

Coast Guard Polar Icebreaker Modernization: Background and Issues for Congress

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Summary

The Coast Guard's proposed FY2018 budget requests \$19 million in acquisition funding for a new polar icebreaker that the Coast Guard wants to begin building in FY2019. The total acquisition cost of a new polar icebreaker had generally been estimated informally at roughly \$1 billion, including design costs, but a congressionally mandated July 2017 report from the National Academies of Sciences, Engineering, and Medicine (NASEM) on the acquisition and operation of polar icebreakers estimates that the ship could cost less (and perhaps considerably less) than \$1 billion.

The project to acquire a new polar icebreaker was initiated in the Coast Guard's FY2013 budget submission. The project has received about \$220.6 million in acquisition funding through FY2017, including \$175 million in FY2017 that was provided in the Coast Guard's acquisition account (\$25 million) and the Navy's shipbuilding account (\$150 million).

The operational U.S. polar icebreaking fleet currently consists of one heavy polar icebreaker, *Polar Star*, and one medium polar icebreaker, *Healy*. In addition to *Polar Star*, the Coast Guard has a second heavy polar icebreaker, *Polar Sea*. This ship suffered an engine casualty in June 2010 and has been non-operational since then. *Polar Star* and *Polar Sea* entered service in 1976 and 1978, respectively, and are now well beyond their originally intended 30-year service lives.

Coast Guard polar icebreakers perform a variety of missions supporting U.S. interests in polar regions. A Department of Homeland Security (DHS) Mission Need Statement (MNS) approved in June 2013 states that "current requirements and future projections ... indicate the Coast Guard will need to expand its icebreaking capacity, potentially requiring a fleet of up to six icebreakers (3 heavy and 3 medium) to adequately meet mission demands in the high latitudes...."

The current condition of the U.S. polar icebreaker fleet, the DHS MNS, and concerns among some observers about whether the United States is adequately investing in capabilities to carry out its responsibilities and defend its interests in the Arctic, have focused policymaker attention on the question of whether and when to acquire one or more new heavy polar icebreakers as replacements for *Polar Star* and *Polar Sea*.

On October 26, 2016, the Coast Guard released a request for information (RFI) to receive industry feedback on its notional polar icebreaker acquisition approach and schedule. The summary of the RFI, dated October 25, 2016, presents a notional schedule for acquiring three heavy polar icebreakers under which procurement of long leadtime materials (LLTM) for the three ships would start in the fourth quarter of FY2019, the second quarter of FY2021, and the second quarter of FY2022, respectively, and the ships would be delivered in the fourth quarter of FY2023, the second quarter of FY2025, and the second quarter of FY2026, respectively.

The summary of the RFI states that the Coast Guard currently envisions having a single U.S. shipyard build all three ships under a contract with options. A contract with options can be viewed as a form of annual contracting. An alternative would be a block buy contract. A block buy contract would reduce the government's flexibility regarding whether and when to acquire the second and third ships, and what design to build them to, and in return reduce the combined acquisition cost of the three ships. CRS estimates that compared to costs using a contract with options, using a block buy contract that included economic order quantity (EOQ) purchases (i.e., up-front batch purchases) of materials and components for the three ships would reduce the combined acquisition cost of the three ships by upwards of 7%, which could equate to a savings of upwards of \$200 million. The July 2017 NASEM report recommends using a block buy contract to procure a single class of four science-ready heavy polar icebreakers to meet (along with continued operation of *Healy*) U.S. needs for both heavy and medium polar icebreakers.

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Introduction

This report provides background information and issues for Congress on the sustainment and modernization of the Coast Guard's polar icebreaker fleet. The Coast Guard's proposed FY2018 budget requests \$19 million in acquisition funding for a new polar icebreaker that the Coast Guard wants to begin building in FY2019. The issue for Congress is whether to approve, reject, or modify the Administration's FY2018 acquisition funding request for a new polar icebreaker, and, more generally, whether to approve, reject, or modify the Coast Guard's overall plan for sustaining and modernizing the polar icebreaking fleet. Congress's decisions on this issue could affect Coast Guard funding requirements, the Coast Guard's ability to perform its polar missions, and the U.S. shipbuilding industrial base.

This report does not cover the icebreakers that the Coast Guard operates on the Great Lakes. A separate CRS report covers acquisition of general-purpose cutters for the Coast Guard.¹ Another CRS report provides an overview of various issues relating to the Arctic.²

Background

Missions of U.S. Polar Icebreakers

U.S. polar ice operations support 9 of the Coast Guard's 11 statutory missions.³ The roles of U.S. polar icebreakers can be summarized as follows:

- conducting and supporting scientific research in the Arctic and Antarctic;
- defending U.S. sovereignty in the Arctic by helping to maintain a U.S. presence in U.S. territorial waters in the region;
- defending other U.S. interests in polar regions, including economic interests in waters that are within the U.S. exclusive economic zone (EEZ) north of Alaska;
- monitoring sea traffic in the Arctic, including ships bound for the United States; and
- conducting other typical Coast Guard missions (such as search and rescue, law enforcement, and protection of marine resources) in Arctic waters, including U.S. territorial waters north of Alaska.

Operations to support National Science Foundation (NSF) research activities in the Arctic and Antarctic have accounted in the past for a significant portion of U.S. polar icebreaker operations.⁴

¹ CRS Report R42567, *Coast Guard Cutter Procurement: Background and Issues for Congress*, by Ronald O'Rourke.

² CRS Report R41153, *Changes in the Arctic: Background and Issues for Congress*, coordinated by Ronald O'Rourke.

³ The nine missions supported by polar ice operations are search and rescue; maritime safety; aids to navigation; ice operations; marine environmental protection; living marine resources; other law enforcement (protect the exclusive economic zone [EEZ]); ports, waterways and costal security; and defense readiness. The two missions not supported by polar ice operations are illegal drug interdiction and undocumented migrant interdiction. (Department of Homeland Security, *Polar Icebreaking Recapitalization Project Mission Need Statement, Version 1.0*, approved by DHS June 28, 2013, p. 10.)

⁴ This passage, beginning with "The roles of...", originated in an earlier iteration of this CRS report and was later transferred by GAO with minor changes to Government Accountability Office, *Coast Guard[]Efforts to Identify Arctic Requirements Are Ongoing, but More Communication about Agency Planning Efforts Would Be Beneficial*, GAO-10-870, September 2010, p. 53.

Supporting NSF research in the Antarctic has included performing an annual mission, called Operation Deep Freeze, to break through the Antarctic ice so as to resupply McMurdo Station, the large U.S. Antarctic research station located on the shore of McMurdo Sound, near the Ross Ice Shelf.

Although polar ice is diminishing due to climate change, observers generally expect that this development will not eliminate the need for U.S. polar icebreakers, and in some respects might increase mission demands for them. Even with the diminishment of polar ice, there are still significant ice-covered areas in the polar regions. Diminishment of polar ice could lead in coming years to increased commercial ship, cruise ship, and naval surface ship operations, as well as increased exploration for oil and other resources, in the Arctic—activities that could require increased levels of support from polar icebreakers.⁵ Changing ice conditions in Antarctic waters have made the McMurdo resupply mission more challenging since 2000.⁶

The Coast Guard's strategy document for the Arctic region, released on May 21, 2013, states that "The United States must have adequate icebreaking capability to support research that advances fundamental understanding of the region and its evolution," and that "The Nation must also make a strategic investment in icebreaking capability to enable access to the high latitudes over the long-term."⁷

Current U.S. Polar Icebreakers

The U.S. polar icebreaker fleet currently includes four ships—three Coast Guard ships and one ship operated by the NSF. The ships are described briefly below.

Three Coast Guard Ships

The Coast Guard's three polar icebreakers—*Polar Star*, *Polar Sea*, and *Healy*—are multimission ships that can break through ice, support scientific research operations, and perform other missions typically performed by Coast Guard ships.

Heavy Polar Icebreakers Polar Star and Polar Sea

Polar Star (WAGB-10) and *Polar Sea* (WAGB-11),⁸ sister ships built to the same general design (**Figure 1** and **Figure 2**), were acquired in the early 1970s as replacements for earlier U.S. icebreakers. They were designed for 30-year service lives, and were built by Lockheed Shipbuilding of Seattle, WA, a division of Lockheed that also built ships for the U.S. Navy, but which exited the shipbuilding business in the late 1980s.

The ships are 399 feet long and displace about 13,200 tons.⁹ They are among the world's most powerful non-nuclear-powered icebreakers, with a capability to break through ice up to 6 feet

⁵ For more on changes in the Arctic due to diminishment of Arctic ice, see CRS Report R41153, *Changes in the Arctic: Background and Issues for Congress*, coordinated by Ronald O'Rourke.

⁶ National Research Council, *Polar Icebreakers in a Changing World, An Assessment of U.S. Needs*, Washington, 2007, pp. 6-7, 14, 63.

⁷ *United States Coast Guard Arctic Strategy*, Washington, May 2013, p. 35; accessed May 24, 2013, at http://www.uscg.mil/seniorleadership/DOCS/CG_Arctic_Strategy.pdf.

⁸ The designation WAGB means Coast Guard icebreaker. More specifically, W means Coast Guard ship, A means auxiliary, G means miscellaneous purpose, and B means icebreaker.

⁹ By comparison, the Coast Guard's new National Security Cutters—its new high-endurance cutters—are about 418 feet long and displace roughly 4,000 tons.

thick at a speed of 3 knots. Because of their icebreaking capability, they are considered heavy polar icebreakers. In addition to a crew of 134, each ship can embark a scientific research staff of 32 people.

Figure 1. *Polar Star* and *Polar Sea*
(Side by side in McMurdo Sound, Antarctica)



Source: Coast Guard photo accessed at <http://www.uscg.mil/pacarea/cgcpolarsea/history.asp> on April 21, 2011.

Polar Star was commissioned into service on January 19, 1976, and consequently is now several years beyond its intended 30-year service life. Due to worn-out electric motors and other problems, the Coast Guard placed the ship in caretaker status on July 1, 2006.¹⁰ Congress in FY2009 and FY2010 provided funding to repair *Polar Star* and return it to service for 7 to 10 years; the repair work, which reportedly cost about \$57 million, was completed, and the ship was reactivated on December 14, 2012.¹¹ Although the repair work on the ship was intended to give it another 7 to 10 years of service, an August 30, 2010, press report quoted then-Commandant of the Coast Guard, Admiral Robert Papp, as saying, “We’re getting her back into service, but it’s a little

¹⁰ Source for July 1, 2006, date: U.S. Coast Guard email to CRS on February 22, 2008. The Coast Guard’s official term for caretaker status is “In Commission, Special.”

¹¹ See, for example, Kyung M. Song, “Icebreaker *Polar Star* Gets \$57 Million Overhaul,” *Seattle Times*, December 14, 2012.

uncertain to me how many more years we can get out of her in her current condition, even after we do the engine repairs.”¹²

Figure 2. Polar Sea



Source: Coast Guard photo accessed at <http://www.uscg.mil/pacarea/cgcpolarsea/img/PSEApics/FullShip2.jpg> on April 21, 2011.

Polar Sea was commissioned into service on February 23, 1978, and consequently is also several years beyond its originally intended 30-year service life. In 2006, the Coast Guard completed a rehabilitation project that extended the ship’s expected service life to 2014. On June 25, 2010, however, the Coast Guard announced that *Polar Sea* had suffered an engine casualty, and the ship was unavailable for operation after that.¹³ The Coast Guard placed *Polar Sea* in commissioned,

¹² Cid Standifer, “Papp: Refurbished Icebreaker Hulls Could Last ‘An Awful Long Time,’” *Inside the Navy*, August 30, 2010.

¹³ On June 25, 2010, the Coast Guard announced that

POLAR SEA suffered an unexpected engine casualty and will be unable to deploy on its scheduled fall 2010 Arctic patrol and may be unavailable for Operation Deep Freeze [the annual mission to break through the Antarctic ice so as to resupply McMurdo Station], Dec. 20 to Jan 2, 2011.

POLAR SEA will likely be in a maintenance status and unavailable for operation until at least January 2011....

Currently, the 420-foot CGC HEALY, commissioned in 1999, is the service’s sole operational polar region icebreaker. While the HEALY is capable of supporting a wide range of Coast Guard missions in the polar regions, it is a medium icebreaker capable of breaking ice up to 4.5-feet thick at three knots.

The impact on POLAR SEA’s scheduled 2011 Arctic winter science deployment, scheduled for Jan. 3 to Feb. 23, 2011, is not yet known and depends on the scope of required engine repair.

(“Icebreaker POLAR SEA Sidelined By Engine Troubles,” *Coast Guard Compass (Official Blog of the U.S. Coast Guard)*, June 25, 2010.)

A June 25, 2010, report stated that “inspections of the Polar Sea’s main diesel engines revealed excessive wear in 33 cylinder assemblies. The Coast Guard is investigating the root cause and hopes to have an answer by August.” (“USCG Cancels Polar Icebreaker’s Fall Deployment,” *DefenseNews.com*, June 25, 2010.) Another June 25 report stated that “five of [the ship’s] six mighty engines are stilled, some with worn pistons essentially welded to their sleeves.” (Andrew C. Revkin, “America’s Heavy Icebreakers Are Both Broken Down,” *Dot Earth (New York Times blog)*, June 25, 2010.)

inactive status on October 14, 2011. The Coast Guard transferred certain major equipment from *Polar Sea* to *Polar Star* to facilitate *Polar Star*'s return to service.¹⁴

Section 222 of the Coast Guard and Maritime Transportation Act of 2012 (H.R. 2838/P.L. 112-213 of December 20, 2012) prohibited the Coast Guard from removing any part of *Polar Sea* and from transferring, relinquishing ownership of, dismantling, or recycling the ship until it submitted a business case analysis of the options for and costs of reactivating the ship and extending its service life to at least September 30, 2022, so as to maintain U.S. polar icebreaking capabilities and fulfill the Coast Guard's high latitude mission needs, as identified in the Coast Guard's July 2010 High Latitude Study.¹⁵ (The business case analysis was submitted to Congress with a cover date of November 7, 2013.)

Medium Polar Icebreaker Healy

Healy (WAGB-20) (**Figure 3**) was acquired in the early 1990s as a complement to *Polar Star* and *Polar Sea*, and was commissioned into service on August 21, 2000. The ship was built by Avondale Industries, a shipyard located near New Orleans, LA, that built numerous Coast Guard and Navy ships, and which eventually became part of Huntington Ingalls Industries (HII).¹⁶ HII in recent years has wound down shipbuilding activities at Avondale; the facility is no longer building ships.¹⁷

Healy is a bit larger than *Polar Star* and *Polar Sea*—it is 420 feet long and displaces about 16,000 tons. Compared to *Polar Star* and *Polar Sea*, *Healy* has less icebreaking capability (it is considered a medium polar icebreaker), but more capability for supporting scientific research. The ship can break through ice up to 4½ feet thick at a speed of 3 knots, and embark a scientific research staff of 35 (with room for another 15 surge personnel and 2 visitors). The ship is used primarily for supporting scientific research in the Arctic.

One National Science Foundation Ship

The nation's fourth polar icebreaker is *Nathaniel B. Palmer*, which was built for the NSF in 1992 by North American Shipbuilding, of Larose, LA. The ship, called *Palmer* for short, is owned by Offshore Service Vessels LLC, operated by Edison Chouest Offshore (ECO) of Galliano, LA (a firm that owns and operates research ships and offshore deepwater service ships),¹⁸ and chartered by the NSF. *Palmer* is considerably smaller than the Coast Guard's three polar icebreakers—it is 308 feet long and has a displacement of about 6,500 tons. It is operated by a crew of about 22, and can embark a scientific staff of 27 to 37.¹⁹

¹⁴ Source: October 17, 2011, email to CRS from Coast Guard Congressional Affairs office.

¹⁵ For more on the High Latitude Study, see **Appendix A**.

¹⁶ HII was previously owned by Northrop Grumman, during which time it was known as Northrop Grumman Shipbuilding.

¹⁷ See, for example, Marc Selinger, "Avondale Shipyard's Fate Remains Unclear," *Defense Daily*, April 21, 2015: 5.

¹⁸ For more on ECO, see the firm's website at <http://www.chouest.com/>.

¹⁹ Sources vary on the exact number of scientific staff that can be embarked on *Palmer*. For some basic information on the ship, see <http://www.nsf.gov/od/opp/support/nathpalm.jsp>,

http://www.usap.gov/vesselScienceAndOperations/documents/prvnews_june03.pdf and

<http://nsf.gov/od/opp/antarct/treaty/pdf/plans0607/15plan07.pdf>,

<http://www.nsf.gov/pubs/1996/nsf9693/fls.htm>, and

<http://www.hazegray.org/worldnav/usa/nsf.htm>.

Figure 3. Healy



Source: Coast Guard photo accessed at http://www.uscg.mil/history/webcutters/Healy_CGC_I_300.jpg on April 21, 2011.

Unlike the Coast Guard's three polar icebreakers, which are multimission ships, *Palmer* was purpose-built as a single-mission ship for conducting and supporting scientific research in the Antarctic. It has less icebreaking capability than the Coast Guard's polar icebreakers, being capable of breaking ice up to 3 feet thick at speeds of 3 knots. This capability is sufficient for breaking through the more benign ice conditions found in the vicinity of the Antarctic Peninsula, so as to resupply Palmer Station, a U.S. research station on the peninsula. Some observers might view *Palmer* not so much as an icebreaker as an oceanographic research ship with enough icebreaking capability for the Antarctic Peninsula. *Palmer's* icebreaking capability is not considered sufficient to perform the McMurdo resupply mission.

Summary

In summary, the U.S. polar icebreaking fleet currently includes

- two heavy polar icebreakers (*Polar Star* and *Polar Sea*), one of which is operational, that are designed to perform missions in either polar area, including the challenging McMurdo resupply mission;
- one medium polar icebreaker (*Healy*) that is used primarily for scientific research in the Arctic; and
- one ship (*Palmer*) that is used for scientific research in the Antarctic.

Table 1 summarizes the four ships.

