysis or as a basis for projecting future costs.

management and oversight organizations do not have reasonable assurance that the cost estimate is reliable, supporting data will not be available for creating a historical database, questions about the approach or data used to create the estimate cannot be answered, lessons learned and a history for tracking why costs changed cannot be recorded, and the scope of the analysis cannot be thoroughly defined. Further, unless the estimate is well documented, analysts unfamiliar with the program will not be able to replicate the estimate.

Partially accurate. The Coast Guard's process for estimating costs is partially accurate because it contains few, if any, minor mathematical mistakes and is regularly updated to reflect significant changes in the program so that it reflects the current status. However, the cost estimate is not considered fully accurate because although Coast Guard officials told us that the data they provided to us incorporated an inflation index of 3 percent for all years based on the consumer price index, they could not provide us with documentation explaining why the Coast Guard chose to use this inflation rate or how it was applied to the data. Applying inflation indexes is an important step in cost estimating because, in the development of an estimate, cost data must be expressed in the same terms. If a mistake is made or the inflation amount is not correct, cost overruns can result. Also, although the cost estimate is based on an average of historical, actual contractor bids for the maintenance project, the Coast Guard was unable to provide documentation that would allow us to assess the reliability of the historical data used, the accuracy of the calculations, the relationship of the data to the historical contractor bids, or the final estimates for all maintenance costs. While having access to historical data can provide the cost estimator with insights into actual costs on similar programs, the utility of the Coast Guard's historical cost estimate data is uncertain because of the limited documentation mentioned above.

According to GAO's 2009 *Cost Estimating and Assessment Guide*, endorsed by OMB and DHS, cost estimates are integral to determining and communicating a realistic view of likely cost outcomes that can be used to plan the work necessary to develop, produce, and support a program. [39] Senior Coast Guard officials responsible for legacy vessel maintenance acknowledged over the course of our review that, although

[39] GAO-09-3SP.

they thought that the Coast Guard had been following cost-estimating best practices, upon close examination, they realized that the Coast Guard had not fully incorporated these best practices into its cost-estimating process. Ensuring that its annual-depot level cost estimates for legacy vessel fleet maintenance incorporate established best practices would better position the Coast Guard to use its cost estimates to more effectively allocate available resources in the constrained federal budget environment.

Declining Condition of the Legacy Vessel Fleet Makes Operational Capacity Targets Increasingly Unachievable

The operational capacity of the Coast Guard's legacy vessel fleet declined from fiscal years 2006 through 2011. In particular, while performance varied across the legacy vessel classes, two key Coast Guard metrics—operational hours and lost cutter days—show that the legacy vessels did not meet their operational capacity targets and lost considerable planned operational time. Coast Guard headquarters officials reported that the declining operational capacity of its legacy vessel fleet—particularly the HECs and MECs—has been a prime contributor to the Coast Guard's declining ability to meet its mission needs. Coast Guard officials reported that delays in the delivery of replacement vessels will require the Coast Guard to continue to operate its legacy vessels beyond their remaining service lives and result in a widening capacity gap.

Legacy Vessel Fleet's Declining Condition Has Reduced Operational Capacity

The operational capacity of the Coast Guard's legacy vessel fleet declined from fiscal years 2006 through 2011, as shown by key Coast Guard performance data. While performance varied across the legacy vessel classes, two key Coast Guard metrics—operational hours and lost cutter days—show that legacy vessels did not meet their operational capacity targets and lost considerable planned operational time, which Coast Guard officials attributed to the legacy vessel fleet's degraded condition and increased maintenance needs. According to the Coast Guard, the reduced operational capacity of its legacy vessel fleet is a prime contributor to the Coast Guard's declining ability to fully meet its missions.

Operational Hours Have Generally Declined

Coast Guard data show that the operational capacity of the legacy vessel fleet overall, as measured by operational hours, has fluctuated over the last 7 fiscal years, with a general decline since 2005. For example, in fiscal year 2011, the legacy vessel fleet's cumulative target for operational hours was 222,740, yet the actual number of operational hours achieved was 180,202—about 23 percent less. Specifically, as shown in figure 8,

Coast Guard operational hour data show a decrease in the HECs' operational capacity in recent years with the HECs accounting for the largest decline in the legacy vessel fleet's operational capacity. In particular, the HEC fleet did not meet the Coast Guard's operational hour target in any year from fiscal year 2005 through 2011. HEC operational hours declined by about 32 percent, or over 12,170 hours, from fiscal year 2008 to 2011.[40] Moreover, the MEC fleet also generally did not meet its operational hour targets, with only the 270-foot MECs meeting their targets in fiscal year 2008 and the total operational hours of the 270-foot and 210-foot MEC classes combined declining nearly 21 percent (17,500 hours) from fiscal year 2007 to fiscal year 2011.[41] Over the last 5 fiscal years, 270-foot MECs accounted for the largest loss in MECs' operational hours, declining by 39 percent, or nearly 18,000 hours, since last meeting their operational hour target in fiscal year 2008. In comparison, while the 210-foot MECs did not meet the operational hours target in any year between fiscal years 2005 through 2011, the fleet's operational hours fluctuated, declining from fiscal years 2007 through 2009, before improving in fiscal years 2010 and 2011.[42] Finally, the 110-foot PB fleet did not meet operational hour targets in 5 of the last 7 fiscal years.[43] Coast Guard data show that since exceeding its target in fiscal year 2006, the PB fleet has faced an increasing capacity gap over the last 5 fiscal

[40]Coast Guard headquarters officials reported that two HEC hulls were decommissioned in fiscal year 2011 for a total reduction of 3,330 HEC operational hours in comparison with operational hours for the previous fiscal year.

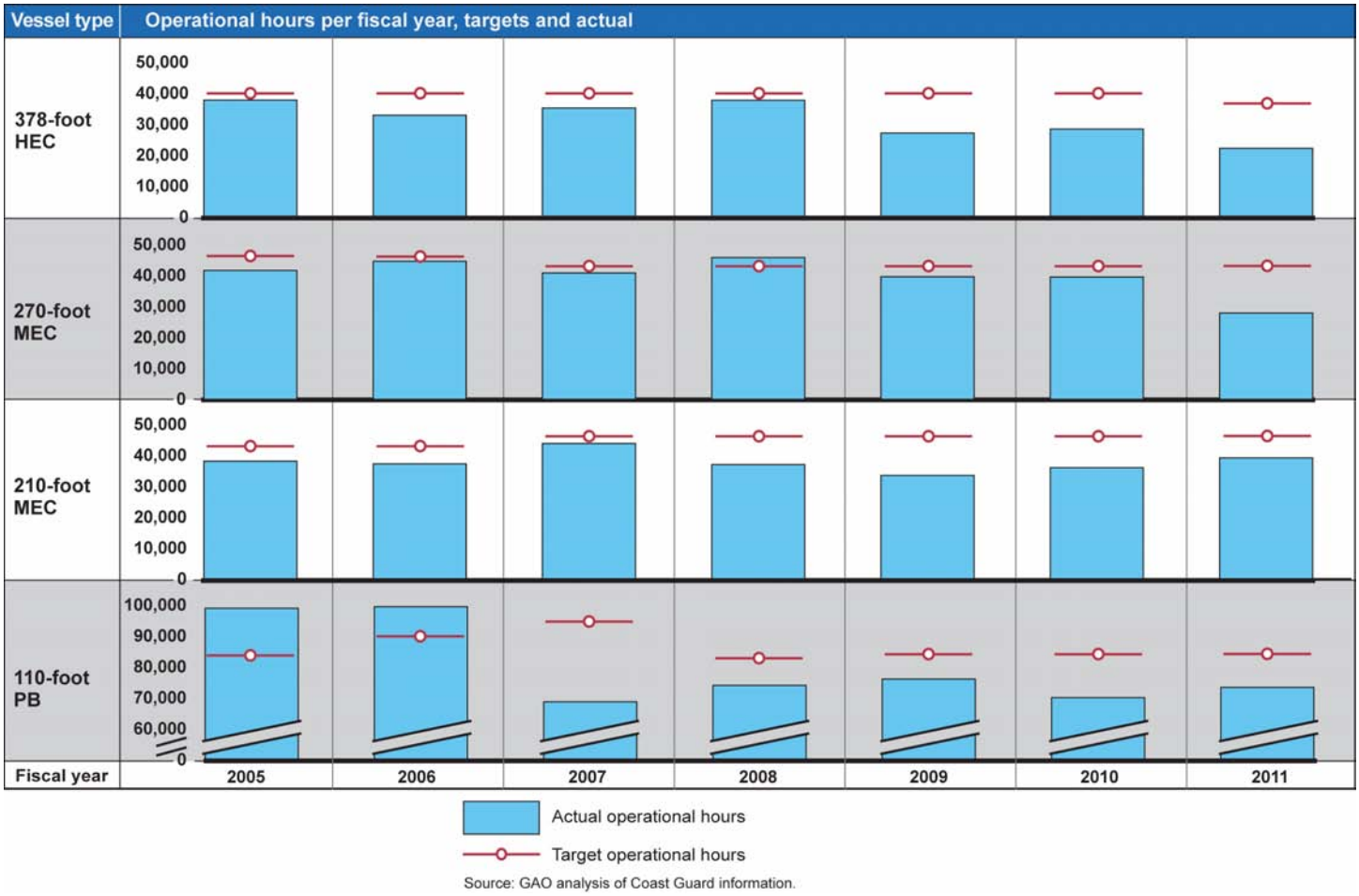
[41]Coast Guard officials attributed declines in MEC capacity primarily to increased unscheduled maintenance. However, they also reported that because MECs were taken out of service on a rotating basis to undergo MEP, doing so may have also decreased MEC operational hours by as much as 9,900 hours annually. The 210-foot MECs underwent the MEP from fiscal years 2008 through 2010 and 270-foot MECs began the MEP from fiscal year 2005 and are scheduled to run through fiscal year 2014.

[42]Coast Guard maintenance officials attributed the improved 210-foot MEC operational hour performance to completion of the MEP for that class in 2010. However, they also said that completion of the MEP does not guarantee improved capacity long-term because the MEP replaced only select systems and many aging parts and systems were not included. For example, the officials cited the case of the MEC *Northland*, which completed its MEP in March 2011, yet suffered two consecutive major casualties in 2011 that resulted in a loss of 396 operational hours.

[43]Our analysis of PB operational hour data included both 123-foot and 110-foot PBs. Coast Guard officials reported that, prior to decommissioning the 123-foot PBs in fiscal year 2007, both vessel classes were categorized within the Coast Guard's PB fleet for the purposes of setting operational hour targets and data analysis.

years—losing an average of 13,856 operational hours each year across the fleet, or about 16 percent below PB targets.[44]

Figure 8: Summary of the Legacy Vessels' Operational Hour Performance Compared with Targets, Fiscal Years 2005 through 2011



Source: GAO analysis of Coast Guard information.

