Status of the Coast Guard's Polar Icebreaking Fleet Capability and Recapitalization Plan

Information Provided to the Committees

on

Commerce, Science, and Transportation, U.S. Senate

and

Transportation and Infrastructure,

House of Representatives

Introduction and Mandate

- Since 1965, Coast Guard (USCG) has been responsible for providing polar icebreaking capability for the United States.
- USCG has two active polar icebreakers, one of which is a heavy polar icebreaker—which has greater icebreaking capability—and is nearing the end of its expected service life.
- To maintain its polar icebreaking capability, USCG is seeking to recapitalize its polar icebreaking fleet through acquisition and sustainment activities.
- Section 3524 of the National Defense Authorization Act for Fiscal Year 2017 (Pub. L. No. 114-328) included a provision for GAO to review U.S. polar icebreaking capabilities.

Contents

- **Objectives**
  - To what extent do USCG's existing polar icebreaking capabilities address key mission requirements?
  - What is the status of USCG's efforts to recapitalize its heavy polar icebreaking fleet, and how has USCG addressed challenges it has identified in implementing the effort?
  - What, if any, potential heavy polar icebreaking capability gap has USCG identified and what plans do USCG, and other federal agencies that depend on USCG heavy polar icebreaking capability, have to address it?
- **Scope and Methodology**
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Scope and Methodology

- To assess the extent USCG has met key polar icebreaking mission requirements, we obtained and analyzed documents from USCG describing these mission requirements, and data showing the extent to which USCG met these requirements during fiscal years 2010 through 2016. By questioning knowledgeable officials about the data and reviewing it for errors or omissions, we determined it was sufficiently reliable for our purposes. We also interviewed officials regarding the factors affecting USCG performance in meeting mission requirements during this period.

- To assess the status of USCG's efforts to recapitalize its heavy polar icebreaking fleet, and how USCG is addressing challenges it has identified in implementing this effort, we obtained and analyzed Department of Homeland Security (DHS) and USCG documentation for the acquisition program (program), such as acquisition decision memoranda, supporting acquisition planning documents, and cost and schedule information. We also interviewed USCG and Navy officials representing the heavy polar icebreaker project's Integrated Program Office. We evaluated USCG efforts based on DHS and USCG acquisition guidance and GAO's identified best practices for Navy shipbuilding (GAO-09-322).

Scope and Methodology

- To describe USCG's potential heavy polar icebreaking capability gap and how USCG and other federal agencies plan to address it, we obtained and analyzed USCG documentation identifying the potential gap, and USCG assessments and strategy documents outlining planning options to address the gap through leasing or recapitalization of the existing heavy polar icebreaker fleet. We also interviewed USCG officials responsible for addressing the potential heavy polar icebreaking capability gap, as well as officials from the National Science Foundation (NSF) and Department of Defense (DOD), which utilize USCG heavy polar icebreaking capability. We evaluated USCG's actions based on risk assessment guidance outlined in *Standards for Internal Control in the Federal Government* , Office of Management and Budget Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs, and our Cost Estimating and Assessment Guide for Best Practices for Developing and Managing Capital Program Costs.

Summary

- USCG's existing polar icebreaking capabilities have been unable to address all mission requirements.
- USCG faces risks in implementing accelerated heavy polar icebreaker acquisition schedule.
- USCG plans ship service life extension to address potential capability gap, but has not completed assessments.

Background

USCG has two active polar icebreakers—the *Polar Star*, a heavy icebreaker, and the *Healy*, a medium icebreaker. An additional USCG heavy icebreaker, the *Polar Sea*, has been inactive since experiencing major engine casualties in June 2010.

- The *Polar Star* can provide year-round access to both Polar Regions, while the *Healy* is capable of carrying out a wide range of activities but cannot access the Antarctic year-round, nor some Arctic areas in winter.
- USCG projects the *Polar Star's* service life will end by fiscal year 2023, and the *Healy's* by fiscal year 2030.
- USCG initiated a recapitalization program in 2013 to maintain heavy icebreaker capability after 2023. In September 2015, the President proposed accelerating acquisition of replacement heavy icebreakers.
- Figure 1 shows USCG's polar icebreakers and their expected service lives.