Table 1. U.S. Polar Icebreakers

	<i>Polar Star</i>	<i>Polar Sea</i>	<i>Healy</i>	<i>Palmer</i>
Operator	USCG	USCG	USCG	NSF
U.S.-Government owned?	Yes	Yes	Yes	No ^a
Currently operational?	Yes (reactivated on December 14, 2012)	No	Yes	Yes
Entered service	1976	1978	2000	1992
Length (feet)	399	399	420	308
Displacement (tons)	13,200	13,200	16,000	6,500
Icebreaking capability at 3 knots (ice thickness in feet)	6 feet	6 feet	4.5 feet	3 feet
Icebreaking capability using back and ram (ice thickness in feet)	21 feet	21 feet	8 feet	n/a
Operating temperature	-60° Fahrenheit	-60° Fahrenheit	-50° Fahrenheit	n/a
Crew (when operational)	155 ^b	155 ^b	85 ^c	22
Additional scientific staff	32	32	35 ^d	27-37

Sources: Prepared by CRS using data from U.S. Coast Guard, National Research Council, National Science Foundation, Department of Homeland Security (DHS) Office of Inspector General, and (for *Palmer*) additional online reference sources. n/a is not available.

- Owned by Edison Chouest Offshore (ECO) of Galliano, LA, and leased to NSF through Raytheon Polar Services Company (RPSC).
- Includes 24 officers, 20 chief petty officers, 102 enlisted, and 9 in the aviation detachment.
- Includes 19 officers, 12 chief petty officers, and 54 enlisted.
- In addition to 85 crew members 85 and 35 scientists, the ship can accommodate another 15 surge personnel and 2 visitors.

In addition to the four ships shown in **Table 1**, a fifth U.S.-registered polar ship with icebreaking capability—the icebreaking anchor handling tug supply vessel *Aiviq*—is used by Royal Dutch Shell oil company to support oil exploration and drilling in Arctic waters off Alaska. The ship, which completed construction in 2012, is owned by ECO and chartered by Royal Dutch Shell. It is used primarily for towing and laying anchors for drilling rigs, but is also equipped for responding to oil spills.

Required Numbers of U.S. Polar Icebreakers

June 2013 DHS Polar Icebreaker Mission Need Statement

The Department of Homeland Security (DHS) in June 2013 approved a Mission Need Statement (MNS) for the polar icebreaker recapitalization project. The MNS states (emphasis added):

This Mission Need Statement (MNS) establishes the need for polar icebreaker capabilities provided by the Coast Guard, to ensure that it can meet current and future mission requirements in the polar regions....

Polar Ice Operations support nine of the eleven authorized [i.e., statutory] Coast Guard missions....²⁰

²⁰ The nine missions supported by polar ice operations are search and rescue; maritime safety; aids to navigation; ice operations; marine environmental protection; living marine resources; other law enforcement (protect the exclusive (continued...))

Current requirements and future projections based upon cutter demand modeling, as detailed in the HLMAR [High Latitude Mission Analysis Report], indicate the Coast Guard will need to expand its icebreaking capacity, potentially requiring a fleet of up to six icebreakers (3 heavy and 3 medium) to adequately meet mission demands in the high latitudes.... The analysis took into account both the Coast Guard statutory mission requirements and additional requirements for year-round presence in both polar regions detailed in the Naval Operations Concept (NOC) 2010. The NOC describes when, where, and how U.S. naval forces will contribute to enhancing security, preventing conflict, and prevailing in war. The analysis also evaluated employing single and multi-crewing concepts. Baseline employment standards for single and multi-crew concepts used 185 DAFHP and 250/280 DAFHP, respectively. Strategic home porting analysis based upon existing infrastructure and distance to operational areas provided the final input to determine icebreaker capacity demand....

In response to the National guidance, the HLMAR was commissioned that identified capability gaps in the Coast Guard's ability to support and conduct required missions in the polar regions. Nine of the Coast Guard's eleven authorized mission programs are conducted in the high latitudes. These directly support the 2012 Department of Homeland Security Strategic Plan as well as twelve of the 22 goals and objectives stated in the *Quadrennial Homeland Security Review (QHSR) Report: A Strategic Framework for a Secure Homeland, February 2010* and the *U.S. Department of Homeland Security Annual Performance Report, Fiscal Years 2010 – 2012*....

... numerous agencies of the Federal Government have an obligation to conduct polar ice operations to meet the requirements mandated by treaties, statutes, and executive direction....

Without recapitalizing the Nation's polar icebreaking capability, the gap between the mission demand and icebreaking capacity and capability will continue to grow. Given the most optimistic scenarios, this gap will grow as the existing fleet ages beyond the vessels' designed service lives and unscheduled maintenance diminishes the assets' operational availabilities. Even with straightline demand, the current polar icebreaker fleet will not be sufficient to meet projected mission demands. The Coast Guard will be unable to meet either the current and projected Coast Guard and Federal agency mission demands or the goals for the QHSR in the high latitudes. Disapproval of the polar icebreaker project will further challenge the agencies responsible for maintaining an active and influential United States presence in the polar regions.²¹

A number of studies have been conducted in recent years to assess U.S. requirements for polar icebreakers and options for sustaining and modernizing the Coast Guard's polar icebreaker fleet. The findings of some of these studies are presented in the **Appendix A**.

January 2014 Implementation Plan for National Strategy for Arctic Region

On May 10, 2013, the Obama Administration released a document entitled *National Strategy for the Arctic Region*.²² On January 30, 2014, the Obama Administration released an implementation

(...continued)

economic zone [EEZ]); ports, waterways and costal security; and defense readiness. The two missions not supported by polar ice operations are illegal drug interdiction and undocumented migrant interdiction. (Department of Homeland Security, *Polar Icebreaking Recapitalization Project Mission Need Statement, Version 1.0*, approved by DHS June 28, 2013, p. 10.)

²¹ Department of Homeland Security, *Polar Icebreaking Recapitalization Project Mission Need Statement, Version 1.0*, approved by DHS June 28, 2013, pp. 1, 2, 9, 10, 11, 12.

²² *National Strategy for the Arctic Region*, May 2013, 11 pp.; accessed May 14, 2013, at <http://www.whitehouse.gov/> (continued...)

plan for this strategy.²³ Of the 36 or so specific initiatives in the implementation plan, one is entitled “Sustain federal capability to conduct maritime operations in ice-impacted waters.” The implementation plan states the following regarding this initiative:

Objective: Ensure the United States maintains icebreaking and ice-strengthened ship capability with sufficient capacity to project a sovereign U.S. maritime presence, support U.S. interests in the Polar Regions and facilitate research that advances the fundamental understanding of the Arctic.

Next Steps: The Federal Government requires the ability to conduct operations in ice-impacted waters in the Arctic. As maritime activity in the Arctic region increases, expanded access will be required. Next steps include:

- The lead and supporting Departments and Agencies will develop a document that lists the capabilities needed to operate in ice-impacted waters to support Federal activities in the Polar Regions and emergent sovereign responsibilities over the next ten to twenty years by the end of 2014.

- Develop long-term plans to sustain Federal capability to physically access the Arctic with sufficient capacity to support U.S. interests by the end of 2017.

Measuring Progress: Sustaining federal capability will be demonstrated through the Federal Government’s ability to conduct operations in the Arctic to support statutory missions and sovereign responsibilities, and to advance interests in the region. Progress in implementing this objective will be measured by completion of the capabilities document, and long term sustainment plan.

Lead Agency: Department of Homeland Security

Supporting Agencies: Department of Commerce (National Oceanic and Atmospheric Administration), Department of Defense, Department of State, Department of Transportation, National Science Foundation[.]²⁴

Coast Guard Testimony

At a November 17, 2015, hearing before the Europe, Eurasia, and Emerging Threats subcommittee and the Western Hemisphere subcommittee of the House Foreign Affairs Committee, then-Vice Admiral Charles Michel, the Vice Commandant of the Coast Guard, stated in his prepared statement that “Polar icebreakers are critical to supporting key national priorities laid out in the National Security Presidential Directive on Arctic Region policy and the National Strategy for the Arctic Region.”²⁵ During the discussion portion of the hearing, Michel testified

(...continued)

sites/default/files/docs/nat_arctic_strategy.pdf. The document includes a cover letter from President Obama dated May 10, 2013.

²³ The White House news release about the release of the implementation plan was posted at <http://www.whitehouse.gov/blog/2014/01/30/white-house-releases-implementation-plan-national-strategy-arctic-region>. The document is posted at http://www.whitehouse.gov/sites/default/files/docs/implementation_plan_for_the_national_strategy_for_the_arctic_region_-_fi....pdf.

²⁴ *Implementation Plan for The National Strategy for the Arctic Region*, January 2014, pp. 8-9.

²⁵ Testimony of Vice Admiral Charles D. Michel, Vice Commandant, U.S. Coast Guard, on “Arctic Operations” Before the House Foreign Affairs Committee—Western Hemisphere & Europe, Eurasia, and Emerging Threats Subcommittees, November 17, 2015, p. 3.

that the “Coast Guard needs at least two heavy icebreakers to provide year-round assured access and self-rescueability in the polar regions.”²⁶

At a June 14, 2016, hearing before the Coast Guard and Maritime Transportation subcommittee of the House Transportation and Infrastructure Committee, Admiral Michel testified that “our commandant also testified that we need self-rescue capability for our heavy icebreaker and that includes the existing *Polar Star* that we have out there now. So that means at least two, the High Latitude study says three heavy polar icebreakers is what the Coast Guard's requirement is. So that's kind of where we're talking about for heavy icebreakers.”²⁷

October 2016 Coast Guard Request for Information (RFI)

On October 26, 2016, the Coast Guard released a request for information (RFI) to receive industry feedback on its notional polar icebreaker acquisition approach and schedule. The summary of the RFI, dated October 25, 2016, states that “The United States Coast Guard has a need for three Heavy Polar Icebreakers and three Medium Polar Icebreakers with the priority being Heavy Polar Icebreakers.”²⁸

Polar Icebreakers Operated by Other Countries

In discussions of U.S. polar icebreakers, some observers note the size of the polar icebreaking fleets operated by other countries. Countries with interests in the polar regions have differing requirements for polar icebreakers, depending on the nature and extent of their polar activities. **Table 2** shows a Coast Guard summary of major icebreakers around the world; the figures in the table include some icebreakers designed for use in the Baltic Sea.

Coast Guard Polar Icebreaker Program

Overview

The Coast Guard's proposed FY2018 budget requests \$19 million in acquisition funding for a new polar icebreaker that the Coast Guard wants to begin building in FY2019. The project to acquire a new polar icebreaker was initiated in the Coast Guard's FY2013 budget submission. The project has received about \$220.6 million in acquisition funding through FY2017, including about \$45.6 million in FY2013-FY2016 and \$175 million in FY2017. The \$175 million in FY2017 was provided in the Coast Guard's acquisition account (\$25 million) and the Navy's shipbuilding account (\$150 million).

²⁶ Transcript of hearing.

²⁷ Transcript of hearing.

²⁸ Summary of RFI, October 25, 2016, page 2, accessed November 10, 2016, at <https://www.uscg.mil/acquisition/icebreaker/pdf/Acquisition-Strategy-RFI.pdf>.

Table 2. Major Icebreakers of the World as of May 1, 2017

(Includes some icebreakers designed for Baltic use)

	Total all types, in inventory (+ under construction + planned)	In inventory, government owned or operated			In inventory, privately owned and operated		
		45,000 or more BHP	20,000 to 44,999 BHP	10,000 to 19,999 BHP	45,000 or more BHP	20,000 to 44,999 BHP	10,000 to 19,999 BHP
Russia	46 (+11 + 4)	6 (all nuclear powered; 2 not operational)	16 (1 nuclear powered; 5 designed for Baltic use)	7		9	8
Finland	10		7 (4 designed for Baltic use)	1			2
Canada	7 (+2 +5)		2	5			
Sweden	7 (+0 +3)		4 (3 designed for Baltic use)				3
United States	5 (+0 +3)	2 (<i>Polar Star</i> and <i>Polar Sea</i> ; <i>Polar Sea</i> not operational)	1 (<i>Healy</i>)			1 (<i>Aiviq</i>)	1 (<i>Palmer</i>)
Denmark	4						4 (all 4 designed for Baltic use)
China	3 (+1 +0)			3			
Estonia	2			2 (both designed for Baltic use)			
Norway	1 (+1 +0)			1			
Germany	1 (+0 +1)						1
Chile	1 (+0 +1)			1			
Australia	1 (+0 +1)			1			
Latvia	1			1 (designed for Baltic use)			
Japan	1		1				
South Korea	1			1			
South Africa	1			1			
Argentina	1			1 (not operational)			
United Kingdom	0 (+1 +0)						

Source: Table prepared by CRS based on U.S. Coast Guard chart showing data compiled by the Coast Guard as of May 1, 2017, accessed September 14, 2017, at <http://www.dco.uscg.mil/Portals/9/DCO%20Documents/Office%20of%20Waterways%20and%20Ocean%20Policy/20170501%20major%20icebreaker%20chart.pdf?ver=2017-06-08-091723-907>.

Notes: BHP = the brake horsepower of the ship's power plant. A ship with 45,000 or more BHP might be considered a heavy polar icebreaker, a ship with 20,000 to 44,999 BHP might be considered a medium polar icebreaker, and a ship with 10,000 to 19,999 BHP might be considered a light polar icebreaker or an ice-capable polar ship.

Desired Capabilities for New Polar Icebreaker

The Coast Guard's key performance parameters (KPPs) for a new polar icebreaker include the following:

- an ability to break through 6 feet of ice at 3 knots (threshold) or 8 feet of ice at three knots (objective);²⁹
- an ability to break through ridged ice of 21 feet;
- an ability to operate without replenishment (i.e., resupply) for 80 days (threshold) or 90 days (objective); and
- an ability to exchange voice and data with DHS, Coast Guard, Defense Department units, and other stakeholders.³⁰

Additional desired capabilities include the following:

- an ability to operate for a total of 3,300 hours (the equivalent of 137.5 days) per year (threshold) or a total of 4,050 hours (the equivalent of 168.75 days) per year (objective);
- an operational availability (i.e., percentage of time available for operation) of 85% (threshold) or 92% (objective); and
- a space and weight allowance for accommodating a communication workspace (objective) or an installed communication workspace (threshold).³¹

The Coast Guard states that the desired capabilities for a new polar icebreaker are similar to the capabilities of *Polar Star* and *Polar Sea* in the following general ways:

- the ability to conduct long-range, high-endurance, independent operations with heavy icebreaking capability;
- flexibility in personnel support spaces and systems;
- interoperability to support interagency and interservice mission execution.³²

The Coast Guard states that the desired capabilities for a new polar icebreaker differ from the capabilities of *Polar Star* and *Polar Sea* in the following general ways:

²⁹ The terms *threshold* and *objective* are acquisition terms. Threshold can be translated roughly as minimum required capability. Objective can be translated roughly as maximum or preferred capability (if feasible and affordable).

³⁰ Coast Guard polar icebreaker program industry day briefing entitled "Polar Icebreaker (PIB) Acquisition Program Industry Engagement," slide 23, accessed April 4, 2016, at <http://www.uscg.mil/ACQUISITION/icebreaker/pdf/Industry%20Day%2018%20March%202016.pdf>.

³¹ Coast Guard polar icebreaker program industry day briefing entitled "Polar Icebreaker (PIB) Acquisition Program Industry Engagement," slide 32, accessed April 4, 2016, at <http://www.uscg.mil/ACQUISITION/icebreaker/pdf/Industry%20Day%2018%20March%202016.pdf>.

³² Coast Guard polar icebreaker program industry day briefing entitled "Polar Icebreaker (PIB) Acquisition Program Industry Engagement," slide 24, accessed April 4, 2016, at <http://www.uscg.mil/ACQUISITION/icebreaker/pdf/Industry%20Day%2018%20March%202016.pdf>.

- features for improved reliability, maintainability, supportability, operational availability, and system redundancy;
- features for meeting modern environmental standards;
- features for improved ship control;
- features for modern human habitability and human systems integration; and
- space, weight, and power margins (i.e., growth margin) for accepting specialized capabilities.³³

Notional Program Schedule

On October 26, 2016, the Coast Guard released a request for information (RFI) to receive industry feedback on its notional polar icebreaker acquisition approach and schedule. The summary of the RFI, dated October 25, 2016, presents a notional schedule for acquiring three heavy polar icebreakers under which procurement of long leadtime materials (LLTM) for the three ships would start in the fourth quarter of FY2019, the second quarter of FY2021, and the second quarter of FY2022, respectively, and the ships would be delivered in the fourth quarter of FY2023, the second quarter of FY2025, and the second quarter of FY2026, respectively. (Each ship would be commissioned into service a few weeks or months after it is delivered.)³⁴

Steps for Reducing Time and Cost to Design and Build

Steps aimed at reducing the time and cost for designing and building one or more new heavy polar icebreakers for the Coast Guard include the following:

- The Coast Guard and Navy have established an integrated program office for the polar icebreaker program, facilitating Navy efforts to share with the Coast Guard ship-design and ship-acquisition knowhow that can reduce the time and cost of designing and building ships.
- All five shipbuilders that have been awarded contracts for design studies and analysis for a new polar icebreaker (see next section) are employing a so-called “parent design” approach, meaning that they intend to modify existing polar icebreaker designs (parent designs) rather than develop entirely new designs from scratch (i.e., “clean-sheet” designs).³⁵ This can reduce the time and cost needed to design a new polar icebreaker, and might also reduce the technical risk and cost risk involved in building the ship.
- The design for the polar icebreaker will rely less on military specifications (MilSpecs) and more on civilian commercial shipbuilding specifications than it might have under a more traditional military ship-acquisition approach.
- The Coast Guard is open to the idea of using a block buy contract to reduce costs for acquiring multiple new polar icebreakers.

³³ Coast Guard polar icebreaker program industry day briefing entitled “Polar Icebreaker (PIB) Acquisition Program Industry Engagement,” slide 26, accessed April 4, 2016, at <http://www.uscg.mil/ACQUISITION/icebreaker/pdf/Industry%20Day%2018%20March%202016.pdf>.

³⁴ Summary of RFI, October 25, 2016, 3 pp., accessed November 10, 2016, at: <https://www.uscg.mil/acquisition/icebreaker/pdf/Acquisition-Strategy-RFI.pdf>.

³⁵ Source: Coast Guard and Navy briefing to CRS and CBO on the polar icebreaker program, July 26, 2017.

As a result of these actions, the Coast Guard states that the estimated delivery date of the first new heavy polar icebreaker has been accelerated a year or two, to 2023, and its estimated acquisition cost (including both design and construction cost), which was once informally estimated at roughly \$1 billion, is now estimated informally to be less than (and perhaps considerably less than) \$1 billion.

Recent Acquisition Actions

February 2017 Award of Five Contracts for Design Studies

A February 22, 2017, Coast Guard news release states:

The Coast Guard today awarded five firm fixed-price contracts for heavy polar icebreaker design studies and analysis. The contracts were awarded to Bollinger Shipyards LLC of Lockport, Louisiana; Fincantieri Marine Group LLC of Washington, D.C.; General Dynamics/National Steel and Shipbuilding Company of San Diego; Huntington Ingalls Inc. of Pascagoula, Mississippi; and VT Halter Marine Inc. of Pascagoula. The total value of the award is approximately \$20 million.