Lost Cutter Days Are Generally Rising

Coast Guard data also show that the legacy vessel fleet lost a considerable number of planned operational days because of unscheduled maintenance. For example, for the HECs and MECs, the

[44]Coast Guard officials attributed this decline in PB capacity to an overall increase in the maintenance needs of PBs given their age and deteriorating hull conditions.

Coast Guard tracks lost cutter days, which are the number of planned operational days that a vessel was unavailable to conduct operations, typically because of maintenance.[45] Coast Guard officials said that lost cutter days are a primary indicator of operational readiness. Specifically, Coast Guard data show the HECs and MECs collectively averaged 772 lost cutter days per year from fiscal years 2006 through 2011.[46]

As shown in figure 9, HECs accounted for the largest share of lost cutter days, averaging 465 lost cutter days each year from fiscal years 2006 through 2011.[47] Further, the number of lost cutter days for the HEC fleet rose rapidly beginning in fiscal year 2008, peaking at 654 lost cutter days in fiscal year 2010. Moreover, for each of the last 3 fiscal years, the number of lost HEC cutter days has been nearly equivalent to three HECs being out of service each year.[48]

In addition, MEC lost cutter days more than doubled from fiscal year 2006 to fiscal year 2010, peaking at 276 lost cutter days for both 210-foot and 270-foot MECs combined. Coast Guard officials attributed the peak in MEC lost cutter days to their deployment to Haiti for humanitarian operations. Coast Guard officials said that, because of their age, all 10 MECs deployed to Haiti suffered severe, mission-affecting casualties, which limited their capacity to conduct the mission. According to the maintenance manager for the MEC fleet, the Haitian earthquake deployment was a wakeup call for the Coast Guard because it demonstrated that the Coast Guard's legacy vessel fleet had been operating with a false sense of readiness because, prior to that incident, the legacy fleet had not been recently challenged to surge assets.

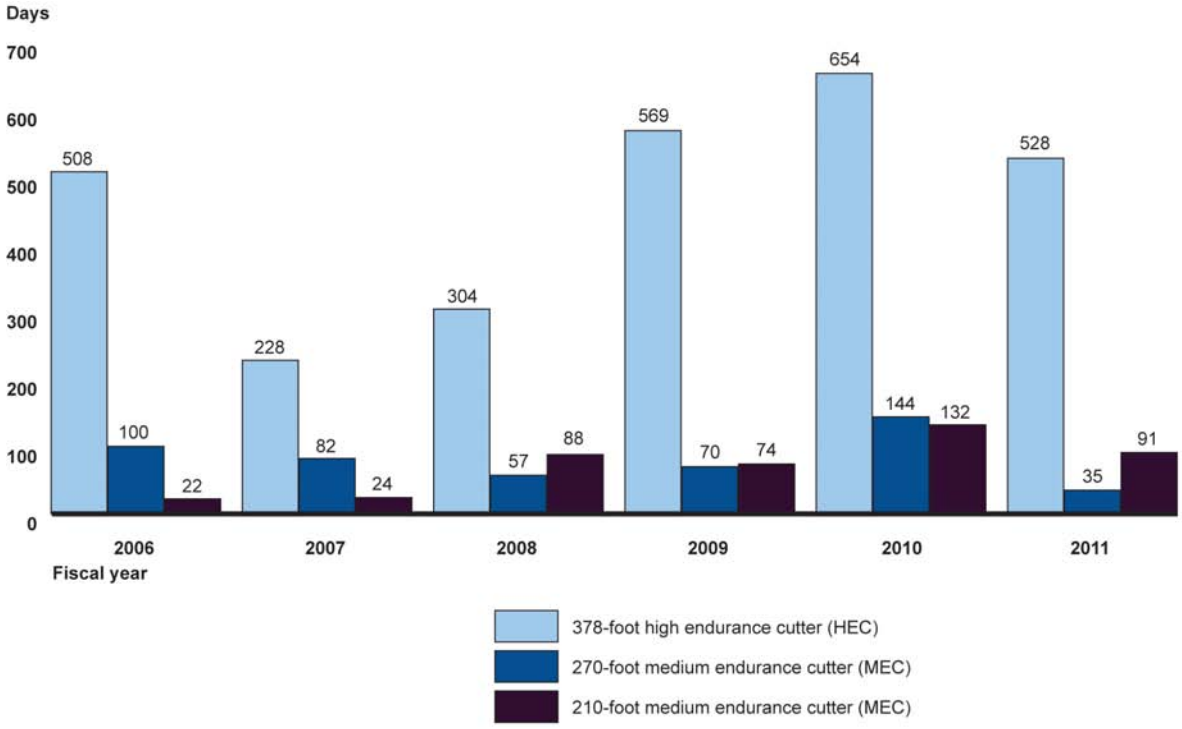
[45]The Coast Guard tracks lost cutter days for HECs and MECs because they are deployed for up to 3 months at a time. The Coast Guard measures PBs' performance in hours since they are deployed for no more than 5 days at a time.

[46]The Coast Guard did not have MEC lost cutter day data available for fiscal year 2005.

[47]According to Coast Guard guidance, HECs and MECs are expected to operate 185 days away from home port each year to conduct missions, which equals 3,330 operational hours. See Commandant Instruction 3100.5B (June 29, 2007).

[48]Coast Guard officials attributed the majority of HEC lost cutter days to propulsion system casualties. For example, the Coast Guard reported that catastrophic engine failure rendered the HECs *Dallas*, *Chase,* and *Gallatin* inoperative for 1 year, 1 year and 5 months, and 2 years, respectively, during this time period. The Coast Guard decommissioned the *Chase* on May 13, 2011, and the *Dallas* on March 30, 2012.

Figure 9: Lost Cutter Days for Legacy High and Medium Endurance Cutters, Fiscal Years 2006 through 2011



Source: GAO analysis of Coast Guard data.

Reduced Operational Capacity Hinders Mission Performance

Coast Guard headquarters officials reported that the declining operational capacity of its legacy vessel fleet—particularly the HECs and MECs—has been a prime contributor to the Coast Guard's declining ability to meet its mission needs and to intercept threats beyond U.S. territorial waters. Specifically, Coast Guard headquarters officials reported that the HEC fleet has become increasingly unreliable and has degraded the Coast Guard's capacity to conduct missions, particularly drug interdiction missions.[49] For example, according to Coast Guard headquarters officials, the number of hours the HEC fleet spent on drug interdiction missions declined 65 percent, or nearly 13,000 hours, from fiscal year 2007 to fiscal year 2010 largely as a result of increased unscheduled

[49]Coast Guard headquarters officials reported that the total amount of drugs interdicted depends on various factors, such as estimated drug flow rate and vessel operational hours and availability. The decline in cocaine interdicted by HECs was parallel to the decline in counter-drug mission hours completed from fiscal years 2007 through 2010.

maintenance. Coast Guard headquarters officials also noted that the decreased operational capacity of the HEC has decreased HEC availability to conduct missions in Alaska. Coast Guard headquarters officials noted that the HECs and their replacement NSCs are the only vessels in its fleet capable of safely launching and recovering small boats and aircraft in the Bering Sea. As a result, lost HEC operational capacity has led the Coast Guard to reassign HECs, as well as three MECs, from missions in other geographic areas to provide additional coverage to missions in Alaska.

Coast Guard headquarters officials stated that the decline in MEC operational hours has most significantly affected the Coast Guard's ability to conduct its alien interdiction mission because the MEC fleet is the primary platform for carrying out this mission. For example, Coast Guard data show the MECs' operational hours in the alien interdiction mission declined 40 percent, or 12,000 hours, from fiscal years 2007 to 2011. Further, Coast Guard headquarters officials reported that the number of migrants interdicted by the MEC fleet declined from 2,200 to 1,200 during this period and noted that increased unscheduled maintenance had been a key contributing factor.

The Operational Capacity Gap is Expected to Widen

Coast Guard officials reported that delays in the delivery of replacement vessels will require the Coast Guard to continue to operate its legacy vessels beyond their remaining service lives and result in a widening capacity gap.[50] The officials added that as the legacy vessels operate further past their service lives, they expect these vessels to become increasingly unreliable, have increasingly diminished operational capacity, and be increasingly costly and challenging to maintain. Coast Guard acquisition documents, assessments, and maintenance managers have noted that past sustainment efforts have shown little correlation between large maintenance expenditures and extended improvements in operational capacity or reduction in maintenance costs. Nonetheless, Coast Guard officials said that the significant delays in delivering some replacement vessels, and the declining condition and capacity of its legacy vessel fleet, warrant further action to ensure the legacy vessels

[50]The *Naval Engineering Manual* defines "remaining service life" as the time period during which no major expenditures will be required for hull and structural repairs or modernizations, or for machinery or system modernizations based solely on the vessel's capability to meet existing mission requirements.

remain operational until their decommissioning so that the Coast Guard can better achieve its missions. Coast Guard officials reported that they are determining potential future actions, including additional refurbishment of MEC vessels, which we discuss later in this report. The Coast Guard reported, and our analysis of Coast Guard documents confirms, that the MEC fleet will be most affected by delays in delivery of replacement vessels. In particular, according to current plans, some of the 270-foot MECs are to remain in service as late as 2033—up to 21 years beyond their expected service lives—before they are replaced by OPCs.

Near Term Increase in Capacity Gap Expected for the HEC and PB Fleets

In the next few years, the operational capacity gap that exists for the HEC and PB fleets is expected to increase because of actions the Coast Guard plans to take to reduce legacy fleet expenditures in an effort to better balance the needs of the legacy fleet with the acquisition of replacement vessels. For example, to reduce legacy fleet maintenance expenditures, the Coast Guard plans to decommission the next two most degraded and costly HECs in fiscal year 2013 and anticipates that this will allow it to save about $17 million.[51] A senior maintenance official reported that decommissioning these HECs may also reduce maintenance expenditures in the long term. Coast Guard officials acknowledged that this accelerated HEC decommissioning will result in operational capacity gaps in the near term, but noted that the delivery of the fourth NSC in fiscal year 2014 and the fifth NSC in fiscal 2016 would mitigate these gaps.