Background

Figure 1: USCG's Polar Icebreakers and Expected Service Lives

Polar Star

Heavy polar icebreaker

Icebreaking	6 feet at 3 knots 21 feet back and ram
Endurance	28,274 nautical miles
Brake horsepower	60,000

Polar Sea (Inactive since 2010)

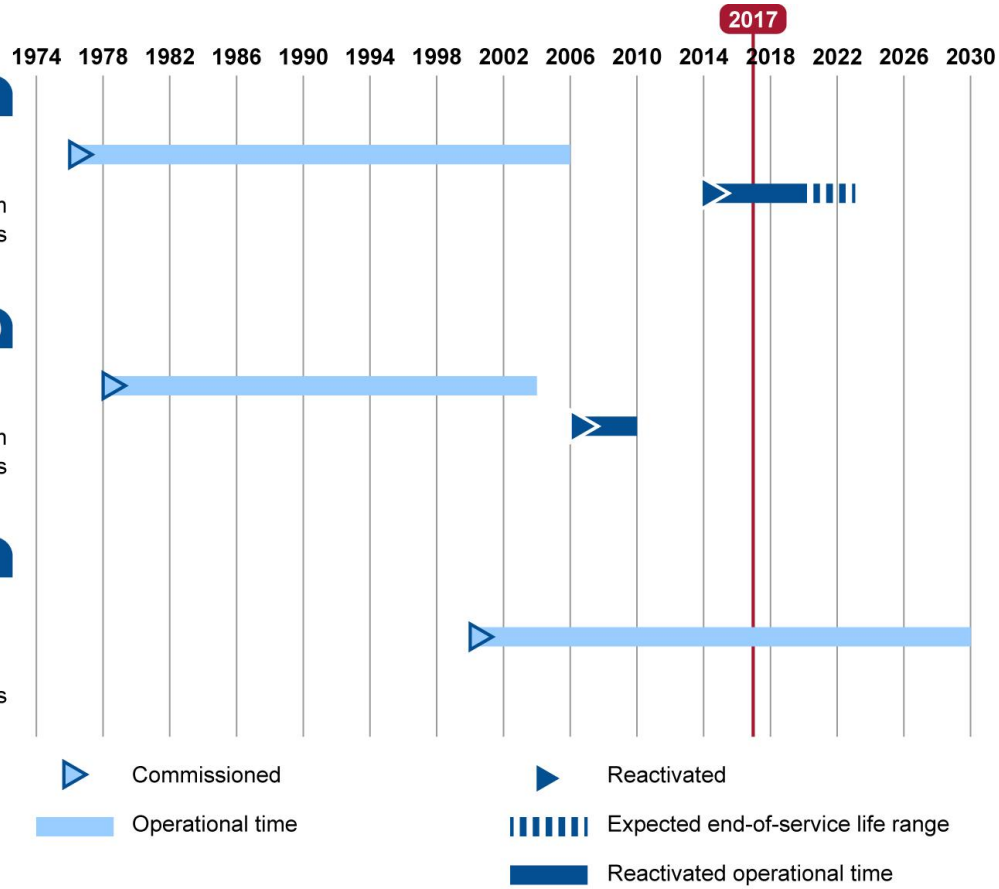
Heavy polar icebreaker

Icebreaking	6 feet at 3 knots 21 feet back and ram
Endurance	28,274 nautical miles
Brake horsepower	60,000

Healy

Medium polar icebreaker

Icebreaking	4.5 feet at 3 knots 8 feet back and ram
Endurance	21,500 nautical miles
Brake horsepower	30,000



Source: GAO analysis of U.S. Coast Guard documents; U.S. Coast Guard (photographs). | GAO-17-698R

Objective 1: USCG's Existing Polar Icebreaking Capabilities Have Been Unable to Address All Mission Requirements

Various Responsibilities Drive USCG's Determination of Polar Icebreaking Mission Requirements

Statutory and Policy Authorities

- Per statute and presidential directives, USCG has an obligation to maintain the capability to conduct polar ice operations.

- Presidential and National Security Directives (National Security Presidential Directive 66/Homeland Security Presidential Directive 25 and Presidential Decision Directive 26) provide specific direction and authority for polar missions and are focused on advancing U.S. interests in the Arctic and Antarctic. Their scope includes U.S. policy on national security and homeland security relevant to the Arctic—including protecting the environment and conserving biologic resources, among other issues.