The objective of the studies is to identify design and systems approaches to reduce acquisition cost and production timelines. In addition to a requirement to develop heavy polar icebreaker designs with expected cost and schedule figures, the contracts require the awardees to examine major design cost drivers; approaches to address potential acquisition, technology and production risks; and benefits associated with different types of production contract types.

The heavy polar icebreaker integrated program office, staffed by Coast Guard and Navy personnel, will use the results of the studies to refine and validate the draft heavy polar icebreaker system specifications. The use of design studies is an acquisition best practice influenced by the Navy's acquisition experience with the landing craft, utility (LCU) amphibious transport ship and T-AO(X) fleet oiler, which are being acquired under accelerated acquisition schedules.

"These contracts will provide invaluable data and insight as we seek to meet schedule and affordability objectives," said Rear Adm. Michael Haycock, the Coast Guard's director of acquisition programs and program executive officer. "Our nation has an urgent need for heavy polar icebreaking capability. We formed an integrated program office with the Navy to take advantage of their shipbuilding experience. This puts us in the best possible position to succeed in this important endeavor."

"The Navy is committed to the success of the heavy icebreaker program and is working collaboratively with our Coast Guard counterparts to develop a robust acquisition strategy that drives affordability and competition, while strengthening the industrial base," said Jay Stefany, executive director, Amphibious, Auxiliary and Sealift Office, Program Executive Office, Ships. "Our ability to engage early with our industry partners will be critical to delivering this capability to our nation."

The studies are expected to take 12 months to complete, with study results provided incrementally during that time. The Coast Guard plans to release a draft request for proposal (RFP) for detail design and construction by the end of fiscal year 2017, followed by release of the final RFP in fiscal year 2018. The integrated program office plans to award a single contract for design and construction of the lead heavy polar icebreaker in fiscal year 2019, subject to appropriations.³⁶

³⁶ "Acquisition Update: Coast Guard Awards Multiple Contracts For Heavy Polar Icebreaker Industry Studies," (continued...)

April 2017 Release of RFI

An April 4, 2017, Coast Guard news release states:

The Coast Guard released its draft heavy polar icebreaker system specifications in a request for information (RFI) today. The request seeks questions, comments and feedback related to heavy polar icebreaker technology risks, sustainability, producibility and affordability. The RFI can be found here.

This RFI is part of ongoing market research conducted with the Navy and includes the draft specifications for icebreaker hull structure, propulsion and electrical plants, command and surveillance systems, weaponry, outfitting and auxiliary systems. Industry sources are invited to submit responses by June 16, 2017, at 11 a.m. Eastern time.

Following market research, the Coast Guard plans to release a request for proposal for detail design and construction of a heavy polar icebreaker in fiscal year 2018. The service plans to begin production activities in 2020.³⁷

Foreign Cooperation and Participation

U.S. Coast Guard Cooperation with Canadian Coast Guard on Model and Test Activities

A February 9, 2017, U.S. Coast Guard news release states:

The U.S. and Canadian governments on Feb. 7 established a partnership that will enable the U.S. Coast Guard heavy polar icebreaker acquisition program to test and validate potential heavy polar icebreaker design models at Canada's National Research Council (NRC) in St John's, Newfoundland.

The testing, which includes analyses of maneuverability in ice and icebreaking resistance and powering, will be used to further inform the baseline requirements for new heavy polar icebreakers, expand current icebreaker design and operational knowledge, and support the urgent need to recapitalize U.S. heavy icebreaking capability. The partnership is being facilitated by the Department of Homeland Security Science and Technology Directorate and was developed under the Agreement Between the U.S. and Canada for Cooperation in Science and Technology for Critical Infrastructure Protection and Border Security, enacted in 2004. Model and test activities at the NRC are scheduled to formally begin in April 2017.

The NRC is home to one of the world's largest ice tank facilities, which is used to measure the performance and evaluate the safety of ice-going ships and structures in controlled model-scale conditions. The NRC ice tank is capable of modeling a wide range of marine ice conditions, including first-year and multiyear ice, pack ice, ridged ice and glacial ice.

In addition to the modeling work that will be conducted at the NRC, the Coast Guard and Navy will conduct additional model test work to evaluate the performance of the

(...continued)

February 22, 2017, accessed March 20, 2017, at <https://www.uscg.mil/acquisition/newsroom/updates/icebreaker022217.asp>.

³⁷ Coast Guard news release, "Acquisition Update: Coast Guard Releases Draft Polar Icebreaker Specifications," April 4, 2017, accessed June 1, 2016.

icebreaker in open water at the Naval Surface Warfare Center, Carderock Division, in Bethesda, Maryland.³⁸

Parent Design Approach Could Involve One or More Foreign Designs

As mentioned above, all five shipbuilders that have been awarded contracts for design studies and analysis for a new polar icebreaker are employing a so-called “parent design” approach, meaning that they intend to modify existing polar icebreaker designs (parent designs) rather than develop entirely new designs from scratch (i.e., “clean-sheet” designs). It is possible that one or more of the parent designs are foreign designs. If a parent design being used by a shipbuilder is a foreign design, that shipbuilder might do so in cooperation with the foreign shipbuilder that developed the original parent design.

General Dynamics Teaming With VARD

A January 17, 2017, press report states:

General Dynamics is teaming with Norwegian ship designer and manufacturer VARD for the Coast Guard’s heavy Polar Icebreaker Program, the company says. GD’s exhibit booth at last week’s Sea Air Space Symposium displayed a graphic with the two companies’ names and an artist’s concept of a Coast Guard Icebreaker. VARD is owned by Italy’s FINCANTIERI. GD says VARD is one of the premiere global designers of polar icebreakers. GD’s NASSCO shipbuilding division is leading the company’s effort on the icebreaker program, for which the Coast Guard early this year plans to award initial design study contracts.³⁹

Cost and Funding

Estimated Acquisition Cost

The total acquisition cost of a new polar icebreaker had generally been estimated informally at roughly \$1 billion, including design costs, but a congressionally mandated July 2017 report from the National Academies of Sciences, Engineering, and Medicine (NASEM) on the acquisition and operation of polar icebreakers estimates that the ship could cost less (and perhaps considerably less) than \$1 billion.⁴⁰ More specifically, the NASEM study stated:

The committee estimates the rough order-of-magnitude (ROM) cost of the first heavy icebreaker to be \$983 million.... If advantage is taken of learning and quantity discounts available through the recommended block buy contracting acquisition strategy, the average cost per heavy icebreaker is approximately \$791 million, on the basis of the acquisition of four ships....

Costs can be significantly reduced by following the committee’s recommendations. Reduction of MIL-SPEC [military specification] requirements can lower costs by up to

³⁸ “Acquisition Update: U.S., Canada Governments Partner On Model And Test Activities To Support Heavy Polar Icebreaker Acquisition Efforts,” February 9, 2017, accessed March 20, 2017, at <https://www.uscg.mil/acquisition/newsroom/updates/icebreaker020917.asp>.

³⁹ “Icebreaker Team,” *Defense Daily*, January 17, 2017: 2.

⁴⁰ National Academies of Sciences, Engineering, and Medicine, Division on Earth and Life Studies and Transportation Research Board, *Acquisition and Operation of Polar Icebreakers: Fulfilling the Nation’s Needs*, Letter Report, with cover letter dated July 11, 2017, 147 pp. For the findings and recommendations of this study, see **Appendix A**.

\$100 million per ship with no loss of mission capability.... The other recommended acquisition, design, and construction strategies will control possible cost overruns and provide significant savings in overall life-cycle costs for the program....

The committee estimates that a first-of-class medium icebreaker will cost approximately \$786 million. The fourth ship of the heavy icebreaker series is estimated to cost \$692 million. Designing a medium-class polar icebreaker in a second shipyard would incur the estimated engineering, design, and planning costs of \$126 million and would forgo learning from the first three ships; the learning curve would be restarted with the first medium design. Costs of building the fourth heavy icebreaker would be less than the costs of designing and building a first-of-class medium icebreaker....⁴¹

An August 1, 2017, press report stated:

The Commandant of the Coast Guard is “very confident” US shipyards can build the country’s first icebreaker in 20 years for less than the standard eye-watering \$1 billion estimate....

“I am very confident we will drive the initial acquisition cost of this platform south of a billion dollars,” [Admiral Paul] Zukunft said this morning at the Center for Strategic & International Studies.⁴²

The Coast Guard estimated in February 2008 that the acquisition of new replacement ships for the *Polar Star* and *Polar Sea* might cost between \$800 million and \$925 million per ship in 2008 dollars.⁴³ The Coast Guard said that this estimate

is based on a ship with integrated electric drive, three propellers, and a combined diesel and gas (electric) propulsion plant. The icebreaking capability would be equivalent to the POLAR Class Icebreakers [i.e., *Polar Star* and *Polar Sea*] and research facilities and accommodations equivalent to HEALY. This cost includes all shipyard and government project costs. Total time to procure a new icebreaker [including mission analysis, studies, design, contract award, and construction] is eight to ten years.⁴⁴

The Coast Guard further stated that this notional new ship would be designed for a 30-year service life.

The High Latitude Study that was provided to Congress in July 2011⁴⁵ states that the above figure of \$800 million to \$925 million in 2008 dollars equates to \$900 million to \$1,041 million in 2012 dollars. The study provides the following estimates, in 2012 dollars, of the acquisition costs for new polar icebreakers:

- \$856 million for 1 ship;

⁴¹ National Academies of Sciences, Engineering, and Medicine, Division on Earth and Life Studies and Transportation Research Board, *Acquisition and Operation of Polar Icebreakers: Fulfilling the Nation’s Needs*, Letter Report, with cover letter dated July 11, 2017, pp. 15-16.

⁴² Sydney J. Freedberg, “US Yards Can Build Icebreaker For Under \$!B: Zukunft,” *Breaking Defense*, August 1, 2017.

⁴³ Coast Guard point paper provided to CRS on February 12, 2008, and dated with the same date, providing answers to questions from CRS concerning polar icebreaker modernization.

⁴⁴ The Coast Guard states further that the estimate is based on the acquisition cost of the *Mackinaw* (WAGB-30), a Great Lakes icebreaker that was acquired a few years ago and commissioned into service with the Coast Guard in June 2006. The *Mackinaw* is 240 feet long, displaces 3,500 tons, and can break ice up to 2 feet, 8 inches thick at speeds of 3 knots, which is suitable for Great Lakes icebreaking. The Coast Guard says it scaled up the acquisition cost for the *Mackinaw* in proportion to the ship’s size compared to that of a polar icebreaker and then adjusted the resulting figure to account for the above-described capabilities of the notional replacement ship and recent construction costs at U.S. Gulf Coast shipyards.

⁴⁵ For more on the High Latitude Study, see **Appendix A**.

- \$1,663 million for 2 ships—an average of about \$832 million each;
- \$2,439 million for 3 ships—an average of \$813 million each;
- \$3,207 million for 4 ships—an average of about \$802 million each;
- \$3,961 million for 5 ships—an average of about \$792 million each; and
- \$4,704 million for 6 ships—an average of \$784 million each.

The study refers to the above estimates as “rough order-of-magnitude costs” that “were developed as part of the Coast Guard’s independent Polar Platform Business Case Analysis.”⁴⁶

Funding in FY2013-FY2018 Budget Submissions

Table 3 shows requested and projected funding for the polar icebreaker program in the Coast Guard’s budget submissions since the initiation of the polar icebreaker program in the FY2013 submission.

Table 3. Funding for Acquisition of New Polar Icebreaker Under FY2013-FY2018 Budget Submissions
(millions of then-year dollars)

Budget	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	5-year total
FY13	8	120	380	270	82						860
FY14		2	8	100	20	100					230
FY15			6	4	100	20	100				230
FY16				4	10	2	100	50			166
FY17					150	0	50	150	430		780
FY18						19	50	150	430	300	949

Source: Table prepared by CRS based on Coast Guard FY2013-FY2018 budget submissions.

Notes: For each line in the table, the first figure shown (e.g., \$8 million in the case of the FY2013 budget) is the amount of funding that was requested for that fiscal year. Actual funding figures for FY2013-FY2017 are as follows: \$7.609 million in FY2013; \$2.0 million in FY2014; zero in FY2015; \$36.0 million in FY2016, and \$175 million in FY2017, for a total of \$220.609 million for the period FY2013-FY2017.

In addition to the \$19 million requested for FY2018, the Coast Guard’s acquisition, construction, and improvements FY2018 unfunded priorities list (UPL), dated July 20, 2017, includes, as its first item, a \$750-million item for a heavy polar icebreaker. The UPL document states that this “additional funding in FY[20]18 supports construction of the first Heavy Polar Icebreaker and maintains the current strategy to stay on schedule, and maybe even accelerate the acquisition further.”⁴⁷

The reduction in five-year funding for a new polar icebreaker during the FY2014-FY2016 budget submissions shown in **Table 3** appears to have been related to the substantial reduction in the annual funding levels in the Coast Guard’s Acquisition, Construction, and Improvements (AC&I) account in those budget submission that is shown in **Table 4**. Prior to the release of the

⁴⁶ *United States Coast Guard High Latitude Region Mission Analysis Capstone Summary*, July 2010, p. 13.

⁴⁷ U.S. Coast Guard, *Acquisition, Construction, and Improvements FY2018 Unfunded Priorities List*, Submission to Congress, July 20, 2017, p. 2.

Administration's September 1, 2015, fact sheet, the Coast Guard testified that if annual funding levels in the AC&I account were not increased from the reduced levels in those budget submissions, the icebreaker would be, essentially, an unfunded requirement. For example, at an April 28, 2015, hearing on Coast Guard resources and priorities before the Oceans, Atmosphere, Fisheries, and Coast Guard subcommittee of the Senate Commerce, Science, and Transportation Committee, Admiral Paul Zukunft, the Commandant of the Coast Guard, testified that

by reactivating Polar Star, we have purchased up to 10 years of decision space to recapitalize our ice-breaking fleet. Two of those years have expired. And while I'm exploring several options to reconstitute our nation's fleet of icebreakers, I will need topline relief [i.e., an increase] in my acquisition budget to make this requirement a reality.⁴⁸

Table 4. Funding in AC&I Account in FY2013-FY2018 Budgets
(millions of dollars, rounded to nearest tenth)

Budget	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	Avg.	% change compared to avg. for FY13 budget
FY13	1,217.3	1,429.5	1,619.9	1,643.8	1,722.0						1,526.5	—
FY14		951.1	1,195.7	901.0	1,024.8	1,030.3					1,020.6	-33.1%
FY15			1,084.2	1,103.0	1,128.9	1,180.4	1,228.7				1,145.0	-25.0%
FY16				1,017.3	1,125.3	1,255.7	1,201.0	1,294.6			1,178.8	-22.8%
FY17					1,136.8	1,259.6	1,339.9	1,560.5	1,840.8		1,427.5	-6.5%
FY18						1,203.7	1,360.9	1,602.7	1,810.6	1,687.5	1,533.1	+0.4%

Source: Table prepared by CRS based on Coast Guard FY2013-FY2018 budget submissions.

For additional discussion of the issue of the funding level of the AC&I account, see **Appendix B**. Below are some additional details on each of the budget submissions since the FY2013 submission.

FY2013 Submission

The Administration's FY2013 budget submission initiated a new project for the design and construction of a new polar icebreaker, and included \$860 million over five years for the acquisition of the ship (**Table 3**)—enough or almost enough to fully fund the acquisition of a new polar icebreaker. (Any remaining needed funding might have been projected for FY2018 and perhaps also FY2019, which were beyond the five-year window of the FY2013 budget submission.) The submission stated that DHS anticipated awarding a construction contract for the ship “within the next five years” (i.e., by FY2018) and taking delivery on the ship “within a decade” (i.e., by 2023).⁴⁹

⁴⁸ Source: Transcript of hearing.

⁴⁹ U.S. Department of Homeland Security, *Annual Performance Report, Fiscal Years 2011-2013*, p. CG-AC&I-40 (pdf page 1,777 of 3,134).

FY2014 Submission

The Administration's FY2014 budget submission reduced the five-year funding for a new polar icebreaker to \$230 million (**Table 3**)—a 73% reduction from the figure in the FY2013 budget submission—but still stated that DHS anticipated awarding a construction contract for the ship “within the next four years” (i.e., by FY2018).⁵⁰

FY2015 Submission

The Administration's FY2015 budget submission maintained five-year funding for a new polar icebreaker at \$230 million (**Table 3**), but did not state when a construction contract for the ship might be awarded, creating uncertainty about the timing of the project.⁵¹

FY2016 Submission

The Administration's FY2016 budget submission, submitted to Congress in February 2015, reduced five-year funding for a new polar icebreaker further, to \$166 million (**Table 3**)—an 81% reduction from the figure in the FY2013 budget submission—and again did not state when a construction contract for the ship might be awarded, maintaining the uncertainty about the timing of the project.⁵²

On September 1, 2015, the White House issued a fact sheet in conjunction with a visit to Alaska by President Obama indicating that the Administration, in its own internal planning, had at some point over the past two years deferred acquisition of a new polar icebreaker to FY2022, but that this had been changed to FY2020.⁵³ The newly announced construction start date of FY2020 was

⁵⁰ Department of Homeland Security, United States Coast Guard, *Fiscal Year 2014 Congressional Justification*, p. CG-AC&I-32 (pdf page 204 of 403).

⁵¹ Department of Homeland Security, United States Coast Guard, *Fiscal Year 2015, Congressional Justification*, p. CG-AC&I-42 (pdf page 196 of 474).

⁵² Department of Homeland Security, United States Coast Guard, *Fiscal Year 2016 Congressional Justification*, p. CG-AC&I-36 (pdf page 202 of 518).

⁵³ The White House, “Fact Sheet: President Obama Announces New Investments to Enhance Safety and Security in the Changing Arctic,” September 1, 2015, accessed September 2, 2015, at <https://www.whitehouse.gov/the-press-office/2015/09/01/fact-sheet-president-obama-announces-new-investments-enhance-safety-and>. Regarding icebreakers, the fact sheet states:

Accelerating the acquisition of new Coast Guard icebreakers. After World War II, the United States Coast Guard had seven icebreakers in its fleet—four under the U.S. Navy and three under the U.S. Coast Guard. Today, the United States technically has three icebreakers in its fleet—all under the command of the U.S. Coast Guard. However, when age and reliability are taken into account, the fleet is down to the equivalent of two fully functional icebreakers and only one heavy-duty icebreaker. Russia, on the other hand, has forty icebreakers and another eleven planned or under construction.