In addition to accelerating the pace of the decommissioning of some HECs, the Coast Guard also did not request funds for its “High Tempo/High Maintenance” (HTHM) program for fiscal year 2013 to save $33.5 million. HTHM was designed to mitigate the loss of 8 PBs to hull

[51]By decommissioning 2 HECs in fiscal year 2013, the Coast Guard will have decommissioned a total of 5 of 12 HECs before their replacements have fully entered into service.

failure and 6 to deployment to Bahrain (14 PBs total)[52] by doubling the operational hour output of 8 PBs through the use of double crews and increased maintenance over the last 5 fiscal years. Coast Guard officials reported that all 8 HTHM PBs will return to their pre-HTHM operational tempo on HTHM's termination at the end of fiscal year 2012. Coast Guard officials stated that termination of the HTHM program is to coincide with the commissioning of seven FRCs, thus mitigating any lost PB capacity. However, our analysis shows that without HTHM, a capacity gap equivalent to the operational hours of 10 PBs will remain even after the seventh FRC is commissioned, which is projected to occur at the end of fiscal year 2013. This is because after the commissioning of the seventh FRC, the capacity gap would decrease equivalent to the operational hours of 7 PBs—but because the Coast Guard also plans to decommission 3 PBs in fiscal year 2013, the capacity gap would grow to be equivalent to the operational hours of 10 PBs.

Longer-Term Capacity Gap Expected for the MEC Fleet

While the delivery of replacement vessels is ongoing to help mitigate the operational capacity gap that exists for the legacy HEC and PB fleets, the significant delay in the delivery of the OPC will result in a longer-term operational capacity gap for the legacy MEC fleet. According to Coast Guard documents, the combined MEC fleet, with 27 vessels, is the largest class of major cutters in terms of numbers of vessels and—because of its size and versatility—is relied upon to conduct a wide variety of missions far from shore. Coast Guard officials stated that the role of the MEC fleet has become even more important in recent years given the declining condition of the HEC fleet. In particular, Coast Guard officials report increasingly using MECs to recover lost HEC capacity. For example, the officials reported shifting MEC operational hours from alien/migrant interdiction missions to drug interdiction missions. According to these Coast Guard officials, a loss of MEC capability puts performance goals at risk. Specifically, the Coast Guard officials reported that the continued decline of legacy fleet operational hours would, among other things, likely result in more cocaine and illegal migrants reaching U.S.

[52]As we reported in June, 2008, the Coast Guard decommissioned all eight 123-foot PBs in fiscal year 2007 due to structural failure of their hulls as a result of their conversion from 110-foot to 123-foot PBs. In addition, beginning in March 2003, six 110-foot patrol boats have contributed to the joint U.S. Navy and Coast Guard National Fleet Policy and the Coast Guard's general defense mission by operating in the Persian Gulf. See GAO, *Coast Guard: Strategies for Mitigating the Loss of Patrol Boats Are Achieving Results in the Near Term, but They Come at a Cost and Longer Term Sustainability Is Unknown*, GAO-08-660 (Washington, D.C.: June 23, 2008).

shores and a decreased capability to protect U.S. waters and fish stocks from the encroachment of foreign fishing vessels.

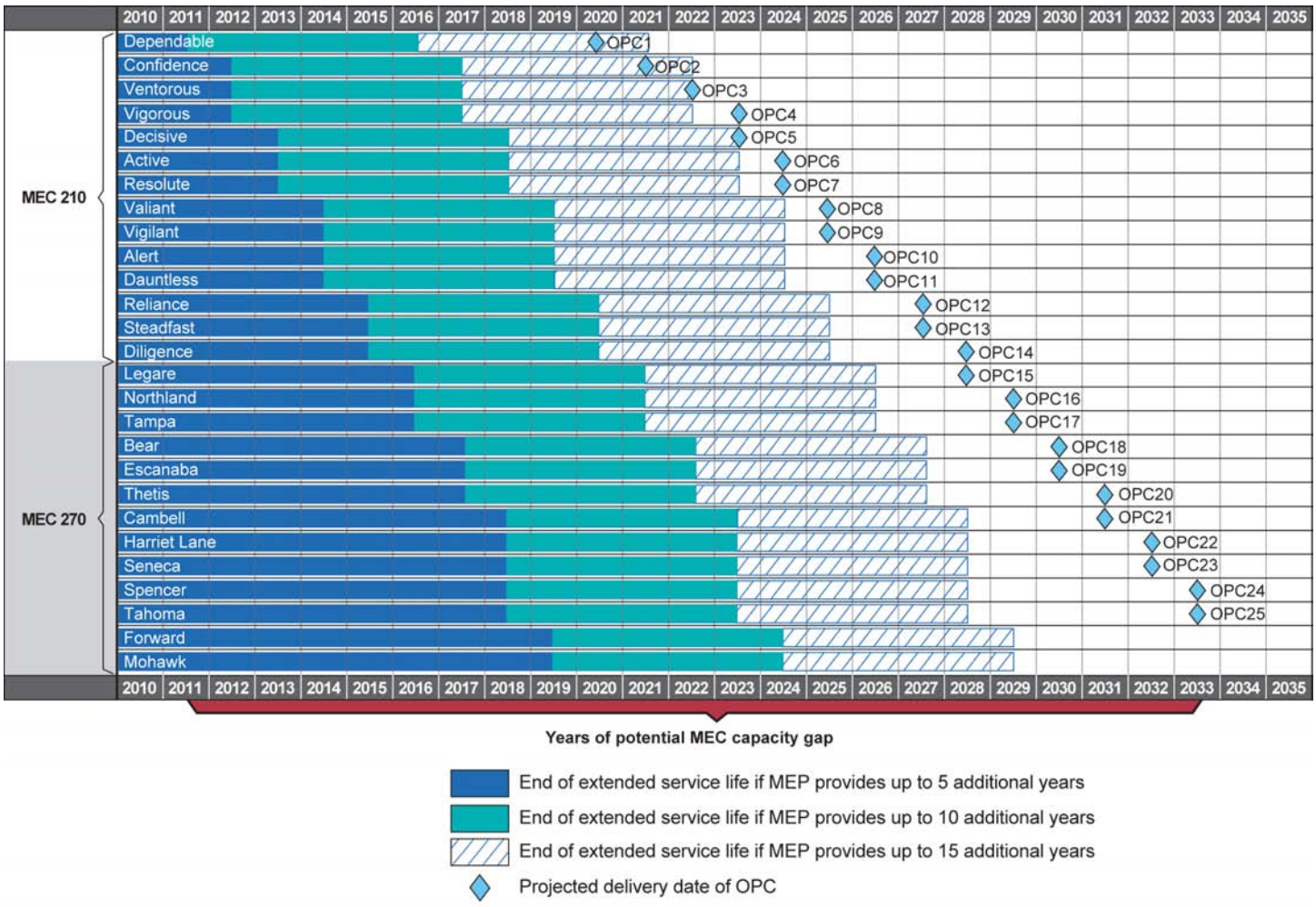
The Coast Guard also reported that the MECs' engineering systems are becoming increasingly obsolete, expensive, and difficult to maintain, which will continue to challenge mission performance. For example, according to a Coast Guard senior commander, because of expectations of diminished capacity of the MEC fleet, the Coast Guard—which relies heavily on the MEC for conducting missions—will need to make difficult choices regarding mission prioritization.

Figure 10 shows that the MECs are rapidly approaching or already have passed the end of their expected service lives and, because of delays in the delivery of the replacement OPCs, the capacity gap will continue to grow. As previously discussed, the Coast Guard is refurbishing every MEC through a MEP with a goal to increase the MECs' reliability and reduce longer-term maintenance costs. Senior Coast Guard officials responsible for the project reported that the MEP may also provide up to 15 years of additional service life to the MEC fleet. Third-party assessments show that the MEP has improved the performance of MECs that have completed the project;[53] however, the Coast Guard acknowledges that the MEP will not entirely bridge the gap between the estimated end of MEC service life and the projected OPC deliveries. Since fiscal year 2007, the expected delivery dates for the OPCs have slipped by 13 years and are now well outside the MEC class's designed service life or any ancillary service life gains that might be achieved by the MEP. Specifically, as a result of OPC delays, some of the 270-foot MECs are now to remain in operation until 2033, up to 21 years beyond their remaining service lives. Even if the most optimistic projections were to be true and the MEP were to extend MECs' service lives by 15 years, the MECs would remain in service increasingly beyond the end of their service lives before full recapitalization by the OPC fleet. The largest MEC capacity gap would occur from fiscal years 2026 through 2033. Coast Guard officials estimate that MEP upgrades may extend each vessel's service life up to 15 years, but they noted that this estimate is optimistic and has no basis in firm engineering studies. Therefore, figure

[53]The Coast Guard has contracted with the Department of Transportation, Research and Innovative Technology Administration's Volpe National Transportation Systems Center to conduct annual assessments of the effectiveness of the MEP.

10 shows MECs' end of service lives if the MEP were to provide 5, 10, or 15 years of additional service.

Figure 10: Comparison of the Projected End of Service Lives for the MEC Fleet with the Planned OPC Delivery Dates, as of May 2012



Source: GAO analysis of Coast Guard documents.

Note: This analysis is based on the Coast Guard's existing fleet of 27 MECs, each of which is identified by class and name. Coast Guard officials also reported that there is no correlation between the end of a vessel's service life and its decommissioning date.

According to senior Coast Guard planners, MEC operating requirements will be unachievable given fiscal and resource constraints without the Coast Guard undertaking a service life extension project in the future. For example, a senior Coast Guard maintenance official estimated that the

Coast Guard would need to raise annual depot-level maintenance funding for the MEC class by 300 percent for the Coast Guard to be able to maintain the MECs until their projected decommissioning dates. Coast Guard officials reported that a further refurbishment of the MECs will be necessary to meet operational requirements and that the Coast Guard is in the early stages of developing plans for addressing the expected gap between remaining MEC fleet service lives and the delivery of the OPC replacements. Officials from the Office of Naval Engineering reported that MEC condition is to be assessed over the next 2 fiscal years and that they plan to use MEC assessments to develop alternatives and present their recommendations to the Cutter Resource Council for approval. Because the Coast Guard is in the early stages of developing this plan, it is too soon evaluate it.

Uncertainties Further Challenge Sustainment Efforts

Coast Guard efforts to sustain its legacy vessel fleet and meet mission requirements until the replacement vessels are delivered are also challenged by uncertainties in two areas. First, the future mix of vessels (fleet mix) is uncertain. The Coast Guard's fiscal years 2013-to-2017 5-year *Capital Investment Plan* does not allocate funds for the acquisition of the last two replacement NSCs, as called for by the program of record.[54] If funds are not requested for these replacement vessels or their deliveries are delayed, it is unclear how this could affect the decommissioning schedule of the HECs, the last of which the Coast Guard currently plans to decommission in fiscal year 2023. Second, it is unclear if the Coast Guard will implement a rotational crew concept for the replacement NSCs. The Coast Guard's program of record assumes that the new NSC fleet will achieve more operational capacity than the legacy HEC fleet (230 versus 185 days away from homeport each year), but this assumption is predicated on implementation of a crew rotation concept in which the Coast Guard would have four sets of crew staff and operate three NSCs on a rotating basis to increase the vessels' operational time. However, we reported in May 2012 that the Coast Guard is reevaluating this rotational crewing concept because initial analysis indicates it may be difficult and too costly to achieve.[55] Coast

[54]The *Capital Investment Plan* projects Coast Guard's acquisition priorities for the next 5 years assuming the limits of budgetary growth set by the Budget Control Act of 2011, P.L. 112-25. We reported in July 2011 that the *Capital Investment Plan* is subject to change annually (see GAO-11-743).