USCG's Existing Polar Icebreaking Capabilities Have Been Unable to Address All Mission Requirements

NSF and Antarctic Icebreaking Mission Requirements

USCG polar icebreakers support U.S. Arctic and Antarctic policy objectives including providing a scientific research platform for NSF and enforcing U.S. laws and international treaty obligations in both polar regions.

- In its 2013 Polar Icebreaker Recapitalization Project Mission Need Statement, USCG reported that national and strategic directives require it "to make all reasonable efforts to assure the availability of icebreaker services as requested by NSF."
- In support of the U.S. Antarctic program and NSF for national science missions, USCG provides reimbursable icebreaking services for the annual resupply of McMurdo Research Station. During fiscal years 2007 through 2013, NSF leased commercial polar icebreakers for this when USCG polar icebreakers were inactive because of sustainment projects or, in the case of the *Polar Sea*, an unexpected major casualty.
- The *Polar Star* has conducted the resupply since 2014 following its reactivation from a multi-year service life extension project. USCG reports that the resupply is the sole mission that the *Polar Star* is able to complete annually, due to its extensive annual post-operation maintenance requirements.
- USCG polar icebreakers also support requests from other government agencies. For example, USCG may also deploy a heavy icebreaker to support Department of State enforcement of the Antarctic Treaty of 1959.

USCG's Existing Polar Icebreaking Capabilities Have Been Unable to Address All Mission Requirements

DOD Polar Icebreaking Mission Requirements

In December 2016, DOD reported to Congress that it had no specific defense requirement for icebreaking capability because Navy Arctic requirements are met by undersea and air assets which can provide year-round presence.

- DOD reported in April 2017 that its only potential defense requirement—for the Thule Air Force Base resupply in Greenland—is met by the Canadian Coast Guard through a Memorandum of Understanding with USCG.
- USCG's 2013 Polar Icebreaker Mission Needs Statement identified polar icebreaker capacity needs as partly based on the 2010 Naval Operations Concept—joint maritime security strategy implementation guidance for the Navy, Marine Corps, and USCG—which stated that U.S. naval forces had a demand for year-round polar icebreaking presence in the Arctic and Antarctic.
- In April 2017, DOD joint staff officials confirmed that DOD and Naval defense strategy had been updated and does not include icebreaking requirements. DOD officials in charge of operations in the Pacific said that although they do not have a requirement for a heavy icebreaker, icebreakers play a key role in aiding the icebreaking mission to McMurdo.
- According to Presidential Memorandum 6646, DOD and DHS (through USCG) shall provide logistical support to the U.S. Antarctic Program.

USCG's Existing Polar Icebreaking Capabilities Have Been Unable to Address All Mission Requirements

USCG Polar Icebreaker Missions

USCG reports its polar ice operations support 9 of its 11 statutory missions.

- According to our preliminary analysis of federal and international law, and discussions with USCG officials, and as shown in figure 2, USCG:
  - may use a leased vessel for 4 missions,
  - generally must use either a public vessel or warship for 5 missions.
- USCG reported that the use of a public vessel or warship enables it to meet all of the 9 statutory missions, while leasing a vessel does not.

USCG's Existing Polar Icebreaking Capabilities Have Been Unable to Address All Mission Requirements

Figure 2: Potential USCG Statutory Missions in Polar Regions and Whether USCG May Execute Them Using a Leased or Public Vessel or Warship

Vessel type	Search and rescue	Aids to navigation	Ice operations	Marine environmental protection	Ports, waterways, and coastal security[a]	Living marine resources	Other law enforcement[b]	Marine safety[b]	Defense readiness[b]
Lease[c]	✓	✓	✓	✓	—	—	—	—	—
Public vessel or warship	✓	✓	✓	✓	✓	✓	✓	✓	✓

✓ USCG may use this type of vessel to conduct this mission.

— USCG may not use this type of vessel to conduct this mission

Source: GAO analysis of US and international law, and U.S. Coast Guard officials. | GAO-17-698R

[a] Federal law provides that the Ports, Waterways, and Coastal Security mission must be carried out with public vessels or private vessels tendered gratuitously for that purpose. 33 U.S.C. § 1234. A public vessel is defined as a government-owned vessel or a demise charter. 46 U.S.C. § 2101(24). Under a demise charter , also known as a bareboat charter, USCG would take responsibility for the crewing, operation, and maintenance of the vessel as described in 46 C.F.R. § 169.107.