The growth of human activity in the Arctic region will require highly engaged stewardship to maintain the open seas necessary for global commerce and scientific research, allow for search and rescue activities, and provide for regional peace and stability. Accordingly, meeting these challenges requires the United States to develop and maintain capacity for year-round access to greater expanses within polar regions.

That is why the Administration will propose to accelerate acquisition of a replacement heavy icebreaker to 2020 from 2022, begin planning for construction of additional icebreakers, and call on Congress to work with the Administration to provide sufficient resources to fund these critical investments. These heavy icebreakers will ensure that the United States can meet our national interests, protect and manage our natural resources, and strengthen our international, state, local, and tribal relationships.

a two-year acceleration from the previously unpublicized date of FY2022, and a two-year deferral from the FY2018 date implied in the FY2013 and FY2014 budget submissions. The fact sheet states that the Administration will also “begin planning for construction of additional icebreakers” beyond the one that the Obama Administration proposed to begin building in FY2020.

On January 13, 2016, the Coast Guard announced that it intended to hold an industry day for the polar icebreaker program, followed by one-on-one meetings between the Coast Guard and prospective shipbuilders and ship designers, as a part of the Coast Guard’s ongoing market research for the program.⁵⁴ The industry day was held on March 18, 2016, and the one-on-one meetings between the Coast Guard and industry officials were scheduled for March 28-31, with industry feedback to be submitted to the Coast Guard by April 5, 2016.⁵⁵

FY2017 Submission

The Coast Guard’s proposed FY2017 budget requested \$150 million in acquisition funding for a new polar icebreaker. The figure of \$150 million included \$147.6 million in the polar icebreaker line of the Coast Guard’s Acquisition, Construction, and Improvements (AC&I) account, and \$2.4 million that is embedded in the personnel and management line in the AC&I account.⁵⁶ The Coast Guard’s FY2017-FY2021 five-year Capital Investment Plan (CIP) included a total of \$780 million in acquisition funding for a new polar icebreaker. As shown in **Table 3**, the \$150 million requested for FY2017 was the first major increment of acquisition funding requested (not just projected for a future fiscal year) for a new polar icebreaker.

FY2018 Submission

The Coast Guard’s proposed FY2018 budget requests \$19 million in acquisition funding for a new polar icebreaker and includes a total of \$949 million over the five-year period FY2018-FY2022. The Coast Guard states that

This request supports activities to complete and release a Request for Proposal (RFP) for Detail Design and Construction in FY 2018. Specifically, this funding supports program-wide activities including open water and ice tank model testing; review of Industry Studies contract deliverables; Integrated Program Office (IPO) and Ship Design Team (SDT) support; logistics and integration development for government furnished information and equipment; and additional modeling efforts to inform the evaluation and source selection process for the Detail Design & Construction RFP....

Currently, the Program is maturing the system specification, developing the RFP for Detail Design & Construction, and completing required documentation to transition to the “Obtain” phase - planned for early FY 2018. In July 2016, the Coast Guard established an Integrated Program Office with the Navy to continue efforts to accelerate the construction timeline and leverage the expertise and best practices from shipbuilding programs in both services. Based on this collaboration and lessons learned by the Navy, the Program was able to significantly mature the acquisition approach with the incorporation of Industry Studies to identify solutions to minimize cost, schedule, production and technology risks. Industry Studies are focusing on leveraging industry perspectives, existing vessel designs,

⁵⁴ “USCG Polar Class Icebreaker Replacement Program,” accessed January 15, 2016, at <https://www.fbo.gov/index?s=opportunity&mode=form&id=a778c49349c443d2658666e19cc100e9&tab=core&tabmode=list&=>.

⁵⁵ “Heavy Polar Icebreaker Industry Engagement Activities,” accessed April 4, 2016, at http://www.uscg.mil/ACQUISITION/icebreaker/Industry_Day_031816.asp.

⁵⁶ Department of Homeland Security, United States Coast Guard, *Fiscal Year 2017 Congressional Justification*, pp. CG-AC&I-28 and CG-AC&I-47 (pdf pages 170 and 189 of 407).

and use of mature technology to inform the iterative development of the Heavy Polar Icebreaker system specification. Future “Obtain” phase activities include award of a contract for Detail Design & Construction for the heavy polar icebreaker.⁵⁷

Actual Prior-Year Funding in FY2013-FY2017

In each line of **Table 3**, the first figure shown (e.g., \$8 million in the case of the FY2013 budget) is the amount of funding that was requested for that fiscal year. Actual funding figures for FY2013-FY2017 are as follows: \$7.609 million in FY2013; \$2.0 million in FY2014; zero in FY2015; \$36.0 million in FY2016; and \$175 million in FY2017, for a total of \$220.609 million for the period FY2013-FY2017.

Issues for Congress

FY2018 Funding Request

One issue for Congress is whether to approve, reject, or modify the Coast Guard’s FY2018 funding request for the polar icebreaker program. In considering this issue, Congress may consider, among other things, whether the Coast Guard has accurately priced the work it is proposing to do in FY2018, whether the Coast Guard’s schedule for polar icebreaker program is appropriate, and how various potential FY2018 funding levels might affect that schedule.

Acquiring Polar Icebreakers with a Block Buy Contract

Another potential issue for Congress concerns the acquisition strategy for acquiring polar icebreakers. As noted earlier (see “October 2016 Coast Guard Request for Information (RFI)”), on October 26, 2016, the Coast Guard released a request for information (RFI) to receive industry feedback on its notional polar icebreaker acquisition approach and schedule. The summary of the RFI, dated October 25, 2016, states that the Coast Guard currently envisions having a single U.S. shipyard build three heavy polar icebreakers under a contract with options. A contract with options can be viewed as a form of annual contracting.

An alternative to a contract with options would be a block buy contract. A block buy contract would reduce the government’s flexibility regarding whether and when to acquire the second and third ships, and what design to build them to,⁵⁸ and in return reduce the combined acquisition cost of the three ships. The Navy has used block buy contracts to reduce procurement costs of

⁵⁷ Department of Homeland Security, U.S. Coast Guard, *Fiscal Year 2018 Congressional Justification*, undated but released May 2017, pp. AC&I-50 and AC&I-51.

⁵⁸ Stated more fully, from a congressional perspective, trade-offs in using block buy contracting include the following:

- reduced congressional control over year-to-year spending, and tying the hands of future Congresses;
- reduced flexibility for making changes in Coast Guard acquisition programs in response to unforeseen changes in strategic or budgetary circumstances (which can cause any needed funding reductions to fall more heavily on acquisition programs not covered by multiyear contracts);
- a potential need to shift funding from later fiscal years to earlier fiscal years to fund economic order quantity (EOQ) purchases (i.e., up-front batch purchases) of components;
- the risk of having to make penalty payments to shipbuilders if multiyear contracts need to be terminated due to unavailability of funds needed to the continue the contracts; and
- the risk that materials and components purchased for ships to be acquired in future years might go to waste if those ships are not eventually acquired.

Virginia-class attack submarines and (in more recent years) Littoral Combat Ships (LCSs), and John Lewis (TAO-205) class oilers (previously known as TAO[X]s).⁵⁹ CRS estimates that compared to costs using a contract with options, using a block buy contract that included economic order quantity (EOQ) purchases (i.e., up-front batch purchases) of materials and components for three heavy polar icebreakers would reduce the combined acquisition cost of the three ships by upwards of 7%, which could equate to a savings of upwards of \$200 million.⁶⁰

In an interview published on March 9, 2017, the Commandant of the Coast Guard, Admiral Paul Zukunft, stated:

Our request is for three heavy and then three medium icebreakers. We're working with the Navy. We've stood up an integrated project office.... just a couple of days ago we awarded an industry study to five contractors to go out and look at what's available, look at what designs [are available] and do everything we can to accelerate the timeline so we can build and deliver a heavy icebreaker by 2023. We haven't built one of these in 40 years.

But the good news is [the] U.S. industry is saying we can build one of these. So now they're going out, looking at preferably an existing design so we don't have to start new. That will drive down the cost and it will accelerate the delivery time.

In response to a follow-on question, he stated:

That's our long-term need and obviously it takes a while to build these. ... But right now we're living on borrowed time with the Polar Star. ... And, hopefully, we'll extend the life of that through 2023. But after starting this first award, we need to have another one right behind it. And, obviously, we need an appropriation to go with that as well. So as we build the first one, it'll give us an idea. Lead ships, regardless of what you're building, always cost more. There's a learning curve by industry and then, with economies of scale, the cost per unit goes down thereafter. And so as we've seen in the past, we expect we can get that cost down.

But if we do, then [we're] looking to do a block buy for the [two] remaining heavies and then do something similar for the medium [polar icebreakers].⁶¹

The congressionally mandated July 2017 NASEM report on acquisition and operation of polar icebreakers states (emphasis as in original):

3. Recommendation: USCG should follow an acquisition strategy that includes block buy contracting with a fixed price incentive fee contract and take other measures to ensure best value for investment of public funds.

Icebreaker design and construction costs can be clearly defined, and a fixed price incentive fee construction contract is the most reliable mechanism for controlling costs for a program of this complexity. This technique is widely used by the U.S. Navy. To

⁵⁹ See CRS Report R41909, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, by Ronald O'Rourke and Moshe Schwartz; CRS Report RL33741, *Navy Littoral Combat Ship/Frigate (LCS/FFGX) Program: Background and Issues for Congress*, by Ronald O'Rourke; and CRS Report R43546, *Navy John Lewis (TAO-205) Class Oiler Shipbuilding Program: Background and Issues for Congress*, by Ronald O'Rourke.

⁶⁰ For more on block buy contracts, see CRS Report R41909, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, by Ronald O'Rourke and Moshe Schwartz. See also CRS Testimony TE10004, *The Status of Coast Guard Cutter Acquisition Programs*, by Ronald O'Rourke.

⁶¹ Brianna Gurciullo, "POLITICO Pro Q&A: Adm. Paul Zukunft, commandant of the U.S. Coast Guard," *Politico Pro*, March 9, 2017.

help ensure best long-term value, the criteria for evaluating shipyard proposals should incorporate explicitly defined lifecycle cost metrics....

A block buy authority for this program will need to contain specific language for economic order quantity purchases for materials, advanced design, and construction activities. A block buy contracting program with economic order quantity purchases enables series construction, motivates competitive bidding, and allows for volume purchase and for the timely acquisition of material with long lead times. It would enable continuous production, give the program the maximum benefit from the learning curve, and thus reduce labor hours on subsequent vessels....

If advantage is taken of learning and quantity discounts available through the recommended block buy contracting acquisition strategy, the average cost per heavy icebreaker is approximately \$791 million, on the basis of the acquisition of four ships.⁶²

Funding Coast Guard Polar Icebreakers Through Navy's Shipbuilding Account

Another potential issue for Congress is whether to fund some or all of the acquisition cost of one or more Coast Guard polar icebreakers through an appropriation account outside the Coast Guard's budget, such as the Navy's shipbuilding account, known formally as the Shipbuilding and Conversion Navy (SCN) appropriation account. Although providing funding for Coast Guard ships through the SCN account creates some complexity in tracking and executing funding for Coast Guard ship acquisition, and can raise a question as to whether that funding would otherwise go toward the acquisition of Navy ships, it has been used for funding Coast Guard polar icebreakers and Coast Guard patrol boats:

- *Healy* was funded largely through the SCN account.⁶³
- The FY2017 Department of Defense appropriations act (Division C of H.R. 244/P.L. 115-31 of May 5, 2017) provided \$150 million for the current polar icebreaker program.
- Thirty-three of the Coast Guard's 49 Island-class 110-foot patrol boats were procured under a Navy contract. The contract was for the construction of 21 of the boats, and included FY1990 SCN funds and prior year DOD non-expiring funding. During the construction phase of the contract, the Navy exercised

⁶² National Academies of Sciences, Engineering, and Medicine, Division on Earth and Life Studies and Transportation Research Board, *Acquisition and Operation of Polar Icebreakers: Fulfilling the Nation's Needs*, Letter Report, with cover letter dated July 11, 2017, pp. 14, 15.

⁶³ The somewhat complicated funding history for the ship is as follows: The Coast Guard's proposed FY1990 budget requested \$244 million for the acquisition of an icebreaker. The FY1990 DOD appropriations act (H.R. 3072/P.L. 101-165 of November 21, 1989) provided \$329 million for the ship in the SCN account. (See pages 77 and 78 of H.Rept. 101-345 of November 13, 1989.) This figure was then reduced by \$4.2 million by a sequester carried out under the Balanced Budget And Emergency Deficit Control Act of 1985, also known as the Gramm-Rudman-Hollings Act (H.J.Res. 372/P.L. 99-177 of December 12, 1985). Another \$50 million was rescinded by the Dire Emergency Supplemental Appropriations for Disaster Assistance, Food Stamps, Unemployment Compensation Administration, and Other Urgent Needs, and Transfers, and Reducing Funds Budgeted for Military Spending Act of 1990 (H.R. 4404/P.L. 101-302 of May 25, 1990). An additional \$59 million for the ship was then appropriated in the FY1992 DOD Appropriations Act (H.R. 2521/P.L. 102-172 of November 26, 1991). Also, an additional \$40.4 million in acquisition funding for the ship was provided through a series of annual appropriations in the Coast Guard's AC&I account from FY1988 through FY2001. The resulting net funding for the ship was thus \$374.2 million, of which \$333.8 million, or 89.2%, was DOD funding, and \$40.4 million, or 10.8%, was Coast Guard acquisition funding. (Source: Undated Coast Guard information paper provided to CRS by Coast Guard legislative liaison office, March 3, 2016.)

options under the contract for the construction 12 additional boats using FY1990 SCN funding.⁶⁴

Building Polar Icebreakers in Foreign Shipyards

Another potential issue for Congress concerns the possibility of building polar icebreakers for the U.S. Coast guard in foreign shipyards. Some observers believe the acquisition cost of U.S. Coast Guard polar icebreakers could be reduced, perhaps substantially, by building them in a foreign shipyard, such as a yard in one of the Nordic countries that is experienced in building icebreakers. Shipyards in Finland reportedly are interested in building polar icebreakers for the U.S. Coast Guard.⁶⁵

Some observers have suggested that a U.S. law known as the Jones Act prevents the U.S. Coast Guard from buying or operating a foreign-built polar icebreaker. The Jones Act, however, does not prevent the U.S. Coast Guard from buying or operating a foreign-built polar icebreaker.⁶⁶ Two other laws, however, are of note in connection with the idea of building a U.S. Coast Guard polar icebreaker in a foreign shipyard. One is 14 U.S.C. 665, which states:

§665. Restriction on construction of vessels in foreign shipyards

(a) Except as provided in subsection (b), no Coast Guard vessel, and no major component of the hull or superstructure of a Coast Guard vessel, may be constructed in a foreign shipyard.

(b) The President may authorize exceptions to the prohibition in subsection (a) when the President determines that it is in the national security interest of the United States to do so. The President shall transmit notice to Congress of any such determination, and no contract may be made pursuant to the exception authorized until the end of the 30-day period beginning on the date the notice of such determination is received by Congress.

The other is 10 U.S.C. 7309, which states:

§7309. Construction of vessels in foreign shipyards: prohibition

⁶⁴ Source: Navy information paper dated August 15, 2017, provided to CRS by Navy Office of Legislative Affairs on August 23, 2017.

⁶⁵ See, for example, Jim Paulin, “Finland Wants In On US Icebreaker Investment,” *Alaska Dispatch News*, September 8, 2015.

⁶⁶ The Jones Act (Section 27 of the Merchant Marine Act of 1920, P.L. 66-261) applies to vessels transporting “merchandise” from one U.S. point to another U.S. point. It requires that such transportation be performed in U.S.-built vessels owned by U.S. citizens and registered in the United States; U.S. registration, in turn, requires that crew members be U.S. citizens. Merchandise is defined to include “merchandise owned by the U.S. Government, a State, or a subdivision of a State; and valueless material” (46 U.S.C. §55102). Merchandise is further defined at 19 U.S.C. §1401(c) to mean “goods, wares, and chattels of every description.” It is the waterborne transportation of merchandise domestically that triggers the Jones Act. A vessel wishing to engage in such transportation would apply to the U.S. Coast Guard for a “coastwise endorsement.” Thus, an icebreaker strictly performing the task it is designed for and not transporting cargo from one U.S. point to another would not be subject to the Jones Act.

The federal agency in charge of deciding what kind of maritime activity must comply with the Jones Act, U.S. Customs and Border Protection (CBP), has confirmed that icebreaking is not one of those activities. In a 2006 ruling, which appears to be its most recent ruling on the subject, CBP informed Alcoa, Inc. that it could use foreign-built and foreign-flagged vessels for icebreaking on the Hudson River in New York State. CBP reasoned that the transporting of equipment, supplies, and materials used on or from the vessel in effecting its service is not coastwise trade, provided that these articles are necessary for the accomplishment of the vessel’s mission and are usually carried aboard the vessel as a matter of course. The 2006 ruling cited earlier rulings in 1974, 1985, and 2000 as precedent.

For more on the Jones Act, see CRS Report RS21566, *The Jones Act: An Overview*, by John Frittelli.

(a) Prohibition.—Except as provided in subsection (b), no vessel to be constructed for any of the armed forces,⁶⁷ and no major component of the hull or superstructure of any such vessel, may be constructed in a foreign shipyard.

(b) Presidential Waiver for National Security Interest.—(1) The President may authorize exceptions to the prohibition in subsection (a) when the President determines that it is in the national security interest of the United States to do so.

(2) The President shall transmit notice to Congress of any such determination, and no contract may be made pursuant to the exception authorized until the end of the 30-day period beginning on the date on which the notice of the determination is received by Congress.

(c) Exception for Inflatable Boats.—An inflatable boat or a rigid inflatable boat, as defined by the Secretary of the Navy, is not a vessel for the purpose of the restriction in subsection (a).

Acquisition vs. Leasing

Another potential issue for Congress is whether future polar icebreakers should be acquired through a traditional acquisition (i.e., the government procuring the ship and owning it throughout its service life) or through a leasing arrangement (under which the icebreakers would be privately built and privately owned, leased to the Coast Guard, and crewed by an all-Coast Guard crew or a mix of Coast Guard personnel and civilian mariners). Factors to consider in assessing this issue include the comparative costs of the two options and the potential differences between them in terms of factors such as average number of days of operation each year and capability for performing various missions. Comparing the potential costs of leasing versus purchasing a capital asset often involves, among other things, calculating the net present value of each option.