[55]GAO, *Homeland Security: Observations on the Coast Guard's and the Department of Homeland Security's Fleet Studies,* GAO-12-751R (Washington, D.C.: May 31, 2012).

Guard officials reported that even if the NSCs are not able to achieve 230 operational days away from homeport, the Coast Guard does not plan to keep the HECs in service longer than current decommissioning schedules show.[56] However, should the NSCs be unable to achieve 230 days away from homeport and given its historic reliance on HECs to conduct certain missions, including the drug interdiction and Alaska missions, it is uncertain how the Coast Guard would be able to fully meet its mission goals without a delay in HEC decommissioning that would necessitate further HEC sustainment.[57]

Operational Hour Targets for Legacy Vessels Are Unrealistic

As previously noted, the Coast Guard has established operational hour targets for the number of hours its vessels are expected to conduct operations or missions each fiscal year. Coast Guard headquarters officials reported that the Coast Guard uses these targets to inform operational planning and force management decisions, such as setting mission performance targets and corresponding resource allocations.[58] Specifically, senior Coast Guard officials from the Office of the Deputy Commandant for Operations told us that they set overall mission performance targets on an annual basis. These officials also reported that, in collaboration with the area commands, headquarters issues guidance prescribing the operational hours that Coast Guard commands are to achieve within each mission area.[59] According to these officials, this guidance serves as a projection of the forces necessary to achieve the performance targets within each mission area and is based on

[56]However, Coast Guard headquarters officials also reported that the agency is in the midst of a 3-year, $4 million study—to be completed in 2013—to develop potential maintenance and sustainment strategies based on assessments and engineer design analyses on the HECs. The officials added that the study results are to inform development of maintenance availability packages, and development and implementation of engineering changes to improve HEC reliability until decommissioning.

[57]The Coast Guard recently revised the HEC decommissioning schedule to delay the decommissioning of the last HEC from 2020 to 2023 in its fiscal years 2013-2017 *Capital Investment Plan*.

[58]Coast Guard headquarters officials also reported that vessels' operation hour targets form the basis of their funding levels and Coast Guard fuel models.

[59]Coast Guard statutory missions are (1) Ports, Waterways, and Coastal Security; (2) Drug Interdiction; (3) Migrant Interdiction; (4) Living Marine Resources; (5) Other Law Enforcement; (6) Marine Safety; (7) Search and Rescue; (8) Marine Environmental Protection; (9) Defense Readiness; (10) Aids to Navigation; and (11) Ice Operations.

budgeted operational capacity for each asset.[60] Operational commanders reported also using this guidance to allocate their resources by determining the number of operational hours that the assets under their command must achieve (i.e., targets) within each mission area.

Senior Coast Guard headquarters officials reported that when setting overall mission performance targets, they consider various factors including continuous improvements and initiatives, expected asset capability, past performance, and external factors. However, they also stated that when setting these targets they assume that if assets achieve their planned operational hour targets, the Coast Guard should generally meet or exceed its performance targets for each mission. For example, senior officials from the Office of the Deputy Commandant for Operations reported on multiple occasions that the Coast Guard adjusts its mission performance targets annually based on each vessel class's capacity with the assumption that each vessel will operate at 100 percent of its planned operating time. Similarly, area commanders also reported allocating their resources based on the assumption that their assets will achieve 100 percent of their operational hour targets.

However, the legacy fleet has increasingly fallen below operational hour targets in recent years. The annual target for the HECs and MECs is 3,330 operational hours; however, these legacy vessel classes have consistently fallen short of this target in each of the last 5 to 7 fiscal years. Moreover, in March 2012 the Commandant of the Coast Guard testified before Congress that HECs are achieving only 70 percent of their operational hour targets and are sailing with major debilitating casualties more than 50 percent of the time.[61] In addition, Coast Guard officials at headquarters and in both area commands reported that the decline in legacy vessel operational capacity has challenged the Coast Guard's ability to meet its mission performance targets. Coast Guard operational commanders reported taking actions to mitigate the effect of declining legacy vessel capacity, such as diverting vessels tasked to other missions

[60]Coast Guard officials stated that Coast Guard areas may request adjustments to headquarters' operational hour guidance based on intelligence, achieved performance to date, or the emergence or disappearance of threats.

[61]*U.S. Coast Guard Fiscal Year 2013 Budget: Hearing Before Senate Committee on Commerce, Science and Transportation, Subcommittee on Oceans, Atmosphere, Fisheries, and Coast Guard*, 2,112th Congress (March 7, 2012) (Oral Testimony of Admiral Robert J. Papp, Jr., Commandant, U.S. Coast Guard).

to help complete operations. For example, an operational planner from the Coast Guard's Pacific Area Command said that legacy vessels have been temporarily deployed outside his command on a recurring basis to mitigate the effect of legacy vessel casualties on higher-priority missions elsewhere. In these instances, he said that he was challenged to meet certain mission performance targets.

The Coast Guard has not revised the operational hour guidance for its HEC, MEC, or PB classes in at least 8 years, despite declining operational capacity and expectations that capacity will continue to decline in the future. As a result, legacy vessel operational hour targets are not realistic. In addition, because the Coast Guard's overall mission performance targets are based, at least in part, on these vessels operational hour targets, the Coast Guard faces increased risk to its ability to meet these performance targets. OMB guidance states that agencies should set performance targets that are ambitious and achievable given program characteristics and should consider circumstances, including past performance, and may annually adjust targets as these factors change.[62] Coast Guard officials reported that they were cognizant of OMB guidance and have considered the merits of changing the operational hour targets, but have elected not to do so because the targets are the foundation of the Coast Guard's mission requirements baseline. In this way, officials said, altering legacy vessel operational targets would (1) lower the mission performance and planning standards that must be met to ensure that the Coast Guard achieves its missions, (2) reduce the funding available to support legacy vessels because budget models are based on resource hour targets, and (3) diminish the Coast Guard's ability to effectively conduct trend analysis of past performance because of shifting baselines and targets. However, our analysis of performance data and testimonial evidence from senior Coast Guard officials shows that the Coast Guard's mission performance and planning standards have gone unmet because of declining legacy vessel operational capacity. For example, operational commanders reported routinely missing mission performance targets because of legacy vessel casualties.

[62]OMB, *Program Assessment Rating Tool Guidance Number 2007-2*, (Washington, D.C.: January 29, 2007).

Because it sets mission performance targets and allocates resources on the assumption that legacy vessels will achieve 100 percent of operational hour targets, the Coast Guard's allocation of resources is not realistic. Coast Guard guidance states that, in accordance with OMB guidance, one should not expect to achieve every target every year. [63] However, because the Coast Guard uses vessels' operational hour targets as an input for setting agency-wide performance targets and to allocate area resources, consistent achievement of its performance targets is at increased risk. The Coast Guard could choose to adjust its legacy fleet targets for annual planning purposes, but retain the underlying assumptions of its budget and fuel models to ensure that the operational and maintenance needs of its legacy vessel fleet are still met. Finally, we have previously reported that the Coast Guard has adjusted legacy vessel operational hour targets in the past for its PB fleet. For example, in June 2008, we reported that the Coast Guard had revised PB operational hour targets in 2004 to account for its greater mission responsibilities since the terrorist attacks of September 11, 2001.[64] By adjusting legacy fleet operational hour targets annually to reflect their actual capacity as evidenced by historic performance and not desired capacity, the Coast Guard would be better able to set achievable and realistic performance targets and plan how to execute its mission by ensuring it allocates legacy vessel operational hours more realistically.

Conclusions

In each of the past 2 fiscal years, the Coast Guard has received supplemental funding to address its growing legacy vessel fleet maintenance needs. Unrealistically low Standard Support Levels have been one factor contributing to this need. However, in the current, constrained fiscal environment, there are no guarantees that such supplemental funding will continue to be available to meet the Coast Guard's legacy vessel fleet maintenance expenditures, which are likely to continue to rise as vessel conditions continue to decline. Thus, it is especially important for the Coast Guard to develop high-quality and reliable cost estimates that clearly convey to decision makers the potential risk of costs exceeding funding levels so that senior Coast Guard leadership and Congress can make more informed funding

[63]U.S. Coast Guard, *Standard Operational Planning / Global Force Management Process Guide.*

[64]See GAO-08-660.

decisions. In particular, the Coast Guard's annual vessel maintenance cost estimation process could be strengthened by better conforming to cost estimating best practices, particularly with respect to comprehensiveness, documentation, and accuracy.

The operational capacity of the legacy vessel fleet has been in decline, as highlighted by the Coast Guard's generally failing to meet operational hour targets for these vessels over the past 7 fiscal years. Further, delays in deploying some of the replacement vessels will lead to a growing operational capacity gap that could persist for some years to come. Despite the growing operational capacity gap, the Coast Guard has not revised legacy vessel operational hour targets to reflect this diminishing capacity. As a result, the Coast Guard's legacy vessel fleet operational hour targets—which are used to inform the Coast Guard's mission planning processes—are not realistic. In addition, because the Coast Guard's mission performance targets are based, in part, on operational hour targets, they risk not being achievable, as called for by OMB guidance. Given historic performance trends and expectations of a widening capacity gap, it is important that the Coast Guard realistically assess the operational capacity of its legacy vessel classes to ensure the operational performance goals and missions are achievable. By adjusting legacy vessel fleet operational hour targets annually to reflect actual capacity, as evidenced by historic performance, the Coast Guard would be better able to plan its missions by ensuring it allocates legacy vessel operational hours more realistically.

Recommendations for Executive Action

We recommend that the Secretary of Homeland Security direct the Commandant of the Coast Guard to take the following two actions:

To strengthen the comprehensiveness, documentation, and accuracy of the Coast Guard's annual depot-level maintenance cost estimates for its legacy vessel fleet, ensure that the Coast Guard's annual depot-level maintenance cost estimates conform to cost-estimating best practices.

To help ensure that the Coast Guard's planning processes result in the effective allocation of available resources and to better ensure it sets achievable performance goals, adjust legacy vessel fleet operational hour targets to reflect actual capacity, as appropriate by class.