[b] According to the Law of the Sea Convention, to exercise immunity on the high seas, a USCG vessel must be a warship or government vessel on noncommercial service. See Law of the Sea Convention, Articles 95, 96. Additionally, only commissioned, warrant, and petty officers may board other vessels as an exercise of USCG's law enforcement authority. 14 U.S.C. § 89. Generally, a public vessel would be crewed by such officers; however, USCG officials noted that a short-term leased vessel could operate with a law enforcement attachment that would conduct law enforcement operations.

[c] For purposes of this table, a lease means a short-term or time lease, in which USCG leases a vessel for a specific period of time and the vessel is crewed by the owner of the vessel.

USCG's Existing Polar Icebreaking Capabilities Have Been Unable to Address All Mission Requirements

Mission Performance – Requests for Icebreaking Services

- USCG is often requested to provide polar icebreaking services for other U.S. government agency operations, and USCG tracks its performance in meeting these requests.
- USCG reported fulfilling 78 percent (25 of 32) of agency requests for polar icebreaking services during fiscal year 2010 through 2016.
- USCG officials cited various factors affecting USCG's ability to meet some requests. For example, officials reported the *Healy* was not available to meet some agency requests because of time constraints.
- USCG was unable to fulfill NSF requests for the McMurdo resupply during fiscal years 2010 through 2013 as its heavy polar icebreakers were inactive. USCG reported meeting all NSF annual requests for the McMurdo resupply since the *Polar Star* was reactivated in fiscal year 2014.

USCG's Existing Polar Icebreaking Capabilities Have Been Unable to Address All Mission Requirements

Mission Performance – Operational Hours

- USCG tracks operational hours conducted by its major cutters, and our preliminary analysis of these data show:

- During fiscal years 2014 through 2016, the *Healy* expended:
  - an average 97 percent (8,157 of 8,379) of its mission hours on ice operations
  - other mission hours expended included Other Law Enforcement and Defense Readiness missions

- During fiscal year 2014 through 2016, the *Polar Star* expended:
  - an average 94 percent (6,734 of its 7,188) of its mission hours on ice operations
  - other mission hours expended included Search and Rescue, Other Law Enforcement, and Defense Readiness missions

Objective 2: USCG Faces Risks in Implementing Accelerated Heavy Polar Icebreaker Acquisition Schedule

As of July 2017, the heavy polar icebreaker acquisition program was in the analyze/select phase of the DHS Acquisition Framework.

DHS Acquisition Framework phases:

1. Program identification: DHS or agency identifies a capability gap.
2. Need: Agency describes the functional capabilities required to address the specific capability gaps.
3. Analyze/select: Agency explores material solutions to meet need, evaluates feasibility of options, develops cost and schedule estimates.
4. Obtain: Agency demonstrates feasibility of the preferred alternative, refines, and buys solution.
5. Produce/Deploy/Support: Agency deploys and maintains the asset.

USCG Faces Risks in Implementing Accelerated Heavy Polar Icebreaker Acquisition Schedule

Highlights of DHS and USCG Actions Taken to Further Acquisition

2014 Program identification—Need and Priorities Established

- DHS approved need for 3 heavy and 3 medium icebreakers
- USCG reported focusing its acquisition effort on heavy icebreakers first
- USCG planned for first new heavy icebreaker in fiscal year 2026

2017 Analyze/Select phase—Establishing Acquisition Approach

- Heavy icebreakers will be built by a single U.S. shipbuilder
- Mature technology and proven ship design should be used
- USCG is planning for delivery of the first of three new heavy icebreakers in fiscal year 2023

USCG Faces Risks in Implementing Accelerated Heavy Polar Icebreaker Acquisition Schedule

Established Partnership with the Navy

- In response to Congressional direction, in August 2016 USCG established an integrated program office to leverage Navy shipbuilding expertise and collaborate on developing and implementing acquisition approach.
  - USCG and the Navy formalized partnership with an MOU in January 2017.
  - In January 2017, USCG and the Navy confirmed USCG's analysis that the preferred alternative for meeting USCG polar icebreaking capability needs is construction of a new heavy icebreaker based upon existing icebreaker design that is modified to meet USCG operational requirements.
  - According to this analysis, USCG and the Navy determined a $1.15 billion preliminary cost estimate for the lead heavy icebreaker in FY2019 dollars. These two services reported collaborating to reduce this cost estimate through the remainder of fiscal year 2017. In July 2017, officials said they had reduced the estimated cost to less than $1 billion.