At a December 1, 2011, hearing before the Coast Guard and Maritime Transportation subcommittee of the House Transportation and Infrastructure Committee that focused on the polar icebreaker fleet, Admiral Robert Papp, the Commandant of the Coast Guard at the time, stated:

As far as we can determine, there are no icebreakers available—no heavy icebreakers available for leasing right now. They would have to be constructed [and then leased].

If we were to lease an icebreaker, I’m sure that a company building an icebreaker outside of the government does not have to contend with the same federal acquisition rules that we have to if we were to construct an icebreaker. It could probably be done quicker.

Personally, I’m ambivalent in terms of how we get an icebreaker for the Coast Guard. We’ve done the legal research. If we lease an icebreaker, we can put a Coast Guard crew on it and still have it as a U.S. vessel supporting U.S. sovereignty.

But the—but they aren’t available right now. And the other challenge that we face is the federal acquisition rules and [Office of Management and Budget Circular] A-11 requirements that [direct how to] score the money [in the budget] for leasing. We’d have to put up a significant amount of upfront money even with a lease that we don’t have room for within our budget currently.⁶⁸

At another point in the hearing, Admiral Papp stated:

⁶⁷ 14 U.S.C. 1, which establishes the Coast Guard, states: “The Coast Guard, established January 28, 1915, shall be a military service and a branch of the armed forces of the United States at all times.”

⁶⁸ Source: Transcript of hearing.

We have looked at various business case scenarios, each and every time looking at, once again, from our normal perspective, the Coast Guard perspective, which has been owning ships forever. And generally, we keep ships 30-40 years or beyond. There is a point where leasing becomes more expensive, it's at or about the 20-25-year timeline.

I just don't have the experience with leasing to be able to give you a good opinion on it. And once again, I'm ambivalent. We just need the icebreaking capability, I think it's for people who can do the analysis, the proper analysis of—but also have to take into account the capabilities required and we need to get about the business of determining the exact capabilities that we need which would take into account National Science Foundation requirements, Coast Guard requirements, requirements to break-in at McMurdo, to come up with a capable ship.⁶⁹

At another point in the hearing, he stated:

As I said, sir, I am truly ambivalent to this except from what I experienced. I do have now two points, yes the Navy leases some ships, but we've got a Navy that has well over 300 ships.

So if they lose a leased vessel or something is pulled back or something happens, they have plenty of other ships they can fall back upon. Right now, all I am falling back on is the Coast Guard cutter Healy. And it feels good to know that we own that and that is our ship for 30 or 40 years and we can rely upon it.

In terms of leasing, I don't know. My personal experience is I lease one of my two cars and I pay a lot of money leasing my car. But at the end of the lease period, I have no car and I've spent a lot of money. So I don't know if that's directly applicable to ships as well, but right now I got half my garage is empty because I just turned one in.⁷⁰

At another point in the hearing, he stated:

We've looked through the legal considerations on this, as long as we have a Coast Guard crew. In fact, you can even make a mixed crew of civilians and Coast Guard people. But as long as it's commanding by—commanded by [a] commissioned officer, you can assert sovereignty, you can take it into war zones and, in fact, the Navy does that as well.⁷¹

Another witness at the hearing—Mead Treadwell, the lieutenant governor of Alaska—stated:

[Regarding] The issue of the ships, the company that is building these ships for Shell [Oil] has visited with me and other state officials, and that's why you heard us say in our testimony that we think the leasing option should be considered. We don't have a way to judge the relative cost. But if on the face of it, it seems like it may be a way to get us the capability that the admiral needs.⁷²

Another witness at the hearing—Jeffrey Garrett, a retired Coast Guard admiral who spent much of his career on polar icebreakers—stated:

The perspective I could offer was when I was a member of the Cameron [sic: Commandant's?] staff back in the last '80s here in Washington, we were directed to

⁶⁹ Source: Transcript of hearing.

⁷⁰ Source: Transcript of hearing.

⁷¹ Source: Transcript of hearing.

⁷² Source: Transcript of hearing. The transcript reviewed by CRS attributes this quote to the GAO witness, Stephen Caldwell, but this appears to be a mistake, as the statement is made by a member of the first witness panel, which included the Commandant of the Coast Guard and the Lieutenant Governor. The GAO witness was a member of the second witness panel. The reference in the quote to “me and other state officials” indicates that the witness speaking was the Lieutenant Governor and not the Commandant.

pursue exactly the same sort of lease versus buy analysis, and in fact, the Coast Guard had a two track procurement strategy to compare leasing a new Polar icebreaker or buying it.

And after over a year of analysis, studies, discussion with other agencies looking around, what became clear was, number one, there was no off-the-shelf asset readily available. And secondly, that in the long run, if you—when you cost it all out and the value of the stream of payments, leasing would actually cost more.

And when we did the recapitalization analysis recently, we also reviewed leasing again, and the I think the findings in that report indicate more expensive over the life of the vessel by about 12 percent.⁷³

When asked why this was the finding, Garrett stated:

A couple of technical things. First of all, whoever builds the ship—and again, this will have to be ship built for the Coast Guard since there's not something off-the-shelf out there that you could lease. Whoever builds it has to raise capital, and nobody can raise capital more inexpensively than the federal government.

Secondly, whoever leases the ship is obviously going to make—want to make a profit on that lease. So just like as Admiral Papp referred to leasing your car, you know, there's going to be a profit involved. And so, if you take the net present value of all of those, of those payments, you got come out with the more expensive package for the same, if you're comparing the same vessel.

The other, the other issue I think is more intangible and that's just the fact that we're really not talking about an auxiliary like the Naval, like the Navy leases a supply ship or something like that. We're talking about a frontline Coast Guard capital asset, if you will, capital ship that's going to be doing frontline government missions projecting U.S. sovereignty.

And you know, the Navy doesn't lease those kinds of ships for its frontline fleet and the Coast Guard doesn't lease those kinds of ships for its mission capabilities, and that's what we're really talking about in terms of the ship we need here.

So while a lease may look attractive, I think there are several things that indicate it may not be the right way to go. And the—I think that's what we came down to. And again, this is all documented in the past and that late '80s analysis was re-summarizing the president's 1990 report to Congress which basically says leasing is more expensive and it's not the way to go for a new ship. That was the ship that actually became the Healy then.⁷⁴

The prepared statement of Stephen Caldwell, the GAO witness at the hearing, states:

The three reports discussed earlier in this [GAO] statement all identify funding as a central issue in addressing the existing and anticipated challenges related to icebreakers. In addition to the Coast Guard budget analysis included in the Recapitalization report, all three reports reviewed alternative financing options, including the potential for leasing icebreakers, or funding icebreakers through the National Science Foundation (NSF) or the Department of Defense (DOD). Although DOD has used leases and charters in the past when procurement funding levels were insufficient to address mission requirements and capabilities, both the Recapitalization report and the High Latitude Study determined that the lack of existing domestic commercial vessels capable of meeting the Coast Guard's mission requirements reduces the availability of leasing options for the Coast

⁷³ Source: Transcript of hearing.

⁷⁴ Source: Transcript of hearing.

Guard. Additionally, an initial cost-benefit analysis of one type of available leasing option included in the Recapitalization report and the High Latitude Study suggests that it may ultimately be more costly to the Coast Guard over the 30-year icebreaker lifespan.⁷⁵

In July 2016, the Coast Guard stated that

NSF leased the icebreaker KRASIN from Russia from 2005-2006, ODEN from the Swedish government from 2007-2010, and VLADIMIR IGNATYUK from Russia in 2012 to support the McMurdo resupply mission. All leases were time charters, and crews were supplied with the leases. As a contingency measure, NSF obtained assurances of assistance from other vessels in the area, such as the Chinese flagged [icebreaking] vessel XUE LONG, in the event they encountered difficulty. They also hired icebreaker captains with previous McMurdo experience to supplement the crew. NSF acquired these leases through a RFP process, and had no assurances that icebreakers would be available to perform the mission, or what price would be quoted.

This process came with risks, as there was no way to gauge icebreaker availability until NSF received responses to their RFP. Additionally, a foreign-flagged commercial or state vessel can become unavailable for a variety of environmental and political reasons. For example, the Swedish government abruptly terminated their contract during the spring/summer of 2011, and NSF was left without a platform to conduct its mission. NSF requested support from CGC HEALY, but it was employed in the Arctic. NSF ultimately leased the Russian icebreaker VLADIMIR IGNATYUK. After that incident, NSF decided to utilize CGC POLAR STAR to support the McMurdo mission, which it has been doing since 2013.⁷⁶

At a June 14, 2016, hearing on the Coast Guard before the Coast Guard and Maritime Transportation subcommittee of the House Transportation and Infrastructure Committee, the following exchange occurred:

REPRESENTATIVE HUNTER (Chairman):

How do you plan on—on filling the capability gap until you get a heavy icebreaker, which is 10 years at the least based on the best projections of Congress and everybody working together? You still haven't answered that one.

ADMIRAL CHARLES MICHEL (Vice Commandant of the Coast Guard):

Well, right—the alternatives now, since we'll provide the answer to that, and it's probably going to be either a rolling recapitalization of the *Polar Star* or to try to bring—let *Polar Star* taper off and then try to bring *Polar Sea* back on and bridge out to the new icebreaker.

I do not know which one at this point, which path we would want to take. I'm not aware of any other—we've looked out there for vessels to lease for heavy icebreaking capabilities. There's nothing out there on planet earth that you can lease in the heavy icebreaking area. So that's kind of where we are, sir.

HUNTER:

Was it the—the Finns that came into my office?

(UNKNOWN)

⁷⁵ Government Accountability Office, *Coast Guard[:] Observations on Arctic Requirements, Icebreakers, and Coordination with Stakeholders, Testimony Before the Subcommittee on Coast Guard and Maritime Transportation, Committee on Transportation and Infrastructure, House of Representatives, Statement of Stephen L. Caldwell, Director, Homeland Security and Justice, GAO-12-254T*, December 1, 2011, p. 24.

⁷⁶ Source: Email from Guard Office of Congressional Affairs to CRS, July 8, 2016.

Mm-hmm.

HUNTER:

Can't remember whether we had the Norwegians or the Finns. I mean, they—have you—you've obviously looked at that, right?

MICHEL:

Yes. As a matter of fact I—I traveled to Sweden and Finland...

HUNTER:

Yeah.

MICHEL:

... and talked to them. And they do not have heavy icebreaking capability that will meet the needs as in the FedBizOpps. As a matter of fact, in—when I'm talking FedBizOpps [I mean] there's a technical package that the Coast Guard put out for our [new] heavy icebreaker [i.e., the one that the Obama Administration wanted to begin building in 2020].

It kind of lays out our basic requirements including the long pole in the tent which is the icebreaking requirement, which is six foot minimum at three knots, desirable eight-foot minimum at three knots and then 21 feet backing and ramming.

When I talked to the shipbuilders over there, they said there is not a vessel like that that currently exists that will meet those requirements in the—in the FedBizOpps technical package. So you'd have to build a vessel like that. And that's the type of vessel that we're looking for.⁷⁷

The congressionally mandated July 2017 NASEM report on acquisition and operation of polar icebreakers states (emphasis as in original):

2. Recommendation: The United States Congress should fund the construction of four polar icebreakers of common design that would be owned and operated by the United States Coast Guard (USCG)....

Government ownership of new polar icebreakers would be less costly than the use of lease financing.... The government has a lower borrowing cost than any U.S.-based leasing firm or lessor. In addition, the lessor would use higher-cost equity (on which it would expect to make a profit) to cover a portion of the lease financing. The committee's analysis shows that direct purchase by the government would cost, at a minimum, 19 percent less than leasing on a net present value basis (after tax). There is also the risk of the lessor going bankrupt and compromising the availability of the polar icebreaker to USCG. For its analysis, the

committee not only relied on its extensive experience with leveraged lease financing but also

reviewed available Government Accountability Office reports and Office of Management and

Budget rules, examined commercial leasing economics and current interest rates, and validated its analysis by consulting an outside expert on the issue....

Chartering (an operating lease) is not a viable option.... The availability of polar icebreakers on the open market is extremely limited. (The committee is aware of the sale

⁷⁷ Transcript of hearing.

of only one heavy icebreaker since 2010.) U.S. experience with chartering a polar icebreaker for the McMurdo resupply mission has been problematic on two prior charter attempts. Chartering is workable only if the need is short term and mission specific. The committee notes that chartering may preclude USCG from performing its multiple missions....⁷⁸

Short-Term Bridge to One or More New Polar Icebreakers

Overview

As mentioned earlier, a new heavy polar icebreaker that begins construction in FY2019 might enter service in 2023, while *Polar Star* was refurbished and reentered service in December 2012 for an intended period of 7 to 10 years—a period that will end between December 2019 and December 2022. Consequently, another potential issue for Congress concerns how to bridge the time between the end of *Polar Star*'s current intended service life and the entry into service of one or more new heavy polar icebreakers.

As testified by CRS on July 21, 2016,⁷⁹ there are at least two options for bridging this time period: One would be to further extend the service life of *Polar Star* and/or repair and extend the service life of *Polar Sea*. The other would be to charter (i.e., lease) one or more other icebreakers (perhaps foreign-owned ones), if such ships are available for charter and have capabilities for performing missions performed by U.S. heavy polar icebreakers. The United States has used both of these approaches in the past to mitigate polar icebreaking capacity gaps:

- In addition to the work done to extend the service life of *Polar Star* by an additional 7 to 10 years, the Coast Guard in the 1970s mitigated a polar icebreaking capacity gap by putting two of its older *Wind*-class icebreakers through a vessel rehabilitation and modernization (VRAM) program.⁸⁰
- Since 2005, the National Science Foundation (NSF) has occasionally chartered foreign polar icebreakers—specifically, the Russian icebreakers *Krasin* and *Vladimir Ignatyuk*, and the Swedish icebreaker *Oden*—to help perform icebreaking missions in polar waters.⁸¹

Extending Service Life of *Polar Star* and/or *Polar Sea*

The Coast Guard is examining the feasibility and potential cost effectiveness of either further extending the service life of *Polar Star* or repairing *Polar Sea*. The Coast Guard states that

One of Coast Guard's two polar-class icebreakers (POLAR STAR) is operational following a reactivation in 2013 that provided an estimated 7-10 years of useful life. The

⁷⁸ National Academies of Sciences, Engineering, and Medicine, Division on Earth and Life Studies and Transportation Research Board, *Acquisition and Operation of Polar Icebreakers: Fulfilling the Nation's Needs*, Letter Report, with cover letter dated July 11, 2017, pp. 10, 12-13.

⁷⁹ See CRS Testimony TE10012, *Coast Guard Arctic Implementation Capabilities*, by Ronald O'Rourke, pp. 6-10.

⁸⁰ See National Research Council, *Polar Icebreakers in a Changing World: An Assessment of U.S. Needs*, Washington, 2007, p. 55. See also Donald L. Canney, "Icebreakers and the U.S. Coast Guard," accessed June 28, 2016, at <http://www.uscg.mil/history/webcutters/Icebreakers.asp>.

⁸¹ Regarding the charters of *Krasin* and *Oden*, see National Research Council, *Polar Icebreakers in a Changing World: An Assessment of U.S. Needs*, Washington, 2007, pp. 6, 14, 63, 80, 97, 111, and U.S. Coast Guard Research & Development Center and ABS Consulting, *Polar Icebreaker Options, Paths Forward to Accomplish U.S. Coast Guard Missions and Contribute to Mission Critical National Science Needs*, May 17, 2011, pp. 9, 14.

second (POLAR SEA) is out of service and undergoing a Material Condition Assessment and an Alternatives Analysis to evaluate the feasibility of reactivation. To ensure the Nation is able to maintain heavy icebreaking capability until replacement assets are delivered, the Coast Guard is evaluating extending the service life of one of these icebreakers. Results from the Material Condition Assessment and Alternatives Analysis, planned for 2016, will inform selection of the candidate icebreaker. Funds requested [for FY2017] (\$3 million) [in the Survey and Design—Vessel and Boats line of the Coast Guard's AC&I account] will support the specification development for the reactivation/sustainment of the selected icebreaker.⁸²

At a June 26, 2013, hearing before the Coast Guard and Maritime Transportation Subcommittee of the House Transportation and Infrastructure Committee, Vice Admiral John P. Currier, the Vice Commandant of the Coast Guard, testified that repairing and reactivating *Polar Sea* for an additional 7 to 10 years of service would require about three years of repair work at a cost of about \$100 million.⁸³

A business case analysis required by Section 222 of the Coast Guard and Maritime Transportation Act of 2012 (H.R. 2838/P.L. 112-213 of December 20, 2102) and submitted to Congress with a cover date of November 7, 2013, states:

A total of 43 mission critical systems in five general categories were assessed and assigned a condition rating. Overall, Propulsion, Auxiliary and Prime Mission Equipment are rated Poor to Fair, while Structure and Habitability are rated Fair to Good. POLAR SEA reactivation is estimated to cost \$99.2 million (excluding annual operations and support costs) to provide 7-10 years of service to the Coast Guard. Given the age of the icebreaker, operations and support costs are projected to rise from \$36.6 million in the first year of operation to \$52.8 million in the tenth year of operation. Combining reactivation costs and point estimates for operating costs, reactivation would cost \$573.9 million. Accounting for operational and technical uncertainties, using a 90% Confidence Level Risk Analysis, the total potential cost rises to \$751.7 million.

Arctic seasonal icebreaking demands through 2022 can be met with existing and planned Coast Guard assets, as current requirements do not justify the need for heavy icebreaking capability in the Arctic. Heavy icebreaker capability is needed to perform Operation Deep Freeze in Antarctica, but Coast Guard assets may not be the only option available to the National Science Foundation to support this activity. Although a second heavy icebreaker would provide redundancy, the cost of this redundant capability would come at the expense of more pressing and immediate operational demands. POLAR STAR, when fully reactivated, will provide heavy icebreaker capability until a new icebreaker can be delivered to meet both current and emerging requirements.⁸⁴

At a July 23, 2014, hearing before the Coast Guard and Maritime Transportation Subcommittee of the House Transportation and Infrastructure Committee, Vice Admiral Peter Neffenger, the Vice Commandant of the Coast Guard, testified that “as I understand it, that \$100 million [estimate for reactivating *Polar Sea*] was a snapshot in time if we were to have begun at that point to reactivate the vessel. We believe that there's been some additional deterioration [in the ship's condition] in

⁸² Department of Homeland Security, United States Coast Guard, *Fiscal Year 2017 Congressional Justification*, pp. CG-AC&I-29 and CG-AC&I-30 (pdf pages 171 and 172 of 407).