Agency Comments and Our Evaluation

We requested comments on a draft of this report from the Secretary of Homeland Security and the Coast Guard. In its written comments, reprinted in appendix V, DHS concurred with the first recommendation, but the actions DHS reported that the Coast Guard has taken or plans to take may not fully address the intent of this recommendation. DHS did not concur with the second recommendation. In addition to the DHS letter, the Coast Guard provided technical comments that we have incorporated, as appropriate.

DHS concurred with the first recommendation, but the actions DHS reported that the Coast Guard has taken or plans to take may not fully address the intent of this recommendation. Specifically, in its letter, DHS raises three issues that could limit the Coast Guard's implementation of the recommendation. The first issue concerns DHS's position that cost estimating best practices are most applicable to new asset acquisitions. We disagree. We assessed the Coast Guard's vessel maintenance cost estimating process using the three best practices from our cost estimating guide that are intended to be applicable to programs and assets in all stages of their life cycles, including maintenance and support. The second issue DHS raised is that although sustainment and maintenance costs for individual vessels are uncertain and challenging to estimate, the Coast Guard mitigates these uncertainties through centralized management. We believe that even given the Coast Guard's centralized management of funding, it is especially important in the face of such uncertainty to follow cost estimating best practices. Following these best practices can help ensure that cost estimates are comprehensive and accurate, which in turn can help ensure that funds will be available when needed. The third issue DHS raised is that, given current fiscal constraints, the Coast Guard will focus on improvements that do not require additional resources. While we agree that federal resources are limited, aligning the cost estimating process for legacy vessel maintenance with best practices would not necessarily require a large investment of resources. In fact, having a well documented cost estimating process and using accurate historical data should enable the Coast Guard to operate more efficiently.

DHS did not concur with the second recommendation that the Coast Guard adjust legacy vessel fleet operational hour targets to reflect actual capacity, as appropriate by class. DHS stated that the Coast Guard has already taken actions to meet the maintenance challenges associated with its aging vessel fleet and strives to meet the annual operational targets associated with those vessels. DHS added that while the legacy vessel fleet has not been able to meet operational hour targets because

of maintenance challenges, reducing the operational hour targets would fail to fully utilize those assets not impacted by maintenance issues. We disagree. As noted in this report, while senior Coast Guard officials reported that the Coast Guard adjusts its mission performance targets annually, it does not adjust legacy vessel operational hour targets annually. These officials also stated that Coast Guard's mission performance targets are based on each vessel class's capacity, with the assumption that each vessel will operate at 100 percent of its planned operating time. We do not believe that reducing the operational hour targets would result in a failure by the Coast Guard to fully utilize assets not impacted by maintenance challenges. Moreover, as noted in this report and as DHS acknowledges in its letter, the legacy vessel fleet has not been able to meet operational hour targets in recent years. Despite declining operational capacity and expectations that capacity will continue to decline in the future, the Coast Guard has not revised the operational hour guidance for its legacy vessel fleet in at least 8 years. Given that (1) OMB guidance states that agencies should set targets that are achievable, (2) operational decisions are being made on the assumption that legacy vessels will achieve 100 percent of operational hour targets, and (3) the Coast Guard has adjusted legacy vessel operational hour targets in the past, we continue to believe that this recommendation has merit.

We are sending copies of this report to the Secretary of Homeland Security and the Commandant of the Coast Guard. This report is also available at no charge on GAO's web-site http://www.gao.gov.

If you or your staff have any questions, please contact me at (202) 512-9610 or caldwells@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Staff acknowledgments are provided in appendix VI.

Stephen L. Caldwell
Director
Homeland Security and Justice

List of Congressional Requesters

The Honorable Susan M. Collins
Ranking Member
Senate Committee on Homeland Security and Governmental Affairs
United States Senate

The Honorable Lisa Murkowski
United States Senate

The Honorable John L. Mica
Chairman
House Committee on Transportation and Infrastructure
House of Representatives

The Honorable Frank A. LoBiondo
Chairman
Subcommittee on Coast Guard and Maritime Transportation
House Committee on Transportation and Infrastructure
House of Representatives

The Honorable Candice S. Miller
Chairwoman
Subcommittee on Border and Maritime Security
House Committee on Homeland Security
House of Representatives

Appendix I: Scope and Methodology

To determine how the condition of the Coast Guard's fleet of legacy vessels changed from fiscal years 2005 through 2011, and to identify the key actions the Coast Guard has taken to improve the condition of the legacy fleet, we analyzed data the Coast Guard reported it used to determine and track the condition of its legacy fleet of vessels over each of these fiscal years. Of the four measures and supporting data the Coast Guard provided, the Coast Guard's Office of Naval Engineering reported that it considers Operational Percent of Time Free from Major Casualties (OpPOTF) to be primary measure for tracking, capturing, and communicating the condition of the legacy vessel fleet from fiscal years 2005 through 2011. We compared vessel OpPOTF against established Coast Guard standards. We assessed the reliability of these data by reviewing the Coast Guard's data management practices and questioning knowledgeable officials about the data and the systems that produced the data. We determined the data to be sufficiently reliable for the purposes of this report. We also interviewed relevant Coast Guard headquarters officials responsible for maintaining the legacy cutter fleet to obtain information on the physical condition of the legacy vessels and actions the Coast Guard reported as key actions to improve the physical condition of the legacy fleet, including officials from the Coast Guard's Office of Naval Engineering and Office of Cutter Forces. We also conducted site visits to five Coast Guard field locations where Coast Guard officials reported the legacy vessels were either homeported or undergoing maintenance and therefore available for us to observe the condition of the legacy vessels and to interview cognizant maintenance officials, operational commanders, and crew members. Specifically, we visited (1) the Pacific Area Command in Alameda, California; (2) the Atlantic Area Command in Portsmouth, Virginia; (3) the Coast Guard Yard in Baltimore, Maryland; (4) district and sector offices in Miami, Florida; and (5) the Coast Guard's district office and Naval Engineering Support Unit in Seattle, Washington. The results of these visits are not generalizable to all Coast Guard field locations, but they did provide valuable insights on key maintenance and operational issues. We also reviewed relevant standards and program documentation, such as the Coast Guard's *Cutter Employment Standards and* Acquisition Program Baselines for legacy vessel sustainment programs.

To determine the key annual maintenance expenditure trends for the Coast Guard's fleet of legacy vessels from fiscal years 2005 through 2011, we obtained Coast Guard data on the total annual legacy vessel maintenance expenditures, including scheduled versus unscheduled expenditures, for maintaining the 378-foot high endurance cutters, the 210-foot and 270-foot medium endurance cutters, and the 110-foot patrol

boats. Senior Coast Guard officials in charge of legacy vessel maintenance confirmed that analyzing these data was the best way to understand key expenditure trends. We also obtained and analyzed Coast Guard data on budgeted annual maintenance funds for these four vessel classes for the same period of time to further identify any expenditure trends and to determine how expenditures for the respective legacy vessel classes compared with budgeted funds. We interviewed cognizant officials from Coast Guard headquarters and Atlantic and Pacific Commands to obtain their perspectives on data trends. We assessed the reliability of these data by reviewing the Coast Guard's data management practices and interviewing knowledgeable officials about the data and the systems that produced the data. We determined the data to be sufficiently reliable for the purposes of this report. To determine the extent to which the Coast Guard's cost-estimating process follows established best practices, we analyzed documentation, such as the guidance the Coast Guard uses to conduct legacy vessel maintenance and to compute its annual legacy vessel maintenance budget, and compared the documentation with criteria for cost estimating best practices outlined in GAO's *Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs*.[1] Finally, we interviewed cognizant Coast Guard officials to obtain information about the Coast Guard's legacy vessel maintenance cost estimating methods.

To determine the operational capacity of the Coast Guard's legacy fleet and the extent to which the Coast Guard faces challenges in sustaining its legacy vessels and meeting mission requirements given delays in fielding the replacement vessels, we analyzed Coast Guard vessel data and measures that the Coast Guard reported were key indicators of the relationship between vessel maintenance condition and operational performance. These included operational hours and lost cutter days. For the operational hour data, we compared the documented performance with established Coast Guard targets for each legacy vessel class across each of the fiscal years. We assessed the reliability of these data by reviewing the Coast Guard's data management practices and interviewing knowledgeable officials about the data and the systems that produced the data. On the basis of our assessments, we determined the data to be sufficiently reliable for the purposes of this report. We interviewed

[1] GAO-09-3SP.

cognizant Coast Guard headquarters officials, including maintenance officials from the Coast Guard's Office of Naval Engineering, as well as officials responsible for budgeting and resources and for assessing and developing operational requirements for the legacy vessels. As previously noted, we conducted site visits to Coast Guard field locations to interview cognizant maintenance officials and operational commanders. We analyzed Coast Guard reports and recapitalization plans, including the *Deepwater Implementation Plan*, *Cutter Capital Asset Management Plan*, and various assessments of vessel condition. We evaluated the Coast Guard's actions against *Program Assessment Rating Tool Guidance Number 2007-2* from the Office of Management and Budget.[2]

We conducted this performance audit from September 2011 through July 2012 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

[2]OMB, *Program Assessment Rating Tool Guidance Number 2007-2*, (Washington, D.C.: January 29, 2007).

Appendix II: Comparison of the Capabilities of the Coast Guard's Legacy Vessels with Those of Their Replacements

This appendix provides further details on how the capabilities of the Coast Guard's legacy vessels compare with the planned capabilities of the replacement vessels.[1] According to the Coast Guard, the replacement vessels are designed to perform the same missions as the legacy vessels, but with greater capabilities.[2] Specifically, this appendix provides further details on how the high endurance cutters (HEC) compare with the national security cutters (NSC), how the medium endurance cutters (MEC) compare with the offshore patrol cutters (OPC), and how the 110-foot patrol boats (PB) compare with the fast response cutters (FRC).

The HEC and the NSC

The Coast Guard plans to replace the HEC with the NSC. Coast Guard officials indicated that better aircraft command and communication capabilities are especially notable when comparing the NSC with the HEC. Table 3 provides a comparison of operational capabilities between the HEC and its replacement, the NSC.

[1]None of the replacement vessels have completed initial operational test and evaluation, a major test event that identifies deficiencies by evaluating operational effectiveness during the execution of simulated operational missions. In advance of this testing, the Coast Guard has completed preliminary tests for the NSC and FRC, such as operational assessments, which the Coast Guard is using to mitigate risk and address problems during asset development prior to initial operational test and evaluation.

[2]The Coast Guard plans for the NSC and the FRC to be able to perform marine safety missions that the 110-foot PB and HEC cannot. Also, the Coast Guard envisions the OPC as a flexible vessel that will be able to perform emergent missions.