USCG Faces Risks in Implementing Accelerated Heavy Polar Icebreaker Acquisition Schedule

Continued Engagement with the Shipbuilding Industry

- Integrated program office sought and obtained industry participation to inform its understanding of the domestic shipbuilding market, and inform its contract development approach.

- In October 2016, USCG issued a market research report based on its shipbuilding industry engagement efforts. Report highlights include:
  - No heavy icebreakers are available for lease that meet all USCG polar missions requirements; build-to-lease may do so, but would not be cost effective.
  - No heavy icebreakers are available for U.S. government purchase.
  - Multiple U.S. shipyards are interested and capable of building a heavy icebreaker.

USCG Faces Risks in Implementing Accelerated Heavy Polar Icebreaker Acquisition Schedule

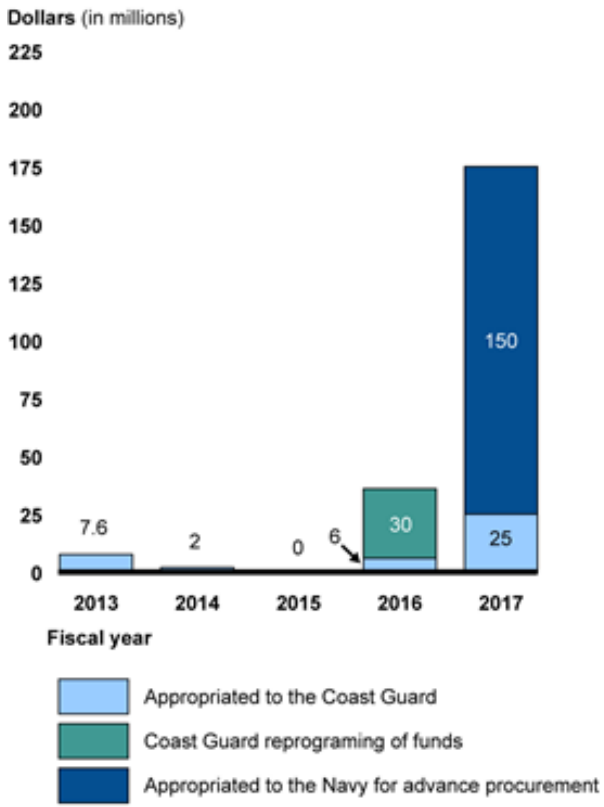
USCG Released Notional Approach and Schedule in October 2016, highlighting:

- Priority to acquire 3 heavy icebreakers through single contract for design and construction.
- Plan to obtain delivery of first heavy icebreaker in fiscal year 2023—three years sooner than initially planned.
- Plan to obtain delivery of two additional heavy icebreakers, in fiscal years 2025 and 2026, respectively.
- Plan to release request for proposal for the completion of what is known as detail design and construction in fiscal year 2018; award contract in fiscal year 2019.

USCG Faces Risks in Implementing Accelerated Heavy Polar Icebreaker Acquisition Schedule

- Since fiscal year 2013, Congress has funded the heavy polar icebreaker acquisition program, including, in total, $41 million for USCG and $150 million for the Navy for advance procurement.
- USCG reprogrammed $30 million in fiscal year 2016 funds for the program.
- Figure 3 shows funding for the heavy polar icebreaker acquisition from fiscal year 2013 to July 2017.

Figure 3: Heavy Polar Icebreaker Acquisition Funding, Fiscal Year 2013 – July 2017



Source: GAO analysis of U.S. Coast Guard information. | GAO-17-698R

USCG Faces Risks in Implementing Accelerated Heavy Polar Icebreaker Acquisition Schedule

USCG Has Addressed Some Acquisition Risks, but Accelerated Schedule Poses Continuing Challenges

- USCG reported that it has identified and taken steps to mitigate certain cost-related risks since starting the acquisition program in 2014. For example:
  - Program officials initially believed that the limited number of shipyards able to build a polar icebreaker and limited expertise in domestic polar icebreaking design and shipbuilding would negatively impact affordability.
  - In January 2017, program officials reported that these risks were unlikely to occur as a result of their mitigation efforts. Specifically, through industry engagement, market analysis, and industry study contracts, USGC determined that a sufficient number of shipyards were interested and able to build the vessel, and obtained design and shipbuilding expertise.