⁸³ Transcript of hearing.

⁸⁴ U.S. Coast Guard, *USCGC POLAR SEA Business Case Analysis, 2103 Report to Congress*, November 7, 2013, p. 4. The report was accessed April 9, 2014, at http://assets.fiercemarkets.net/public/sites/govit/polarsea_businesscaseanalysis_nov2013.pdf. See also “Second Heavy Icebreaker Not Necessary Through 2022, Says Coast Guard,” *Fierce Homeland Security* (<http://www.fiercehomelandsecurity.com>), January 19, 2014, which includes a link to the assets.fiercemarkets.net site at which the report was posted.

the 2.5 years it's been sitting [at pier].... But I suspect that it will be something more than \$100 million once we do the assessment [of the ship's condition].”⁸⁵

In an interview published on September 26, 2015, Admiral Paul Zukunft, the Commandant of the Coast Guard, stated:

One course of action is to reactivate an even older ship, the *Polar Sea*, and we're doing an assessment on that to see what would it take to reactivate it. So we'll make that decision next year. So there's always this cut to the chase, how much is it going to cost?

This is a ship that's been laid up now for five years, parts were cannibalized in order to get the *Polar Star* running, it hasn't had a crew on it for that same amount of time as well. So it's like an old car that's been laid up without an engine in it, an engine that's been stripped of its parts. It's not until you really tear into it, and what you maybe thought you could do for \$100 million is now \$200, is now \$300, \$400 and you reach a point where you keep throwing good money after bad. You step back and say, well if it was a car, you should've bought a new car instead.

The other part to look at with these old icebreakers is if they don't meet today's MARPOL code [a regulation to limit accidental or operational pollution from ships] for environmental compliance. If we are setting the standards, we the United State Coast Guard, ship-going standards to operate in the Arctic under that polar code, then by golly we ought to be in compliance as well and not in violation. So as we look at new construction, we want to make sure we're in compliance with modern day environmental standards up there as well.

When asked by the interviewer, as a follow-up question, whether he has “any idea of costs for reactivating the *Polar Sea*,” Zukunft replied:

That's why we're doing this full assessment, but we should know probably within a year from now, and what that will provide us is a floor. It will cost not less than, and I would never give an exact amount because it's not until you tear into this with an old ship in trying to find new parts and the like, those costs in all likelihood will grow over time.⁸⁶

At a June 14, 2016, hearing before the Coast Guard and Maritime Transportation Subcommittee of the House Transportation and Infrastructure Committee, Admiral Michel testified that

We just had *Polar Sea*, which is inoperable currently, out of the water at Vigor Shipyard, and a— an assessment is due to the committee on July the 24th, as promised by the commandant, a material assessment of that particular vessel. And we are on schedule to deliver that to you.

But all those decisions on a rolling recapitalization for *Polar Star* or what we want to do with *Polar Sea* need to be judged in context. And I have under way an alternatives analysis that will take a look at how we want to bridge out to that new icebreaker.

And that's what I'd like to do is bridge out to that new construction icebreaker that I request the Congress' support and—and assistance in the president's budget request.⁸⁷

A February 17, 2017, press report stated:

The Coast Guard has determined it would be too costly to refurbish the heavy icebreaker USCGC *Polar Sea* (WAGB-11) and has designated the ship a “parts donor” to sister ship

⁸⁵ Transcript of hearing.

⁸⁶ Jacqueline Klimas, “Interview: Adm. Paul Zukunft, Coast Guard Commandant,” *Washington Examiner*, September 26, 2015. Material in brackets as in original.

⁸⁷ Transcript of hearing.

USCGC Polar Star (WAGB-10), the service's assistant commandant for engineering and logistics said this week.

The service will focus on building a class of new heavy icebreakers and keeping Polar Star running until the new hulls come online.

A recent detailed examination of icebreaker – commissioned in 1977 – found the ship had a sturdy hull, but upgrading ship systems to make it operational would require an effort that was not deemed cost-effective, Rear Adm. Bruce Baffer said during American Society of Naval Engineers' Technologies, Systems and Ships event.

"Polar Sea is now the parts donor for Polar Star. When we looked at Polar Sea, the hull is in good shape but everything inside the hull was obsolete. There was not a thing inside that hull... that we could replace," Baffer said.

"The hull is in good shape, but cutting from the top down and rebuilding the ship – virtually every thing on the ship, in place, stick built, it was just too expensive."⁸⁸

Chartering an Icebreaker

Overview

The feasibility of the option of chartering an icebreaker as a short-term bridge to one or more new polar icebreakers would depend on whether an icebreaker was available for charter at the time of the year when the United States would need it to perform desired missions in the Arctic or Antarctic. Foreign polar icebreakers like *Krasin*, *Vladimir Ignatyuk*, and *Oden*, mentioned above, are used by their own countries for icebreaking operations, and may not always be available for charter when the United States might want to use them. If an icebreaker were available for charter, the potential cost effectiveness of this option would then depend on the cost of the charter, the ability of the ship to perform U.S. polar icebreaker missions, and how these costs and capabilities compare to the option of extending the service life of *Polar Star*.

Aiviq Being Offered for Lease

One ship that is being offered for lease to the Coast Guard as an interim polar icebreaker is *Aiviq*, an Arctic oil-exploration support ship owned by Edison Chouest Offshore (ECO) (**Figure 4**). The 361-foot-long ship was ordered in 2009, completed in 2012, and chartered by Royal Dutch Shell to support that company's effort (now ended) to explore for oil in Arctic waters. Following Shell's decision to end that effort, alternative uses for *Aiviq* have been sought. The ship has been modified to serve as a polar icebreaker, and it is being offered to the Coast Guard for lease as an interim polar icebreaker. It reportedly has also been offered for use as an icebreaker to the Canadian government.⁸⁹

⁸⁸ Sam LaGrone, "Coast Guard: Icebreaker Polar Sea Now a 'Parts Donor,' Refurbishment Deemed Too Expensive," *USNI News*, February 17, 2017.

⁸⁹ See for example, "More Sparks Fly in Canada Shipbuilding Controversy," *Marine Log*, March 18, 2016.

Figure 4. Aiviq



Source: “Arctic Supply Vessel Aiviq,” accessed September 14, 2017, at <http://www.mascoat.com/arctic-supply-vessel-aiviq.html>.

The possibility of leasing *Aiviq* as an interim polar icebreaker has been discussed at certain recent hearings about the Coast Guard. For example, at a July 25, 2017, hearing on Coast Guard capabilities before the Coast Guard and Maritime transportation subcommittee of the House Transportation and Infrastructure Committee, the following exchange occurred:

REPRESENTATIVE DON YOUNG (continuing):

Have you looked at, Admiral, I know this has been an ongoing battle with me and the Coast Guard over the years, the other possibility of getting an ice breaker into the arena quicker than having one constructed like leasing from another outfit? You know, I've been talking about this a long time. Have you analyzed this again?

I know the last time we had a study, it was 1980. That's a long time ago. So is there a way we can put metal on the water, especially for the new shipping through and the—and the cruise ships, because that Healy is old, and—is—have you looked at that at all?

ADMIRAL PAUL ZUKUNFT, COMMANDANT, U.S. COAST GUARD:

We have. In fact, one potential vendor, we've had multiple interactions. They have a platform that has yet to complete ice trials. We—we would not want to lease something they can't demonstrate its ability to actually operate in the ice that—that Healy sees. Healy was actually beset in ice for 36 hours last year, so it's not ice free up there, and that's a medium ice breaker. This particular platform doesn't have the capability of Healy.

But we would at least want to make sure that ice trials were completed. That we could actually be a good steward of taxpayer dollars, so at least a platform that would meet our

requirements. So we've had multiple interactions, the last one was probably in May, and the issue of ice trials is still on the table right now.⁹⁰

Later in the same hearing, the following exchange occurred:

REPRESENTATIVE DUNCAN HUNTER, CHAIRMAN:

Going back to Mr. Young's question. too, about leasing. You said you—you're—you're waiting for—I'm—I'm guessing money for ice trials. That's what you said.

ZUKUNFT:

No real dollars have been negotiated in any of this. So...

HUNTER:

But in—in real terms, you're only paying for gas? I mean what—what does it cost to do ice trials. It's gas, right? You're not going to hire more Coast Guardsmen to come in and—and do it. I mean so that's a figure—your—your overhead's fixed. So what is the cost to—to go do ice trials with the (inaudible)?

ZUKUNFT:

That would really be for the...

HUNTER:

The ice—once again the only...

ZUKUNFT:

... vendor to decide.

HUNTER:

... existing U.S. made ice breaker in America.

ZUKUNFT:

Yeah. So this—this is a ship that is built with direct drive diesel. Ice breakers are typically diesel electric, which means the generators push the shaft, and they absorb that shock load every time you collide with ice.

A reduction gear, fixed gear is going to that—that gear box is going to absorb all that shock. So if you're going to do ice trials, there's a likelihood you might have to replace a reduction gear. There might be real hidden costs of doing ice trials. So if I'm a vendor, I might want to protect myself from some of that risk.

Now I'm not the vendor but those would be some of my thoughts of, OK, if you're really serious about this and I do ice trials and now I've just caused X number of dollars that I am now going to have to fit. And oh, by the way, you're not going to lease it because it didn't meet your requirements. I think those are some of the issues that we still have to negotiate.⁹¹

Coast Guard Statements in 2016

The Coast Guard stated in 2016 that

NSF [the National Science Foundation] leased the icebreaker KRASIN from Russia from 2005-2006, ODEN from the Swedish government from 2007-2010, and VLADIMIR

⁹⁰ Source: Transcript of hearing.

⁹¹ Source: Transcript of hearing.

IGNATYUK from Russia in 2012 to support the McMurdo resupply mission. All leases were time charters, and crews were supplied with the leases. As a contingency measure, NSF obtained assurances of assistance from other vessels in the area, such as the Chinese flagged [icebreaking] vessel XUE LONG, in the event they encountered difficulty. They also hired icebreaker captains with previous McMurdo experience to supplement the crew. NSF acquired these leases through a RFP process, and had no assurances that icebreakers would be available to perform the mission, or what price would be quoted.

This process came with risks, as there was no way to gauge icebreaker availability until NSF received responses to their RFP. Additionally, a foreign-flagged commercial or state vessel can become unavailable for a variety of environmental and political reasons. For example, the Swedish government abruptly terminated their contract during the spring/summer of 2011, and NSF was left without a platform to conduct its mission. NSF requested support from CGC [Coast Guard cutter] HEALY, but it was employed in the Arctic. NSF ultimately leased the Russian icebreaker VLADIMIR IGNATYUK. After that incident, NSF decided to utilize CGC POLAR STAR to support the McMurdo mission, which it has been doing since 2013.⁹²

At the June 14, 2016, hearing, the following exchange occurred:

REPRESENTATIVE HUNTER (Chairman):

How do you plan on—on filling the capability gap until you get a heavy icebreaker, which is 10 years at the least based on the best projections of Congress and everybody working together? You still haven't answered that one.

ADMIRAL MICHEL:

Well, right—the alternatives now, since we'll provide the answer to that, and it's probably going to be either a rolling recapitalization of the *Polar Star* or to try to bring—let *Polar Star* taper off and then try to bring *Polar Sea* back on and bridge out to the new icebreaker.

I do not know which one at this point, which path we would want to take. I'm not aware of any other—we've looked out there for vessels to lease for heavy icebreaking capabilities. There's nothing out there on planet earth that you can lease in the heavy icebreaking area. So that's kind of where we are, sir.

HUNTER:

Was it the—the Finns that came into my office?

(UNKNOWN)

Mm-hmm.

HUNTER:

Can't remember whether we had the Norwegians or the Finns. I mean, they—have you—you've obviously looked at that, right?

MICHEL:

Yes. As a matter of fact I—I traveled to Sweden and Finland...

HUNTER:

Yeah.

MICHEL:

⁹² Source: Email from Guard Office of Congressional Affairs to CRS, July 8, 2016.

... and talked to them. And they do not have heavy icebreaking capability that will meet the needs as in the FedBizOpps. As a matter of fact, in—when I'm talking FedBizOpps [I mean] there's a technical package that the Coast Guard put out for our [new] heavy icebreaker [i.e., the one that the Obama Administration wanted to begin building in 2020].

It kind of lays out our basic requirements including the long pole in the tent which is the icebreaking requirement, which is six foot minimum at three knots, desirable eight-foot minimum at three knots and then 21 feet backing and ramming.

When I talked to the shipbuilders over there, they said there is not a vessel like that that currently exists that will meet those requirements in the—in the FedBizOpps technical package. So you'd have to build a vessel like that. And that's the type of vessel that we're looking for.⁹³

Legislative Activity for FY2018

Summary of Appropriation Action on FY2018 Funding Request

The Coast Guard's proposed FY2018 budget requests \$19 million in acquisition funding for a new polar icebreaker. **Table 5** summarizes Congressional appropriation action on this funding request.

Table 5. Summary of Congressional Appropriations Action on FY2018 Funding Request

(millions of dollars)

Polar icebreaker	Request	HAC	SAC	Conf.
Coast Guard acquisition account	19	19		
Navy shipbuilding account	0	0		
Total	19	19		

Source: Table prepared by CRS, based on Coast Guard's FY2018 budget submission and committee reports on FY2018 DHS Appropriations Act and FY2018 DOD Appropriations Act. **HAC** is House Appropriations Committee; **SAC** is Senate Appropriations Committee; **Conf.** is conference agreement.

FY2018 DHS Appropriations Act (H.R. 3355)

House

The House Appropriations Committee, in its report (H.Rept. 115-239 of July 21, 2017) on H.R. 3355, recommends the funding level shown in the HAC column of the Coast Guard acquisition account line in **Table 5**. H.Rept. 115-239 states:

Polar Ice Breaking Vessel. The Committee is concerned with the increasing Russian military presence in the Arctic region. As Russia continues to reopen Cold War era bases and conduct military exercises in the region, it is essential that the United States maintain a robust capability to operate in the region to ensure its national security and economic interests are protected, and to counter Russian aggression. The Committee acknowledges

⁹³ Transcript of hearing.

the Coast Guard's long-term requirements for additional heavy and medium icebreakers as its current inventory reaches the end of service life. A potential capability gap may require the Coast Guard to consider unique, short-term procurement strategies. The Committee directs the Coast Guard to examine capabilities of existing vessels to operate in the Arctic as evidenced by industry-conducted ice trials to determine what Coast Guard statutory requirements could be met by such vessels. Further, the Committee encourages the Secretary of Homeland Security to work with the Secretary of Defense on a strategy for the future procurement of additional heavy icebreakers, which are essential to the maritime security interests of the United States and allies in the region. (Page 47)⁹⁴

FY2018 DHS Appropriations Act (Division E of H.R. 3354)

House

H.R. 3354, which earlier was the FY2018 Department of the Interior, Environment, and Related Agencies Appropriations Bill, subsequently became a consolidated appropriations bill that includes, *inter alia*, the FY2018 DHS Appropriations Act (H.R. 3355—see previous section) as Division E. The text of H.R. 3354 as a consolidated appropriations act was posted by the House Rules Committee as Rules Committee Print 115-31.⁹⁵

On September 7, 2017, as part of its consideration of H.R. 3354, the House rejected, 170 to 241, H.Amdt. 310, which was amendment number 74 as printed in H.Rept. 115-295 of September 5, 2017, on H.Res. 500, providing for the consideration of H.R. 3354. H.Amdt. 310 would reduce funding for the Operations and Support account of the Immigration and Customs Enforcement (ICE) agency within DHS by \$849.5 million, and increase the Coast Guard's Acquisition, Construction and Improvements (AC&I) account by an equal amount for the construction of heavy polar icebreakers.

Also on September 7, 2017, as part of its consideration of H.R. 3354, the House approved, 245 to 168, H.Amdt. 313, which was amendment number 77 as printed in H.Rept. 115-295 of September 5, 2017, on H.Res. 500, providing for the consideration of H.R. 3354. H.Amdt. 313 reduces the Coast Guard's Operating Expenses (OE) account by \$5 million, and increases the Coast Guard's research and development account by an equal amount to fund Coast Guard expenses associated with icebreaking trials for the *Aiviq*, a ship that is being offered for lease to the Coast Guard as an interim polar icebreaker, (For more on *Aiviq*, see "Chartering an Icebreaker" in "Short-Term Bridge to One or More New Polar Icebreakers".)

FY2018 DOD Appropriations Act (Division A of H.R. 3219)

House

H.R. 3219 as reported by the House Appropriations Committee (H.Rept. 115-219 of July 13, 2017) was the FY2018 DOD Appropriations Act. H.R. 3219 as passed by the House is called the Make America Secure Appropriations Act, 2018. H.R. 3219 as passed by the House includes the FY2018 DOD Appropriations Act as Division A and four other appropriations acts as Divisions B through E. The discussion below relates to Division A.

⁹⁴ For additional minority views regarding icebreakers, see pp. 156-157 of H.Rept. 115-239.

⁹⁵ The report was accessed on September 11, 2017, at: <http://docs.house.gov/billsthisweek/20170904/BILLS%20-115HR3354HR3268HR3267HR3280HR3355HR3358HR3362HR3353-RCP115-31.pdf>.

The House Appropriations Committee, in its report (H.Rept. 115-219 of July 12, 2017) on H.R. 3219, recommends the funding level shown in the HAC column of the Navy shipbuilding account line in **Table 5**. H.Rept. 115-219 states:

ICEBREAKERS

The Committee remains concerned with the increasing Russian military expansion in the Arctic region. As Russia continues to reopen Cold War era bases and conduct military exercises in the region, the Committee urges the Secretary of Defense to make countering Russian aggression in the Arctic a priority. The Committee encourages the Secretary of Defense to work with the Secretary of Homeland Security on a strategy for the future procurement of icebreakers, which are essential to the maritime security interests of the United States and allies in the region. (Page 162)

FY2018 National Defense Authorization Act (H.R. 2810/S. 1519)

House Committee Report

In H.R. 2810 as reported by the House Armed Services Committee (H.Rept. 115-200 of July 6, 2017), **Section 122** states:

SEC. 122. Procurement authority for icebreaker vessels.

(a) Authority.—The Secretary of the Department in which the Coast Guard is operating may enter into a contract or other agreement with the Secretary of the Navy under which the Navy shall act as general agent for the Department in which the Coast Guard is operating for the purpose of entering into a contract on behalf of such Department, beginning with the fiscal year 2018 program year, for the procurement of the following:

- (1) Not more than three heavy icebreaker vessels.
- (2) Not more than three medium icebreaker vessels.