Table 3: Comparison of Capabilities between the HEC and Its Replacement, the NSC

Capability	HEC	NSC
Number in fleet	Originally 12, now 9[a]	8 planned[b]
Year first-in-class cutter commissioned	1967	2008
Crew size	166	109
Length	378 feet	418 feet
Days away from homeport	185 days per year	Up to 230 days per year[c]
Maximum time at sea without reprovisioning	45 days	60 days
Range	14,000 nautical miles[d]	12,000 nautical miles
Maximum speed	29 knots[e]	28 knots
Patrol speed	12 knots	15 knots
Draft[f]	19 feet	22 feet
Seakeeping capabilities for normal operations	Up to 13-foot seas	Up to 13-foot seas
Intelligence gathering	On-board intelligence gathering facility (cannot transmit classified data) and helicopter	Secure information system for transmitting classified data, unmanned aircraft (planned), and helicopters
Weapons	Gun weapon system and close-in weapon system, four machine guns, and two countermeasure launching systems	Gun weapon system and close-in weapon system, six machine guns, and two countermeasure launching systems
Ability to withstand a biological or chemical attack	Yes	Yes[g]
Aircraft command capabilities	No comprehensive aircraft launch and recovery control center, one aircraft hangar, partially automated helicopter recovery system	Comprehensive aircraft launch and recovery control center, two aircraft hangars, partially automated helicopter recovery system[h]
Small boat capabilities	Carries two small boats and has two small boat recovery systems	Carries three small boats, and has one side-mounted small boat recovery system for one small boat and one stern-mounted small boat recovery system for two small boats

Source: GAO analysis of information provided by the Coast Guard.

[a]The high endurance cutter fleet originally included 12 vessels, but the Coast Guard has decommissioned 3 since fiscal year 2011.

[b]As of July 2012, the Coast Guard had commissioned three NSCs. The Coast Guard's fiscal year 2013-2017 5-year *Capital Investment Plan* does not allocate funds for the acquisition of NSCs 7 and 8, as called for by the program of record.

[c]To achieve 230 days away from homeport, the Coast Guard plans to use a "crew rotational concept" in which four crews staff and operate three cutters on a rotating basis.

[d]According to the Coast Guard, HECs can achieve a 14,000 nautical mile range only if they ballast their fuel tanks once the tanks are depleted, a procedure that is rarely undertaken. HECs have a range of 9,600 nautical miles under normal circumstances.

[e]According to the Coast Guard, the age and condition of the HECs, coupled with renovation and modernization modifications made to these vessels over the years, make many HECs unable to achieve a maximum speed of 29 knots.

[f]Draft refers to the depth of water needed to float the vessel.

[g]NSCs are outfitted with a Collective Protective System, which should allow continued operations in a contaminated environment.

[h]According to the Coast Guard, the HEC flight deck is certified to accommodate a multimission (HH-65) helicopter, while the NSC flight deck is certified to accommodate a multimission helicopter and the larger medium-range recovery (HH-60) helicopter.

The MECs and the OPC

The Coast Guard plans to replace the 210-foot and 270-foot MECs with the OPC. While the OPCs are in the initial stages of design, Coast Guard officials told us that they anticipate that the OPC's speed, seakeeping, small boat capabilities, and ability to operate in a full spectrum of climate and environmental conditions will be especially notable in comparison with those of the MECs. Table 4 provides a comparison of operational capabilities between the 270-foot and 210-foot MECs and their replacement, the OPC.

Table 4: Comparison of Capabilities of the 270-foot and 210-foot MECs and their Replacement, the OPC

Capability	210-foot MEC	270-foot MEC	OPC
Number in fleet	14	13	25 planned
Year first-in-class cutter commissioned	1964	1983	2020 planned
Crew size	76	100	90 to 104, with additional detachments for aviation and intelligence support. Maximum accommodation for 120-126 people.
Length	210 feet	270 feet	To be determined
Days away from homeport	185	185	Up to 230 days per year
Maximum time at sea without re-provisioning	21 days	21 days	45 days to 60 days
Range	6,100 nautical miles at 13 knots	9,900 nautical miles at 12 knots	8,500 to 9,500 nautical miles at 14 knots
Maximum speed	18 knots	19.5 knots	22 to 25 knots
Patrol speed	6 to 8 knots	12 knots	10 knots
Draft	11 feet 6 inches	14 feet	To be determined
Seakeeping	Launch and recover boats in up to 8-foot seas. Launch and recover helicopters in up to 4-foot seas	Launch and recover boats in up to 8-foot seas. Launch and recover helicopters in up to 8-foot seas	Launch and recover boats and helicopters in up to 13-foot seas

Capability	210-foot MEC	270-foot MEC	OPC
Intelligence gathering	Secure information system for transmitting classified data	Prototype carry-on signals exploitation system aboard limited number of vessels and secure information system for transmitting classified data	Carry-on signals exploitation system (objective), secure information system for transmitting classified data, and unmanned aircraft
Ability to withstand a biological or chemical attack	No	Yes	Yes
Weapons	Three machine guns and small arms	Gun weapon system, fire control radar, decoy launching system; four machine guns, and small arms	Gun weapon systems, multi-mode radar (objective) electro-optical sighting system, decoy launching system, and two stabilized small arm mounts with small arms
Aircraft command capabilities	Helicopter capture system, no hangar	Helicopter capture system and one hangar for an MH-65 helicopter	One hangar for a H-65 helicopter (threshold) or H-60/H-65/H60R helicopter (objective) and a future unmanned aircraft system space/weight/power (threshold)
Small boat capabilities	Two side-launching dual point davits for the two small boats[a]	One side-launching dual point davit starboard side for one small boat and one articulated single point davit on the port side of the stern for a second small boat	Two side-launched small boats (threshold) or three side-launched small boats (objective)

Source: GAO analysis of information provided by the Coast Guard.

[a]A davit is the mechanical system used to lower a vessel's small boat into the water.

The PB and the FRC

The Coast Guard plans to replace the 110-foot PB with the FRC. Coast Guard officials told us that the better seakeeping, communications, and small boat capabilities are especially notable when comparing the FRC with the PB. Table 5 provides a comparison of operational capabilities between the 110-foot PB and its replacement, the FRC.

Table 5: Comparison of Capabilities of the 110-foot PB and Its Replacement, the FRC

Characteristic	110-foot PB	FRC
Number in fleet	41[a]	58 planned[b]
Year first-in-class cutter commissioned	1986	2012
Crew size	16	24
Length	110 feet	154 feet
Operational tempo/days away from homeport	1,800 operational hours per year	2,500 operational hours per year
Maximum time at sea without reprovisioning	5 days	5 days
Range	1,900 nautical miles at 15 knots	2,500 nautical miles at 15 knots
Maximum speed	28 knots	28 knots
Patrol speed	15 knots	18 knots
Draft	7.5 feet	10 feet
Seakeeping capabilities for operations	Up to 8-foot seas	Up to 13-foot seas
Intelligence gathering	No	No
Weapons	One cannon crew-served weapon and two machine guns	One cannon gyro-stabilized remote operated weapon with an optical targeting sensor and four machine guns
Ability to withstand a biological or chemical attack	No	No
Aircraft command capabilities	Not flight deck equipped	Not flight deck equipped
Small boat capabilities	One 18-foot rigid hull inflatable boat with seating for 8 crew, 28 knots maximum speed, handheld communications, and a single point davit launch system	One small boat with seating for 11 crew, 40 knots maximum speed, communications, stern ramp launch and recovery, integrated radar and electronic charting, and 200 nautical miles range capable for over-the-horizon operations

Source: GAO analysis of information provided by the Coast Guard.

[a]The 110-foot PB fleet originally included 49 vessels. The Coast Guard converted 8 of the 110-foot PBs to 123-foot PBs, but discontinued further conversions in 2005 and decommissioned the 123-foot PBs in 2007 because they were experiencing technical difficulties, such as hull buckling, and were not able to meet post-September 11, 2001 mission requirements.

[b]As of May 2012, the Coast Guard has commissioned one FRC.

Appendix III: Further Information on Condition and Costs of the Coast Guard's Legacy Vessel Fleet

This appendix provides further details on the condition and costs of the Coast Guard's HEC, MEC, and PB fleet of legacy vessels from fiscal years 2005 through 2011. In particular, this appendix summarizes condition and cost information for each legacy vessel class using Coast Guard data on top mission degraders, cost drivers, and associated costs; and compares scheduled and unscheduled depot-level maintenance expenditures with the vessels' Standard Support Levels (SSL).[1]

The HEC Fleet

As stated earlier, the condition of the HEC fleet is poor. Coast Guard officials attributed the poor performance of the HEC fleet to the increased frequency of major casualties. Each year the Coast Guard's Office of Naval Engineering compiles a list of the top five mission degraders and cost drivers and their total obligated amounts. Table 6 provides that information for the HEC fleet for fiscal year 2011.

Table 6: HEC Fleet Top Five Major Mission Degraders and Top Cost Drivers and Associated Total Obligation Amounts, Fiscal Year 2011

Major mission degraders	Top cost drivers and total obligated amount
1. Main diesel engines	1. Main gas turbine, $594,000
2. Ship's service diesel generators	2. Main diesel engine, $294,800
3. Main gas turbine	3. SPS-73 surface search radar, $230,100
4. SPS-73 surface search radar	4. Propeller hub assembly, $189,800
5. Main reduction gear	5. Emergency gas turbine generator, $174,300

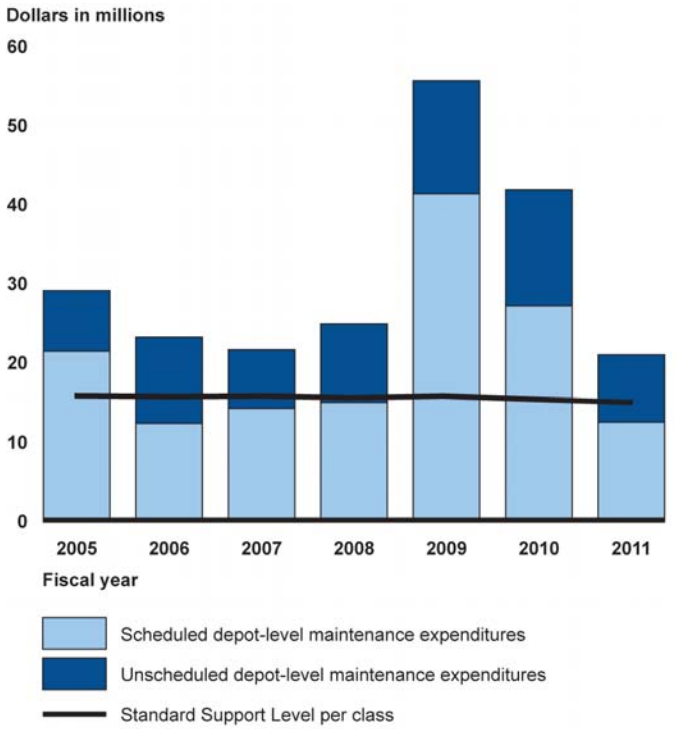
Source: GAO analysis of Coast Guard data.