USCG Faces Risks in Implementing Accelerated Heavy Polar Icebreaker Acquisition Schedule

Accelerated Acquisition Schedule Poses Continued Risks

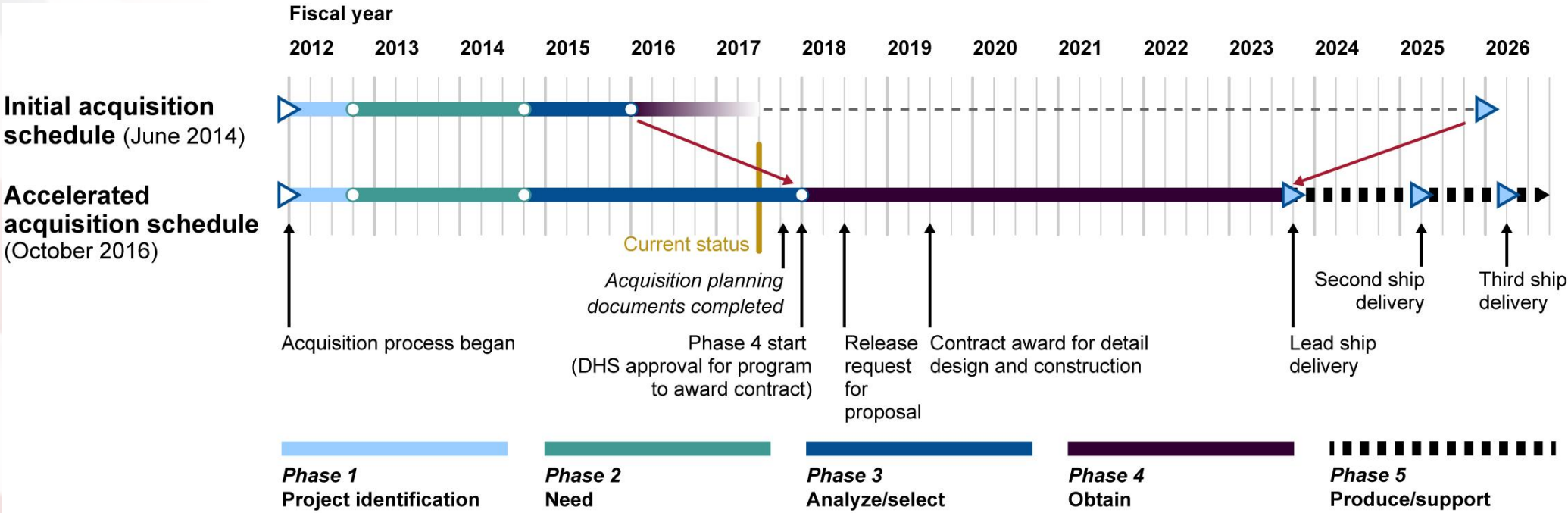
According to USCG's January 2017 annual program review, the current schedule to complete acquisition planning documents to support DHS's approval for the obtain phase is aggressive and program risks remain.

- In accordance with DHS acquisition requirements, the program must complete several acquisition planning documents to ensure it is prepared to obtain the icebreaker and, in doing so, effectively implement design and construction.
- USCG officials reported several acquisition planning documents were under development as of March 2017, including the official program schedule, and acquisition and life cycle cost estimates.
- However, USCG officials reported that should the acquisition planning documents not be completed and approved by the end of fiscal year 2017, the program may be unable to meet its schedule for entering the obtain phase in early fiscal year 2018. As a result, it may be unable to release the request for proposal for detail design and construction in mid-fiscal year 2018. This may then lead it to delay its schedule for awarding the contract in fiscal year 2019 and extend the proposed delivery date.

USCG Faces Risks in Implementing Accelerated Heavy Polar Icebreaker Acquisition Schedule

- USCG officials reported their plan for the program to achieve its next major acquisition milestone—DHS approval to enter the obtain acquisition phase—and award a contract for detail design and construction in late fiscal year 2019. See figure 4.

Figure 4: Polar Icebreaker Acquisition Program, Original and Accelerated Schedules



Source: GAO analysis of U.S. Coast Guard information. | GAO-17-698R

USCG Faces Risks in Implementing Accelerated Heavy Polar Icebreaker Acquisition Schedule

- According to guidance in USCG's Major Systems Acquisition Manual, a program does not conduct obtain phase activities until it is approved to obtain the asset—after key documents such as the cost estimate, program baseline, and acquisition plan are complete and approved.