(b) Condition for out-year contract payments.—A contract entered into under subsection (a) shall provide that any obligation of the United States to make a payment under the contract for a fiscal year after fiscal year 2018 is subject to the availability of appropriations for that purpose for such later fiscal year.

(c) Definitions.—In this section:

(1) HEAVY ICEBREAKER VESSEL.—The term “heavy icebreaker vessel” means a vessel that is able—

- (A) to break through nonridged ice that is not less than six feet thick at a speed of three knots;
- (B) to break through ridged ice that is not less than 21 feet thick; and
- (C) to operate continuously for 80 days without replenishment.

(2) MEDIUM ICEBREAKER VESSEL.—The term “medium icebreaker vessel” means a vessel that is able—

- (A) to break through nonridged ice that is not less than four and one-half feet thick at a speed of three knots; and
- (B) to operate continuously for 80 days without replenishment.

Section 123 of H.R. 2810 as reported states:

SEC. 123. Limitation on availability of funds for procurement of icebreaker vessels.

(a) Limitation.—Except as provided in subsection (b), none of the funds authorized to be appropriated by this Act or otherwise made available for the Department of Defense for fiscal year 2018 may be obligated or expended for the procurement of an icebreaker vessel.

(b) Exception.—Notwithstanding the limitation in subsection (a), the Secretary of the Navy may use funds described in such subsection to act as general agent for the Department in which the Coast Guard is operating pursuant to a contract or other agreement entered into under section 122.

Section 1012 of H.R. 2810 as reported states:

SEC. 1012. National Defense Sealift Fund: construction of national icebreaker vessels.

Section 2218 of title 10, United States Code, as amended by section 2211, is further amended—

(1) in subsection (c)(1), by adding at the end the following new subparagraph:

“(E) Construction (including design of vessels), purchase, alteration, and conversion of national icebreaker vessels.”; and

(2) in subsection (d)(1),

(A) in subparagraph (B), by striking “and” and the end;

(B) in subparagraph (C), by striking the period and inserting “; and”; and

(C) by adding at the end the following new subparagraph:

“(D) construction (including design of vessels), purchase, alteration, and conversion of national icebreaker vessels.”.

House Floor Action

On July 13, 2017, as part of its consideration of H.R. 2810, the House rejected by a vote of 198 to 220 a proposed amendment to strike Section 123 (see above) from H.R. 2810 as reported. The proposed amendment was amendment 1 as printed in H.Rept. 115-217 of July 13 (legislative day July 12), 2017, on H.Res. 440, providing for the further consideration of H.R. 2810.

Senate

In S. 1519 as reported by the Senate Armed Services Committee (S.Rept. 115-125 of July 10, 2017), **Section 1048** states:

SEC. 1048. Authorization to procure up to six polar-class icebreakers.

(a) Authority To procure icebreakers.—

(1) IN GENERAL.—The Secretary of the department in which the Coast Guard is operating may, in consultation with the Secretary of the Navy, enter into a contract or contracts for the procurement of up to six polar-class icebreakers, including—

(A) polar-class heavy icebreakers; and

(B) polar-class medium icebreakers.

(2) CONDITION FOR OUT-YEAR CONTRACT PAYMENTS.—A contract entered into under paragraph (1) shall provide that any obligation of the United States to make a payment under the contract for a fiscal year after fiscal year 2018 is subject to the availability of appropriations or funds for that purpose for such later fiscal year.

(b) Comptroller General of the United States report.—

(1) IN GENERAL.—Not later than 45 days after the date of the enactment of the this Act, the Comptroller General of the United States shall submit to the Committees on Armed Services of the Senate and the House of Representatives, the Committee on Commerce, Science, and Transportation of the Senate, and the Committee on Transportation and Infrastructure of the House of Representatives a report assessing the cost and procurement schedule for new United States icebreakers.

(2) ELEMENTS.—The report required in paragraph (1) shall include an analysis of the following:

(A) The current status of the efforts of the Coast Guard to acquire new icebreaking capability, including coordination through the Integrated Program Office.

(B) Actions being taken by the Coast Guard to incorporate key practices from other nations that procure icebreakers to increase knowledge and reduce costs and risks.

(C) The extent by which the cost and schedule for building Coast Guard icebreakers differs from those in other countries, if known.

(D) The extent that innovative acquisition practices (such as multiyear funding and block buys) may be applied to icebreaker acquisition to reduce the cost and accelerate the schedule.

(E) A capacity replacement plan to mitigate a potential icebreaker capability gap if the Polar Star cannot remain in service.

(F) Any other matters the Comptroller General considers appropriate.

Regarding Section 1048, S.Rept. 115-125 states:

Authorization to procure up to six polar-class icebreakers (sec. 1048)

The committee recommends a provision that would allow the Secretary of the Department in which the Coast Guard is operating, in consultation with the Secretary of the Navy, to enter into a contract or contracts for the procurement of up to six polar-class icebreakers, including both polar-class heavy icebreakers and polar-class medium icebreakers. The committee notes that section 3 of title 14, United States Code, states, “the Coast Guard shall be a service in the Department of Homeland Security.”

As codified in a May 19, 2017 Memorandum of Agreement between the Department of the Navy and Department of Homeland Security (DHS), the committee notes the Undersecretary of Management in the DHS serves as the Acquisition Decision Authority for the Polar Icebreaker Program and that this program is governed in accordance with DHS Acquisition Management Directive 102-01 and Instruction 102-01-001. The committee believes maintaining authority, responsibility, and accountability with the Acquisition Decision Authority is essential to delivering icebreakers on cost and schedule.

Accordingly, the committee believes the Secretary of the Department of Homeland Security should be the single official provided with authorities, limitations, or other legislative direction related to the Polar Icebreaker Program. (Page 232)

Appendix A. Recent Studies Relating to Coast Guard Polar Icebreakers

A number of studies have been conducted in recent years to assess U.S. requirements for polar icebreakers and options for sustaining and modernizing the Coast Guard's polar icebreaker fleet. This appendix presents the findings of some of these studies, with the most recent study on top.

July 2017 National Academies Report

A July 2017 report on the acquisition and operation of polar icebreakers by the National Academies of Sciences, Engineering, and Medicine that was directed by Congress in Section 604 of the Coast Guard Authorization Act of 2015 (H.R. 4188/P.L. 114-120 of February 8, 2016) concluded the following:

INTRODUCTION

The United States has strategic national interests in the polar regions. In the Arctic, the nation must protect its citizens, natural resources, and economic interests; assure sovereignty, defense readiness, and maritime mobility; and engage in discovery and research. In the Antarctic, the United States must maintain an active presence that includes access to its research stations for the peaceful conduct of science and the ability to participate in inspections as specified in the Antarctic Treaty. The committee's charge... was to advise the U.S. House of Representatives and the U.S. Senate on an assessment of the costs incurred by the federal government in carrying out polar icebreaking missions and on options that could minimize lifecycle costs. The committee's consensus findings and recommendations are presented below. Unless otherwise specified, all estimated costs and prices for the future U.S. icebreakers are expressed in 2019 dollars, since that is the year in which the contracts are scheduled to be made. Supporting material is found in the appendices.

FINDINGS AND RECOMMENDATIONS

1. Finding: The United States has insufficient assets to protect its interests, implement U.S. policy, execute its laws, and meet its obligations in the Arctic and Antarctic because it lacks adequate icebreaking capability.

For more than 30 years, studies have emphasized the need for U.S. icebreakers to maintain presence, sovereignty, leadership, and research capacity—but the nation has failed to respond....The strong warming and related environmental changes occurring in both the Arctic and the Antarctic have made this failure more critical. In the Arctic, changing sea ice conditions will create greater navigation hazards for much of the year, and expanding human industrial and economic activity will magnify the need for national presence in the region. In the Antarctic, sea ice trends have varied greatly from year to year, but the annual requirements for access into McMurdo Station have not changed. The nation is ill-equipped to protect its interests and maintain leadership in these regions and has fallen behind other Arctic nations, which have mobilized to expand their access to ice-covered regions. The United States now has the opportunity to move forward and acquire the capability to fulfill these needs....

2. Recommendation: The United States Congress should fund the construction of four polar icebreakers of common design that would be owned and operated by the United States Coast Guard (USCG).

The current Department of Homeland Security (DHS) Mission Need Statement (DHS 2013) contemplates a combination of medium and heavy icebreakers. The committee's recommendation is for a single class of polar icebreaker with heavy icebreaking

capability. Proceeding with a single class means that only one design will be needed, which will provide cost savings. The committee has found that the fourth heavy icebreaker could be built for a lower cost than the lead ship of a medium icebreaker class....

The DHS Mission Need Statement contemplated a total fleet of “potentially” up to six ships of two classes—three heavy and three medium icebreakers. Details appear in the High Latitude Mission Analysis Report. The Mission Need Statement indicated that to fulfill its statutory missions, USCG required three heavy and three medium icebreakers; each vessel would have a single crew and would homeport in Seattle. The committee’s analysis indicated that four heavy icebreakers will meet the statutory mission needs gap identified by DHS for the lowest cost. Three of the ships would allow continuous presence in the Arctic, and one would service the Antarctic.

As noted in the High Latitude Report, USCG’s employment standard is 185 days away from home port (DAFHP) for a single crew. Three heavy icebreakers in the Arctic provide 555 DAFHP, sufficient for continuous presence. In addition, the medium icebreaker USCG Cutter Healy’s design service life runs through 2030. If greater capacity is required, USCG could consider operating three ships with four crews, which would provide 740 DAFHP. The use of multiple crews in the Arctic could require fewer ships while providing a comparable number of DAFHP. For example, two ships (instead of the recommended three) operating in the Arctic with multiple crews could provide a similar number of annual operating days at a lower cost, but such an arrangement may not permit simultaneous operations in both polar regions and may not provide adequate redundancy in capability. More important, an arrangement under which fewer boats are operated more often would require more major maintenance during shorter time in port, often at increasing cost. In addition, if further military presence is desired in the Arctic, USCG could consider ice-strengthening the ninth national security cutter.

One heavy icebreaker servicing the Antarctic provides for the McMurdo breakout and international treaty verification. The availability of the vessel could be extended by homeporting in the Southern Hemisphere. If the single vessel dedicated to the Antarctic is rendered inoperable, USCG could redirect an icebreaker from the Arctic, or it could rely on support from other nations. The committee considers both options to be viable and believes it difficult to justify a standby (fifth) vessel for the Antarctic mission when the total acquisition and lifetime operating costs of a single icebreaker are projected to exceed \$1.6 billion. Once the four new icebreakers are operational, USCG can reasonably be expected to plan for more distant time horizons. USCG could assess the performance of the early ships once they are operational and determine whether additional capacity is needed.

USCG is the only agency of the U.S. government that is simultaneously a military service, a law enforcement agency, a marine safety and rescue agency, and an environmental protection agency. All of these roles are required in the mission need statement for a polar icebreaker. USCG, in contrast to a civilian company, has the authorities, mandates, and competencies to conduct the missions contemplated for the polar icebreakers. Having one agency with a multimission capability performing the range of services needed would be more efficient than potentially duplicating effort by splitting polar icebreaker operations among other agencies.

The requirement for national presence is best accomplished with a military vessel. In addition, USCG is fully interoperable with the U.S. Navy and the nation’s North Atlantic Treaty Organization partners. USCG is already mandated to operate the nation’s domestic and polar icebreakers. Continuing to focus this expertise in one agency remains the logical approach....

Government ownership of new polar icebreakers would be less costly than the use of lease financing (see Appendix C). The government has a lower borrowing cost than any

U.S.-based leasing firm or lessor. In addition, the lessor would use higher-cost equity (on which it would expect to make a profit) to cover a portion of the lease financing. The committee's analysis shows that direct purchase by the government would cost, at a minimum, 19 percent less than leasing on a net present value basis (after tax). There is also the risk of the lessor going bankrupt and compromising the availability of the polar icebreaker to USCG. For its analysis, the committee not only relied on its extensive experience with leveraged lease financing but also reviewed available Government Accountability Office reports and Office of Management and Budget rules, examined commercial leasing economics and current interest rates, and validated its analysis by consulting an outside expert on the issue....

Chartering (an operating lease) is not a viable option.... The availability of polar icebreakers on the open market is extremely limited. (The committee is aware of the sale of only one heavy icebreaker since 2010.) U.S. experience with chartering a polar icebreaker for the McMurdo resupply mission has been problematic on two prior charter attempts. Chartering is workable only if the need is short term and mission specific. The committee notes that chartering may preclude USCG from performing its multiple missions....

In the committee's judgment, an enlarged icebreaker fleet will provide opportunities for USCG to strengthen its icebreaking program and mission. Although the number of billets that require an expert is small compared with the overall number of billets assigned to these icebreakers, more people performing this mission will increase the pool of experienced candidates. This will provide personnel assignment officers with a larger pool of candidates when the more senior positions aboard icebreakers are designated, which will make icebreaking more attractive as a career path and increase the overall level of icebreaking expertise within USCG. Importantly, the commonality of design of the four recommended heavy icebreakers will reduce operating and maintenance costs over the service life of these vessels through efficiencies in supporting and crewing them. Having vessels of common design will likely improve continuity of service, build icebreaking competency, improve operational effectiveness, and be more cost-efficient....

3. Recommendation: USCG should follow an acquisition strategy that includes block buy contracting with a fixed price incentive fee contract and take other measures to ensure best value for investment of public funds.

Icebreaker design and construction costs can be clearly defined, and a fixed price incentive fee construction contract is the most reliable mechanism for controlling costs for a program of this complexity. This technique is widely used by the U.S. Navy. To help ensure best long-term value, the criteria for evaluating shipyard proposals should incorporate explicitly defined lifecycle cost metrics....

A block buy authority for this program will need to contain specific language for economic order quantity purchases for materials, advanced design, and construction activities. A block buy contracting program³ with economic order quantity purchases enables series construction, motivates competitive bidding, and allows for volume purchase and for the timely acquisition of material with long lead times. It would enable continuous production, give the program the maximum benefit from the learning curve, and thus reduce labor hours on subsequent vessels.

The acquisition strategy would incorporate (a) technology transfer from icebreaker designers and builders with recent experience, including international expertise in design, construction, and equipment manufacture; (b) a design that maximizes use of commercial off-the-shelf (COTS) equipment, applies Polar Codes and international standards, and only applies military specifications (MIL-SPEC) to the armament, aviation, communications, and navigation equipment; (c) reduction of any "buy American" provisions to allow the sourcing of the most

suitable and reliable machinery available on the market; and (d) a program schedule that allows for completion of design and planning before the start of construction. These strategies will allow for optimization of design, reduce construction costs, and enhance reliability and maintainability....

4. Finding: In developing its independent concept designs and cost estimates, the committee determined that the costs estimated by USCG for the heavy icebreaker are reasonable. However, the committee believes that the costs of medium icebreakers identified in the High Latitude Mission Analysis Report are significantly underestimated.

The committee estimates the rough order-of-magnitude (ROM) cost of the first heavy icebreaker to be \$983 million. (See Appendix D, Table D-6.) Of these all-in costs, 75 to 80 percent are shipyard design and construction costs; the remaining 20 to 25 percent cover government-incurred costs such as government-furnished equipment and government-incurred program expenses. If advantage is taken of learning and quantity discounts available through the recommended block buy contracting acquisition strategy, the average cost per heavy icebreaker is approximately \$791 million, on the basis of the acquisition of four ships. The committee's analysis of the ship size to incorporate the required components (stack-up length) suggests an overall length of 132 meters (433 feet) and a beam of 27 meters (89 feet). This is consistent with USCG concepts for the vessel.

Costs can be significantly reduced by following the committee's recommendations. Reduction of MIL-SPEC requirements can lower costs by up to \$100 million per ship with no loss of mission capability.... The other recommended acquisition, design, and construction strategies will control possible cost overruns and provide significant savings in overall life-cycle costs for the program.

Although USCG has not yet developed the operational requirements document for a medium polar icebreaker, the committee was able to apply the known principal characteristics of the USCG Cutter Healy to estimate the scope of work and cost of a similar medium icebreaker. The committee estimates that a first-of-class medium icebreaker will cost approximately \$786 million. The fourth ship of the heavy icebreaker series is estimated to cost \$692 million. Designing a medium-class polar icebreaker in a second shipyard would incur the estimated engineering, design, and planning costs of \$126 million and would forgo learning from the first three ships; the learning curve would be restarted with the first medium design. Costs of building the fourth heavy icebreaker would be less than the costs of designing and building a first-of-class medium icebreaker... In developing its ROM cost estimate, the committee agreed on a common notional design and basic assumptions.... Two committee members then independently developed cost estimating models, which were validated internally by other committee members. These analyses were then used to establish the committee's primary cost estimate....

5. Finding: Operating costs of new polar icebreakers are expected to be lower than those of the vessels they replace.

The committee expects the operating costs for the new heavy polar icebreakers to be lower than those of USCG's Polar Star. While USCG's previous experience is that operating costs of new cutters are significantly higher than those of the vessels they replace, the committee does not believe this historical experience applies in this case. There is good reason to believe that operating costs for new ships using commercially available modern technology will be lower than costs for existing ships.... The more efficient hull forms and modern engines will reduce fuel consumption, and a well-designed automation plant will require fewer operation and maintenance personnel, which will allow manning to be reduced or freed up for alternative tasks. The use of COTS technology and the minimization of MIL-SPEC, as recommended, will also reduce long-term maintenance costs, since use of customized equipment to meet MIL-SPEC

requirements can reduce reliability and increase costs. A new vessel, especially over the first 10 years, typically has significantly reduced major repair and overhaul costs, particularly during dry-dock periods, compared with existing icebreakers—such as the Polar Star—that are near or at the end of their service life.... The Polar Star has many age-related issues that require it to be extensively repaired at an annual dry-docking. These issues will be avoided in the early years of a new ship. However, the committee recognizes that new ship operating costs can be higher than those of older ships if the new ship has more complexity to afford more capabilities. Therefore, any direct comparisons of operating costs of newer versus older ships would need to take into account the benefits of the additional capabilities provided by the newer ship.

USCG will have an opportunity to evaluate the manning levels of the icebreaker in light of the benefits of modern technology to identify reductions that can be made in operating costs....

6. Recommendation: USCG should ensure that the common polar icebreaker design is science-ready and that one of the ships has full science capability.