Scheduled and unscheduled maintenance expenditures for the HEC fleet fluctuated from fiscal year 2005 through 2011, peaking in fiscal years 2009 and 2010. Coast Guard officials told us that major casualties on three HECs contributed disproportionately to the unscheduled maintenance expenditures in fiscal years 2010 and 2011, and that they have since decommissioned two of these vessels. Depot-level maintenance expenditures for the legacy HEC fleet were 1.4 to 3.6 times greater than SSLs in each year from fiscal years 2005 through 2011. Figure 11 shows the scheduled and unscheduled depot-level

[1]SSLs are the Coast Guard's annual budgeted funds for depot-level maintenance for each of its vessel classes. Scheduled and unscheduled maintenance expenditures and SSLs have been adjusted for inflation, and are reported here in fiscal year 2012 dollars.

maintenance expenditures for the legacy HEC class during fiscal years 2005 through 2011, along with how these expenditures compared with the HEC fleet's SSLs.

Figure 11: HEC Fleet Scheduled and Unscheduled Depot-Level Maintenance Expenditures Compared with Standard Support Levels (SSL), Fiscal Years 2005 through 2011



Source: GAO analysis of Coast Guard data.

The MEC Fleet

As stated earlier, the condition of the Coast Guard's fleet of 27 MECs is generally poor, although the 210-foot MECs were generally in better condition than the 270-foot MECs. Tables 6 and 7 provide information on the top five mission degraders and cost drivers and their total obligated amounts for the 210-foot and 270-foot MEC fleets, respectively, for fiscal year 2011.

Table 7: 210-Foot MEC Fleet Top Five Major Mission Degraders and Cost Drivers and Associated Total Obligation Amounts, Fiscal Year 2011

Major mission degraders	Top cost drivers and total obligated amount
1. Machinery plant control and monitoring system	1. SPS-73 surface search radar, $134,700
2. Main diesel engine	2. Main diesel engine, $133,300
3. SPS-73 surface search radar	3. Reverse osmosis desalination plant, $50,100
4. Reverse osmosis water maker	4. Helicopter in-flight refueling hose, $46,500
5. P6 dewatering pump	5. Welin Lambie boat davit, $43,800

Source: GAO analysis of Coast Guard data.

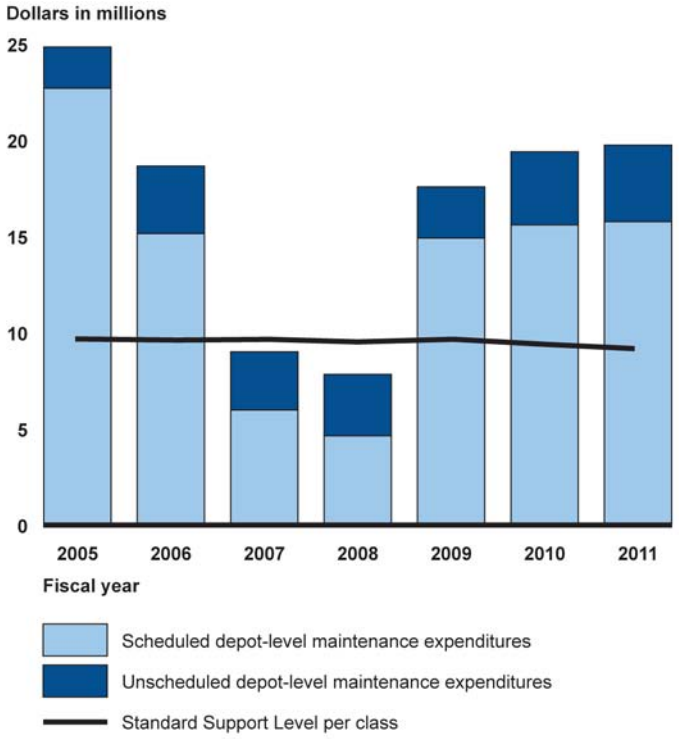
Table 8: 270-Foot MEC Fleet Top Five Major Mission Degraders and Cost Drivers and Associated Total Obligation Amounts, Fiscal Year 2011

Major mission degraders	Top cost drivers and total obligated amount
1. Machinery plant control and monitoring system	1. MK39 gyrocompass, $693,100
2. Main diesel engine	2. SPS-73 surface search radar , $98,100
3. Reverse osmosis desalination plant	3. Main diesel engine, $72,200
4. Welin Lambie boat davit	4. Gallery oven, $57,500
5. Ship's service diesel generator	5. Fuel transfer pump, $54,200

Source: GAO analysis of Coast Guard data.

Scheduled depot-level maintenance expenditures for the 270-foot MEC fleet fluctuated from fiscal year 2005 through 2011, while unscheduled depot-level maintenance expenditures for the 270-foot MEC fleet remained comparatively stable during this same time period. The depot-level maintenance expenditures were less than SSLs for the 210-foot MEC fleet in fiscal years 2007 and 2008, but were 1.6 to 2.4 times greater than SSLs throughout the rest of this period. Figure 12 compares the scheduled and unscheduled depot-level maintenance expenditures for the 270-foot MECs during fiscal years 2005 through 2011 with the SSLs.

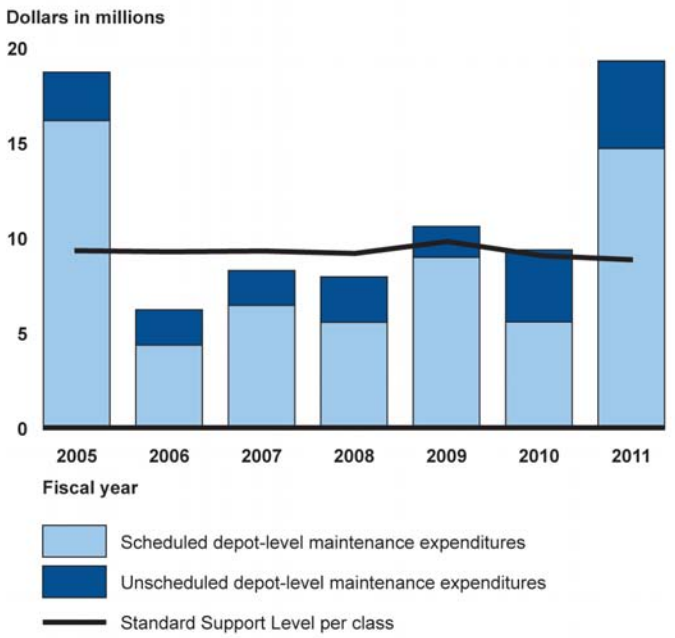
Figure 12: 270-Foot MEC Fleet Scheduled and Unscheduled Depot-Level Maintenance Expenditures Compared with Standard Support Levels, Fiscal Years 2005 through 2011



Source: GAO analysis of Coast Guard data.

As shown in figure 13, scheduled and unscheduled depot-level maintenance expenditures for the 210-foot MEC fleet fluctuated from fiscal years 2005 through 2011. The depot-level maintenance expenditures were less than SSLs for the 210-foot MEC fleet from fiscal years 2006 through 2008, and nearly equal in fiscal year 2010, but were 1.5 to 2.2 times greater than SSLs throughout the rest of this period.

Figure 13: 210-Foot MEC Fleet Scheduled and Unscheduled Deport-Level Maintenance Expenditures Compared with Standard Support Levels, Fiscal Years 2005 through 2011



Source: GAO analysis of Coast Guard data.

The PB Fleet

As stated earlier, the legacy PB fleet is generally in poor condition, but has improved some in recent years, which Coast Guard officials attribute to improved maintenance practices and the effects of vessel sustainment projects. Table 8 shows the Coast Guard's top five mission degraders, cost drivers, and the associated costs for the legacy PB fleet for fiscal year 2011.

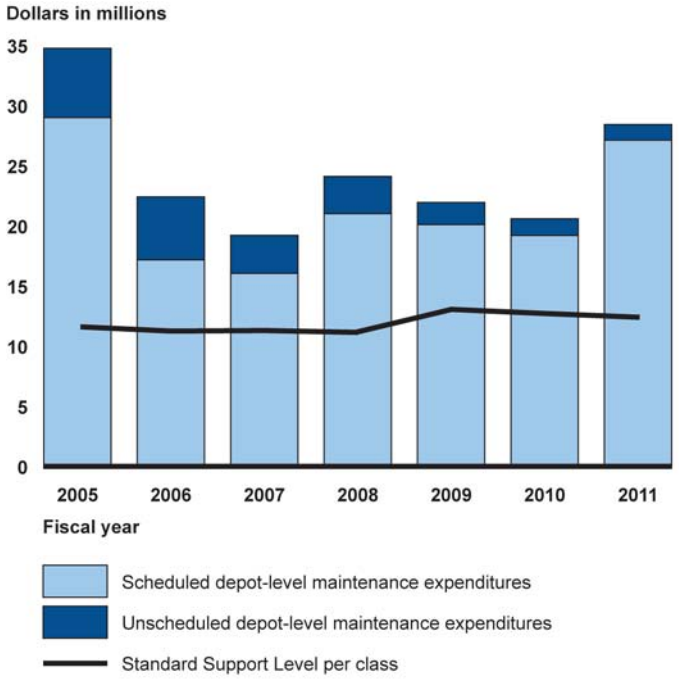
Table 9: 110-Foot PB Fleet Top Five Major Mission Degraders, Cost Drivers, and Associated Costs, Fiscal Year 2011

Major mission degraders	Top cost drivers and total obligated amount
1 Main diesel engine	1. Fin stabilizer hydraulic ram, $102,300
2. P-100 dewatering/firefighting pump	2. Reduction gear, $87,900
3. Ship's service diesel generator	3. Main diesel engine, $76,700
4. Ship's service diesel generator raw water pump	4. Propulsion shaft, $57,800
5. Air conditioning raw water pump	5. Gyro compass, $47,500

Source: GAO analysis of Coast Guard data.

Scheduled depot-level maintenance expenditures for the legacy PB fleet fluctuated from fiscal year 2005 through 2011, while unscheduled depot level maintenance expenditures for the fleet declined steadily during this period. Coast Guard officials reported that this decline was likely due to increased scheduled maintenance, which helped reduce casualties. Depot-level maintenance expenditures were 1.6 to 2.9 times greater than SSLs for the PB fleet in each year from fiscal years 2005 through 2011. Figure 14 compares the scheduled and unscheduled depot-level maintenance expenditures for the PB fleet during fiscal years 2005 through 2011 with the SSLs.