- DHS acquisition guidance states that allowing time to ensure the acquisition information is properly understood and approved helps the program office better ensure the program is on a path to succeed through all acquisition phases.

USCG Faces Risks in Implementing Accelerated Heavy Polar Icebreaker Acquisition Schedule

To meet its accelerated acquisition schedule, the first icebreaker—currently estimated at nearly $1 billion—needs to be fully funded in fiscal year 2019.

- In fiscal year 2017, Congress appropriated a total of $150 million for the Navy for advance procurement, which, in effect, authorizes the program to begin acquisition.
- USCG is planning to begin key detail design activities in fiscal year 2019, but officials said the program may start some aspects of design in fiscal year 2018.
- USCG actions for acquiring the new icebreakers to date have been consistent with USCG and DHS acquisition guidance.
- At this time it is unknown what USCG's fiscal year 2018 funding may be for the polar icebreaker recapitalization program—both the amount and its purpose.

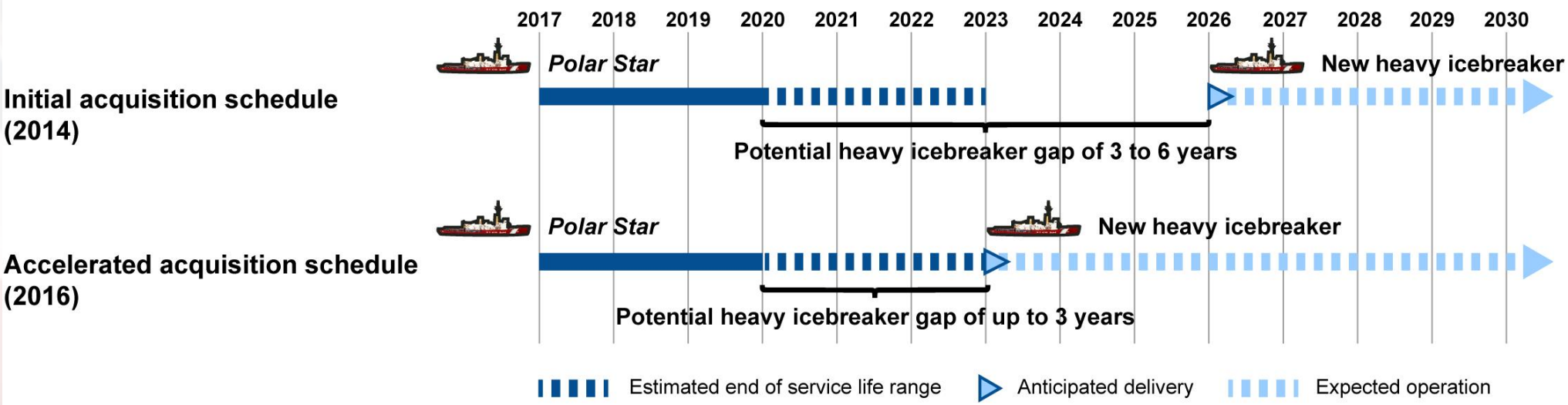
Objective 3: USCG Plans Ship Service Life Extension to Address Potential Capability Gap, but Has Not Completed Assessments

USCG Plans Limited Service Life Extension of the *Polar Star*

- According to USCG planning documents, the *Polar Star's* useful service life will end between fiscal years 2020 and 2023. This creates a potential gap in USCG's heavy icebreaking capability between the end of the *Polar Star's* service life and the arrival of the lead replacement heavy icebreaker, scheduled for delivery in 2023.
- This potential up-to-3-year heavy icebreaking capability gap is shorter than USCG would have faced under its initial heavy icebreaker acquisition schedule, which estimated lead ship delivery in 2026. See figure 5.
- USCG has previously experienced a heavy icebreaking capability gap, most recently during fiscal years 2011 through 2013, when its heavy icebreakers were inactive. During this time, NSF leased a commercial heavy icebreaker for its McMurdo resupply.
- NSF officials told us in spring 2017 that their contingency plan would be to lease a commercial icebreaker if the *Polar Star* were to be unavailable for use in the future.

USCG Plans Ship Service Life Extension to Address Potential Capability Gap, but Has Not Completed Assessments

Figure 5: USCG Potential Heavy Polar Icebreaker Capability Gap Under Initial and Notional (Accelerated) Acquisition Schedules



Source: GAO analysis of U.S. Coast Guard documents. | GAO-17-698R

USCG Plans Ship Service Life Extension to Address Potential Capability Gap, but Has Not Completed Assessments

- USCG has reported its commitment to maintaining heavy polar icebreaking capability, and has been exploring options to sustain this capability until the delivery of the first heavy icebreaker.
- In January 2017, USCG reported the results of its statutorily mandated assessment of four options and their associated costs to sustain heavy icebreaking capability, as shown in figure 6. USCG determined these options were not cost or operationally effective as a bridging strategy for addressing the potential capability gap.

Figure 6: USCG Options and Their Estimated Costs to Bridge Potential Heavy Polar Icebreaker Capability Gap, as Identified in January 2017 Assessment

	Reactivate Polar Sea for 7-10 years	Reactivate Polar Sea for 10-15 years	Reactivate Polar Sea for 15-20 years	Extend Polar Star for 7-10 years
Total acquisition cost (Dollars in millions)	$489	$551	$641	$426
Lifecycle cost (Dollars in millions)	$984	$1,347	$1,729	$934
Project duration	8 years	8.5 years	9 years	7.5 years

Source: GAO analysis of Coast Guard information.| GAO-17-698R

USCG Plans Ship Service Life Extension to Address Potential Capability Gap, but Has Not Completed Assessments

- USCG reported in its January 2017 assessment that instead it is developing plans for a limited service life extension of the *Polar Star*. However, the assessment did not include an analysis of this approach.
- This extension of the *Polar Star* is intended to keep it operational and available for the annual NSF McMurdo resupply until fiscal year 2025.
- USCG officials stated this extension would mitigate the risk if the lead ship, scheduled for delivery in fiscal year 2023, is delayed.
- The Coast Guard's Capital Investment Plan for fiscal years 2018-2022 includes $60 million of a planned $75 million for polar icebreaker sustainment, which officials reported as being the rough estimate for the *Polar Star's* limited service life extension.

USCG Plans Ship Service Life Extension to Address Potential Capability Gap, but Has Not Completed Assessments

- Officials stated in May 2017 that this $75 million estimate is based on the cost of the *Polar Star's* prior 7-10 year service life extension which was completed in fiscal year 2013.
- However, in July 2017 we reported that the Coast Guard has not completed a cost estimate for this effort, and that the $75 million estimate may be unrealistic.
- To refine its rough cost estimate, USCG officials stated in April 2017 they were conducting ship engineering inspections (e.g. structure and machinery) on the *Polar Star* to determine the work needed for the limited service life extension. USCG officials also stated they did not yet have a specific date for completing the inspections nor the development of a formal cost estimate and approach for implementing the planned extension, but are aiming to do so by December 2017.
- In keeping with OMB guidance on making decisions about federal programs, decisions about the limited service life extension should include comprehensive information about the benefits and costs associated with the planned upgrades, including its capability to meet operational objectives. In addition, cost estimating best practices should be used when developing the formal cost estimate. These best practices outline the steps that should be followed to develop a credible cost estimate to include, but not limited to, conducting a risk and uncertainty analysis that accounts for the probability of risk occurrence.

USCG Plans Ship Service Life Extension to Address Potential Capability Gap, but Has Not Completed Assessments

- Coast Guard officials had not been fully collaborating with relevant federal stakeholders to ensure that they have assessed all potential options for bridging the potential gap.
- For example, the bridging strategy planning reports and assessments the Coast Guard has issued thus far have not included input from relevant federal stakeholders such as NSF, the sole mission requester of the *Polar Star*, to ensure that all alternatives are fully considered.
- Coast Guard officials stated that the Coast Guard meets regularly with NSF through bi-weekly meetings to discuss a range of icebreaking issues, but had not specifically involved NSF in technical working groups of an engineering nature since this is a Coast Guard responsibility.
- NSF officials confirmed in April 2017 that they had not been included in the Coast Guard's development of the current bridging strategy approach and believed their involvement in the development of this approach would inform the effort and support decision makers.
- As of August 2017, NSF officials reported that the situation had changed and their collaboration had improved as the Coast Guard had taken steps to engage NSF regarding the bridging strategy.

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