Figure 14: 110-Foot PB Fleet Scheduled and Unscheduled Depot Level Maintenance Expenditures Compared with Standard Support Levels, Fiscal Years 2005 through 2011



Source: GAO analysis of Coast Guard data.

Appendix IV: Evaluation of the Coast Guard's Process for Estimating Legacy Vessel Maintenance Costs

This appendix provides information on the relationship between the three best practice characteristics and the 15 related steps of a high-quality cost estimate as established in GAO's *Cost Estimating and Assessment Guide*.[1] In particular, this appendix provides more details on the extent to which the Coast Guard's cost-estimating process meets the best practices characteristics and steps, and explains how we determined the overall assessment ratings.

In determining that the Coast Guard's process for developing legacy vessel maintenance cost estimates does not fully reflect best practices, we evaluated the Coast Guard's cost estimation process against GAO's 2009 *Cost Estimating and Assessment Guide*. This guide states that a high-quality and reliable cost estimate includes best practice characteristics—three of which are relevant to the Coast Guard's estimating process. These characteristics are that the estimate is (1) well documented, (2) comprehensive, and (3) accurate. Moreover, the guide establishes 10 related steps that, if followed, should result in high-quality cost estimates.[2] Because this report deals with only the maintenance of legacy Coast Guard vessels, we tailored our evaluation criteria, as shown in table 8. We applied the following scale across the categories of best practices and related steps:

- **Not met:** The Coast Guard provided no evidence that satisfies any portion of the criterion.
- **Minimally met:** The Coast Guard provided evidence that satisfies a small portion of the criterion.
- **Partially met:** The Coast Guard provided evidence that satisfies about one-half of the criterion.
- **Substantially met:** The Coast Guard provided evidence that satisfies a large portion of the criterion.
- **Met:** The Coast Guard provided complete evidence that satisfies the entire criterion.

After reviewing the documentation that the Coast Guard submitted for its cost estimation process, conducting interviews with knowledgeable

[1]GAO, *GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs*, GAO-09-3SP (Washington, D.C.: Mar. 2, 2009).

[2]Since we determined that the fourth best practice characteristic—"credible"—is not appropriate for this assessment, we did not assess two steps related to the "credible" characteristic as identified in GAO's *Cost Estimating and Assessment Guide*.

officials, and reviewing relevant source documents, we determined that the Coast Guard's process partially meets three characteristics of a reliable cost estimate, as shown in table 9. We determined the overall assessment rating by assigning each individual assessment rating a number: Not met = 1, minimally met = 2, partially met = 3, substantially met = 4, and met = 5. We then took the average of the individual assessment ratings to determine the overall assessment rating for each characteristic. The resulting average becomes the overall assessment as follows: Not met = 1 to 1.4, minimally met = 1.5 to 2.4, partially met = 2.5 to 3.4, substantially met = 3.5 to 4.4, and met = 4.5 to 5.0.

Table 10: Summary Assessment of the Coast Guard's Cost Estimation Process Compared with Best Practices

Best practice	Overall assessment	Step	Individual assessment
Comprehensive	Partially met	The cost estimate includes all life cycle costs	Not applicable
		The cost estimate completely defines the program, reflects the current schedule, and is technically reasonable.	Substantially met
		The cost estimate work breakdown structure is product-oriented, traceable to the statement of work/objective, and at an appropriate level of detail to ensure that cost elements are neither omitted nor double-counted.[a]	Substantially met
		The estimate documents all cost-influencing ground rules and assumptions.	Minimally met
Well documented	Partially met	The documentation captures the source data used, the reliability of the data, and how the data were normalized.[b]	Partially met
		The documentation describes in sufficient detail the calculations performed and the estimating methodology used to derive each element's cost.	Partially met
		The documentation describes step by step how the estimate was developed, so that a cost analyst unfamiliar with the program could understand what was done and replicate it.	Minimally met
		The documentation discusses the technical baseline description and the data in the baseline is consistent with the estimate.	Substantially met
		The documentation provides evidence that the cost estimate was reviewed and accepted by management.	Partially met
Accurate	Partially met	The cost estimate results are unbiased, not overly conservative or optimistic, and based on an assessment of most likely costs.	Minimally met
		The estimate has been adjusted properly for inflation.	Minimally met
		The estimate contains few, if any, minor mistakes.	Substantially met
		The cost estimate is regularly updated to reflect significant changes in the program so that it always reflects the current status.	Substantially met
		Variances between planned and actual costs are documented, explained, and reviewed.	Minimally met

Best practice	Overall assessment	Step	Individual assessment
		The estimate is based on a historical record of cost estimating and actual experiences from other comparable programs.	Partially met

Source: GAO analysis of Coast Guard information.

[a]A work breakdown structure shows the requirements and what must be accomplished to develop a program, and provides the basis for identifying resources and tasks for developing a program cost estimate. It provides a basic framework for estimating costs, developing schedules, identifying resources, determining where risks may occur, and providing the means for measuring program status.

[b]The purpose of data normalization is to make a given data set consistent with and comparable with other data used in the estimate. Since data can be gathered from a variety of sources, they are often in different forms and need to be adjusted before being used for comparison analysis or as a basis for projecting future costs.

Appendix V: Comments from the Department of Homeland Security

U.S. Department of Homeland Security
Washington, D.C. 20528

July 25, 2012

Stephen L. Caldwell
Director, Homeland Security and Justice
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Re: Draft Report GAO-12-741, "COAST GUARD: Legacy Vessels' Declining Conditions Reinforce Need for More Realistic Performance Targets"

Dear Mr. Caldwell:

Thank you for the opportunity to review and comment on this draft report. The U.S. Department of Homeland Security (DHS) appreciates the U.S. Government Accountability Office's (GAO's) work in planning and conducting its review and issuing this report.

The Department is pleased to note GAO's positive recognition that the Coast Guard has taken actions to improve the condition of its legacy vessel fleet, including the reorganization of its maintenance command structure. The Coast Guard's merger of supply and maintenance functions into the "Product Line" construct facilitated better visibility of class-wide issues and identification of maintenance cost drivers and operational availability degraders allowing maintenance managers to target resources to address problems that had the greatest "return on investment" in terms of operational performance and cost avoidance.

Moreover, the Coast Guard was able to leverage centralized acquisition contracts to provide flexibility and responsiveness to eliminate variability in contracted maintenance, to stabilize costs, including performance of depot-level maintenance availabilities, and to overhaul/repair contracts for major propulsion and auxiliary system components. Furthermore, the Coast Guard is replacing legacy vessels that have exceeded their economic service life with new assets as quickly as possible. For example, the FY 2013 President's Budget supports construction of the sixth National Security Cutter, the 19th and 20th Fast Response Cutter, an additional Maritime Patrol Aircraft, as well as continued sustainment of in-service assets.

The report contained two recommendations, one with which DHS concurs and the other with which the Department non-concurs. Specifically, GAO recommended that the Secretary of Homeland Security direct the Commandant of the Coast Guard to:

Recommendation 1: To strengthen the comprehensiveness, documentation, and accuracy of the Coast Guard's annual depot-level maintenance cost estimates for its legacy vessel fleet, ensure that the Coast Guard's annual depot level maintenance cost estimates conform to cost estimating best practices.

Response: Concur. With the recent modernization of the Coast Guard's naval engineering maintenance program, coupled with the use of the Fleet Logistics System and Asset Logistics Management Information System, the Coast Guard is continuing to pursue a maintenance cost estimation process that captures the efforts required to accurately assess the annual cost for maintenance and repair. As noted in the report, the Coast Guard cost estimation process already satisfies many of the criteria contained in the major tenets of *GAO's Cost Estimating and Assessment Guide*. Elements of the GAO cost estimating best practices are applicable to asset sustainment; however, these practices are most applicable to new asset acquisitions. Cost estimation assumptions, considerations, and procedures for in-service sustainment and repair of operational ships and boats (vessels) are different than those of new acquisitions. In particular, a significant amount of uncertainty exists regarding "conditions found" as maintenance and repair work are performed on these older vessels. This uncertainty is challenging to model or estimate, even while following the GAO best practices.

Furthermore, from a practical budgeting perspective, while the costs of performing sustainment and maintenance activities from ship to ship remain uncertain, the Coast Guard centrally manages all the resources used to accomplish these maintenance activities. Thus, despite the fact that cost variation remains among individual sustainment activities, the impacts of this uncertainty are mitigated through centralized management. Coast Guard maintenance managers prioritize within the resource base to accomplish the most critical maintenance activities with the greatest overall impact to operational readiness.

Although more accurate cost estimates for sustainment activities would provide valuable information to maintenance managers, the Coast Guard must evaluate what additional resources would be required to improve these estimates, and to what extent these improved estimates would help bolster operational readiness or lower overall costs. Given current fiscal constraints, the Coast Guard will focus on improvements that do not require additional resources.

Recommendation 2: To help ensure that the Coast Guard's planning processes result in the effective allocation of available resources and to better ensure it sets achievable performance goals, adjust legacy vessel fleet operational hour targets to reflect actual capacity, as appropriate by class.

Response: Non-concur. The Coast Guard has already taken specific, positive actions to address the continuing maintenance challenges associated with an aging fleet and strives to meet the annual operational targets associated with these vessels. While GAO accurately reports that the Coast Guard has been unable to meet those operational target hours because of maintenance challenges, reducing the target hours would fail to fully utilize assets not impacted by maintenance issues. Specifically, as a class, many assets may not meet their operational targets, but individual assets often do. From an operational planning perspective, reducing the operational targets would result in a "lost opportunity" for capital assets that are fully able to conduct Coast Guard missions, resulting in a potentially significant decrease in overall efficiency and raising the overall cost to conduct Coast Guard operations.

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Again, thank you for the opportunity to review and comment on this draft report. Please feel free to contact me if you have any questions. We look forward to working with you in the future.

Sincerely,

for Jim H. Crumpacker
Director
Departmental GAO-OIG Liaison Office

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Appendix VI: GAO Contact and Staff Acknowledgments

Staff Contact

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In addition to the contact named above, Christopher Conrad (Assistant Director), Jason Berman, Chloe Brown, and Michael Lenington made key contributions to this report. Also contributing to this report were David Alexander, Jennifer Echard, Richard Eiserman, Eric Hauswirth, Anna Irvine, Tracey King, Dawn Locke, Lara Miklozek, Robin Nye, Joshua Ormond, Karen Richey, and Jack Smuck.

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