All four proposed ships would be designed as “science-ready,” which will be more cost-effective when one of the four ships—most likely the fourth—is made fully science capable. Including science readiness in the common polar icebreaker design is the most cost-effective way of fulfilling both the USCG’s polar missions and the nation’s scientific research polar icebreaker needs.... The incremental costs of a science-ready design for each of the four ships (\$10 million to \$20 million per ship) and of full science capability for one of the ships at the initial build (an additional \$20 million to \$30 million) are less than the independent design and build cost of a dedicated research medium icebreaker.... In briefings at its first meeting, the committee learned that the National Science Foundation and other agencies do not have budgets to support full-time heavy icebreaker access or the incremental cost of design, even though their science programs may require this capability. Given the small incremental cost, the committee believes that the science capability cited above should be included in the acquisition costs.

Science-ready design includes critical elements that cannot be retrofitted cost-effectively into an existing ship and that should be incorporated in the initial design and build. Among these elements are structural supports, appropriate interior and exterior spaces, flexible accommodation spaces that can embark up to 50 science personnel, a hull design that accommodates multiple transducers and minimizes bubble sweep while optimizing icebreaking capability, machinery arrangements and noise dampening to mitigate interference with sonar transducers, and weight and stability latitudes to allow installation of scientific equipment. Such a design will enable any of the ships to be retrofitted for full science capability in the future, if necessary....

Within the time frame of the recommended build sequence, the United States will require a science-capable polar icebreaker to replace the science capabilities of the Healy upon her retirement. To fulfill this need, one of the heavy polar icebreakers would be procured at the initial build with full science capability; the ability to fulfill other USCG missions would be retained. The ship would be outfitted with oceanographic overboarding equipment and instrumentation and facilities comparable with those of modern oceanographic research vessels. Some basic scientific capability, such as hydrographic mapping sonar, should be acquired at the time of the build of each ship so that environmental data that are essential in fulfilling USCG polar missions can be collected.

7. Finding: The nation is at risk of losing its heavy polar icebreaking capability—experiencing a critical capacity gap—as the Polar Star approaches the end of its extended service life, currently estimated at 3 to 7 years.

The Polar Star, built in 1976, is well past its 30-year design life. Its reliability will continue to decline, and its maintenance costs will continue to escalate. Although the ship

went through an extensive life-extending refit in 2011–2012, the Polar Star’s useful life is estimated to end between 2020 and 2024. As USCG has recognized, the evaluation of alternative arrangements to secure polar icebreaking capacity is important, given the growing risks of the Polar Star losing its capability to fulfill its mission....

8. Recommendation: USCG should keep the Polar Star operational by implementing an enhanced maintenance program (EMP) until at least two new polar icebreakers are commissioned.

Even if the committee’s notional schedule for new polar icebreakers is met, the second polar icebreaker would not be ready until July 2025.... The committee’s proposed EMP could be designed with planned—and targeted—upgrades that allow the Polar Star to operate every year for its Antarctic mission. The necessary repairs could be performed in conjunction with the ship’s current yearly dry-docking schedule within existing annual expenditures, estimated to average \$5 million. In particular, the EMP would require improvements in the ship’s operating systems, sanitary system, evaporators, main propulsion systems, and controllable pitch propellers. In the committee’s judgment, the EMP could be accomplished within USCG’s average annual repair expenditures for the Polar Star, which currently range between \$2 million and \$9 million.⁹⁶

Coast Guard High Latitude Study Provided to Congress in July 2011

In July 2011, the Coast Guard provided to Congress a study on the Coast Guard’s missions and capabilities for operations in high-latitude (i.e., polar) areas. The study, commonly known as the High Latitude Study, is dated July 2010 on its cover. The High Latitude Study concluded the following:

[The study] concludes that future capability and capacity gaps will significantly impact four [Coast Guard] mission areas in the Arctic: Defense Readiness, Ice Operations, Marine Environmental Protection, and Ports, Waterways, and Coastal Security. These mission areas address the protection of important national interests in a geographic area where other nations are actively pursuing their own national goals....

The common and dominant contributor to these significant mission impacts is the gap in polar icebreaking capability. The increasing obsolescence of the Coast Guard’s icebreaker fleet will further exacerbate mission performance gaps in the coming years....

The gap in polar icebreaking capacity has resulted in a lack of at-sea time for crews and senior personnel and a corresponding gap in training and leadership. In addition to providing multi-mission capability and intrinsic mobility, a helicopter-capable surface unit would eliminate the need for acquiring an expensive shore-based infrastructure that may only be needed on a seasonal or occasional basis. The most capable surface unit would be a polar icebreaker. Polar icebreakers can transit safely in a variety of ice conditions and have the endurance to operate far from logistics bases. The Coast Guard’s polar icebreakers have conducted a wide range of planned and unscheduled Coast Guard missions in the past. Polar icebreakers possess the ability to carry large numbers of passengers, cargo, boats, and helicopters. Polar icebreakers also have substantial command, control, and communications capabilities. The flexibility and mobility of polar icebreakers would assist the Coast Guard in closing future mission performance gaps effectively....

⁹⁶ National Academies of Sciences, Engineering, and Medicine, Division on Earth and Life Studies and Transportation Research Board, *Acquisition and Operation of Polar Icebreakers: Fulfilling the Nation’s Needs*, Letter Report, with cover letter dated July 11, 2017, pp. 9-20.

Existing capability and capacity gaps are expected to significantly impact future Coast Guard performance in two Antarctic mission areas: Defense Readiness and Ice Operations. Future gaps may involve an inability to carry out probable and easily projected mission requirements, such as the McMurdo resupply, or readiness to respond to less-predictable events. By their nature, contingencies requiring the use of military capabilities often occur quickly. As is the case in the Arctic, the deterioration of the Coast Guard's icebreaker fleet is the primary driver for this significant mission impact. This will further widen mission performance gaps in the coming years. The recently issued Naval Operations Concept 2010 requires a surface presence in both the Arctic and Antarctic. This further exacerbates the capability gap left by the deterioration of the icebreaker fleet....

The significant deterioration of the Coast Guard icebreaker fleet and the emerging mission demands to meet future functional requirements in the high latitude regions dictate that the Coast Guard acquire material solutions to close the capability gaps....

To meet the Coast Guard mission functional requirement, the Coast Guard icebreaking fleet must be capable of supporting the following missions:

- **Arctic North Patrol.** Continuous multimission icebreaker presence in the Arctic.
- **Arctic West Science.** Spring and summer science support in the Arctic.
- **Antarctic, McMurdo Station resupply.** Planned deployment for break-in, supply ship escort, and science support. This mission, conducted in the Antarctic summer, also requires standby icebreaker support for backup in the event the primary vessel cannot complete the mission.
- **Thule Air Base Resupply and Polar Region Freedom of Navigation Transits.** Provide vessel escort operations in support of the Military Sealift Command's Operation Pacer Goose; then complete any Freedom of Navigation exercises in the region.

In addition, the joint Naval Operations Concept establishes the following mission requirements:

- **Assured access and assertion of U.S. policy in the Polar Regions.** The current demand for this mission requires continuous icebreaker presence in both Polar Regions.

Considering these missions, the analysis yields the following findings:

- **The Coast Guard requires three heavy and three medium icebreakers to fulfill its statutory missions.** These icebreakers are necessary to (1) satisfy Arctic winter and transition season demands and (2) provide sufficient capacity to also execute summer missions. Single-crewed icebreakers have sufficient capacity for all current and expected statutory missions. Multiple crewing provides no advantage because the number of icebreakers required is driven by winter and shoulder season requirements. Future use of multiple or augmented crews could provide additional capacity needed to absorb mission growth.
- **The Coast Guard requires six heavy and four medium icebreakers to fulfill its statutory missions and maintain the continuous presence requirements of the Naval Operations Concept.** Consistent with current practice, these icebreakers are single-crewed and homeported in Seattle Washington.
- **Applying crewing and home porting alternatives reduces the overall requirement to four heavy and two medium icebreakers.** This assessment of non-material solutions shows that the reduced number of icebreakers can be achieved by

having all vessels operate with multiple crews and two of the heavy icebreakers homeporting in the Southern Hemisphere.

Leasing was also considered as a nonmaterial solution. While there is no dispute that the Coast Guard's polar icebreaker fleet is in need of recapitalization, the decision to acquire this capability through purchase of new vessels, reconstruction of existing ships, or commercial lease of suitable vessels must be resolved to provide the best value to the taxpayer. The multi-mission nature of the Coast Guard may provide opportunities to conduct some subset of its missions with non government-owned vessels. However, serious consideration must be given to the fact that the inherently governmental missions of the Coast Guard must be performed using government-owned and operated vessels. An interpretation of the national policy is needed to determine the resource level that best supports the nation's interests....

The existing icebreaker capacity, two inoperative heavy icebreakers and an operational medium icebreaker, does not represent a viable capability to the federal government. The time needed to augment this capability is on the order of 10 years. At that point, around 2020, the heavy icebreaking capability bridging strategy expires.⁹⁷

At a July 27, 2011, hearing on U.S. economic interests in the Arctic before the Oceans, Atmosphere, Fisheries, and Coast Guard subcommittee of the Senate Commerce, Science, and Transportation Committee, the following exchange occurred:

SENATOR OLYMPIA J. SNOWE: On the high latitude study, do you agree with—and those—I would like to also hear from you, Admiral Titley, as well, on these requirements in terms of Coast Guard vessels as I understand it, they want to have—I guess, it was a three medium ice breakers. Am I correct in saying that? Three medium ice breakers.

ADMIRAL ROBERT PAPP, COMMANDANT OF THE COAST GUARD: I agree with the mission analysis and as you look at the requirements for the things that we might do up there, if it is in the nation's interest, it identifies a minimum requirement for three heavy ice breakers and three medium ice breakers and then if you want a persistent presence up there, it would require—and also doing things such as breaking out (inaudible) and other responsibilities, then it would take up to a maximum six heavy and four medium.

SNOWE: Right. Do you agree with that?

PAPP: If we were to be charged with carrying out those full responsibilities, yes, ma'am. Those are the numbers that you would need to do it.

SNOWE: Admiral Titley, how would you respond to the high latitude study and has the Navy conducted its own assessment of its capability?

REAR ADMIRAL DAVID TITLEY, OCEANOGRAPHER AND NAVIGATOR OF THE NAVY: Ma'am, we are in the process right now of conducting what we call a capabilities based assessment that will be out in the summer of this year.

We are getting ready to finish that—the Coast Guard has been a key component of the Navy's task force on climate change, literally since day one when the Chief of Naval Operations set this up, that morning, we had the Coast Guard invited as a member of our executive steering committee.

So we have been working very closely with the Coast Guard, with the Department of Homeland Security, and I think Admiral Papp—said it best as far as the specific

⁹⁷ *United States Coast Guard High Latitude Region Mission Analysis Capstone Summary*, July 2010, pp. 10-13, 15.

comments on the high latitude study but we have been working very closely with the Coast Guard.⁹⁸

January 2011 DHS Office of Inspector General Report

A January 2011 report on the Coast Guard's polar icebreakers from the DHS Office of the Inspector General stated:

The Coast Guard does not have the necessary budgetary control over its [polar] icebreakers, nor does it have a sufficient number of icebreakers to accomplish its missions in the Polar Regions. Currently, the Coast Guard has only one operational [polar] icebreaker [i.e., *Healy*], making it necessary for the United States to contract with foreign nations to perform scientific, logistical, and supply activities. Without the necessary budgetary control and a sufficient number of icebreaking assets, the Coast Guard will not have the capability to perform all of its missions, will lose critical icebreaking expertise, and may be beholden to foreign nations to perform its statutory missions. The Coast Guard should improve its strategic approach to ensure that it has the long-term icebreaker capabilities needed to support Coast Guard missions and other national interests in the Arctic and Antarctic regions.⁹⁹

Regarding current polar icebreaking capabilities for performing Arctic missions, the report states:

The Coast Guard's icebreaking resources are unlikely to meet future demands. [The table below] outlines the missions that Coast Guard is unable to meet in the Arctic with its current icebreaking resources.

Arctic Missions Not Being Met

Requesting Agency	Missions Not Being Met
United States Coast Guard	<ul style="list-style-type: none">—Fisheries enforcement in Bering Sea to prevent foreign fishing in U.S. waters and overfishing—Capability to conduct search and rescue in Beaufort Sea for cruise line and natural resource exploration ships—Future missions not anticipated to be met: 2010 Arctic Winter Science Deployment
NASA	Winter access to the Arctic to conduct oceanography and study Arctic currents and how they relate to regional ice cover, climate, and biology
NOAA and NSF	Winter research

⁹⁸ Source: Transcript of hearing.

⁹⁹ Department of Homeland Security, Office of Inspector General, *The Coast Guard's Polar Icebreaker Maintenance, Upgrade, and Acquisition Program*, OIG-11-31, January 2011, p. 1 (Executive Summary). Report accessed September 21, 2011, at http://www.dhs.gov/xoig/assets/mgmttrpts/OIG_11-31_Jan11.pdf.

Department of Defense

Assured access to ice-impacted waters
through a persistent icebreaker presence
in the Arctic and Antarctic¹⁰⁰

The report also states:

Should the Coast Guard not obtain funding for new icebreakers or major service life extensions for its existing icebreakers with sufficient lead-time, the United States will have no heavy icebreaking capability beyond 2020 and no polar icebreaking capability of any kind by 2029. Without the continued use of icebreakers, the United States will lose its ability to maintain a presence in the Polar Regions, the Coast Guard's expertise to perform ice operations will continue to diminish, and missions will continue to go unmet.¹⁰¹

Regarding current polar icebreaking capabilities for performing Antarctic missions, the report states:

The Coast Guard needs additional icebreakers to accomplish its missions in the Antarctic. The Coast Guard has performed the McMurdo Station resupply in Antarctica for decades, but with increasing difficulty in recent years. The Coast Guard's two heavy-duty icebreakers [i.e., *Polar Star* and *Polar Sea*] are at the end of their service lives, and have become less reliable and increasingly costly to keep in service....

In recent years, the Coast Guard has found that ice conditions in the Antarctic have become more challenging for the resupply of McMurdo Station. The extreme ice conditions have necessitated the use of foreign vessels to perform the McMurdo break-in....

As ice conditions continue to change around the Antarctic, two icebreakers are needed for the McMurdo break-in and resupply mission. Typically, one icebreaker performs the break-in and the other remains on standby. Should the first ship become stuck in the ice or should the ice be too thick for one icebreaker to complete the mission, the Coast Guard deploys the ship on standby. Since the *Polar Sea* and *Polar Star* are not currently in service, the Coast Guard has no icebreakers capable of performing this mission. [The table below] outlines the missions that will not be met without operational heavy-duty icebreakers.

Arctic Missions Not Being Met

Requesting Agency	Missions Not Being Met
NSF	Missions not anticipated to be met: 2010-2011 Operation Deep Freeze – McMurdo Station Resupply
Department of State	Additional inspections of foreign facilities in Antarctica to enforce the Antarctic Treaty and ensure facilities' environment compliance ¹⁰²

¹⁰⁰ Department of Homeland Security, Office of Inspector General, *The Coast Guard's Polar Icebreaker Maintenance, Upgrade, and Acquisition Program*, OIG-11-31, January 2011, p. 9.

¹⁰¹ Department of Homeland Security, Office of Inspector General, *The Coast Guard's Polar Icebreaker Maintenance, Upgrade, and Acquisition Program*, OIG-11-31, January 2011, p. 10.

¹⁰² Department of Homeland Security, Office of Inspector General, *The Coast Guard's Polar Icebreaker Maintenance, Upgrade, and Acquisition Program*, OIG-11-31, January 2011, pp. 10-11.

The report's conclusion and recommendations were as follows:

Conclusion

With an aging fleet of three icebreakers, one operational and two beyond their intended 30-year service life, the Coast Guard is at a critical crossroads in its Polar Icebreaker Maintenance, Upgrade, and Acquisition Program. It must clarify its mission requirements, and if the current mission requirements remain, the Coast Guard must determine the best method for meeting these requirements in the short and long term.

Recommendations

We recommend that the Assistant Commandant for Marine Safety, Security, and Stewardship:

Recommendation #1: Request budgetary authority for the operation, maintenance, and upgrade of its icebreakers.

Recommendation #2: In coordination with the Department of Homeland Security, request clarification from Congress to determine whether Arctic missions should be performed by Coast Guard assets or contracted vessels.

Recommendation #3: In coordination with the Department of Homeland Security, request clarification from Congress to determine whether Antarctic missions should be performed by Coast Guard assets or contracted vessels.

Recommendation #4: Conduct the necessary analysis to determine whether the Coast Guard should replace or perform service-life extensions on its two existing heavy-duty icebreaking ships.

Recommendation #5: Request appropriations necessary to meet mission requirements in the Arctic and Antarctic.¹⁰³

The report states that

The Coast Guard concurred with all five of the recommendations and is initiating corrective actions. We consider the recommendations open and unresolved. The Coast Guard provided information on some of its ongoing projects that will address the program needs identified in the report.¹⁰⁴

2010 U.S. Arctic Research Commission Report

A May 2010 report from the U.S. Arctic Research Commission (USARC) on goals and objectives for Arctic research for 2009-2010 stated:

To have an effective Arctic research program, the United States must invest in human capital, research platforms, and infrastructure, including new polar class icebreakers, and sustained sea, air, land, space, and social observing systems.... The Commission urges the President and Congress to commit to replacing the nation's two polar class icebreakers.¹⁰⁵

¹⁰³ Department of Homeland Security, Office of Inspector General, *The Coast Guard's Polar Icebreaker Maintenance, Upgrade, and Acquisition Program*, OIG-11-31, January 2011, p. 12.

¹⁰⁴ Department of Homeland Security, Office of Inspector General, *The Coast Guard's Polar Icebreaker Maintenance, Upgrade, and Acquisition Program*, OIG-11-31, January 2011, p. 13.

¹⁰⁵ U.S. Arctic Research Commission, *Report on Goals and Objectives for Arctic Research 2009-2010*, May 2010, p. 4. Accessed online December 5, 2011, at http://www.arctic.gov/publications/usarc_2009-10_goals.pdf.

2007 National Research Council Report

A 2007 National Research Council (NRC) report, *Polar Icebreakers in a Changing World: An Assessment of U.S. Needs*, assessed roles and future needs for Coast Guard polar icebreakers.¹⁰⁶ The study was required by report language accompanying the FY2005 DHS appropriations act (H.R. 4567/P.L. 108-334).¹⁰⁷ The study was completed in 2006 and published in 2007. Some sources refer to the study as the 2006 NRC report. The report made the following conclusions and recommendations:

Based on the current and future needs for icebreaking capabilities, the [study] committee concludes that the nation continues to require a polar icebreaking fleet that includes a minimum of three multimission ships [like the Coast Guard's three current polar icebreakers] and one single-mission [research] ship [like Palmer]. The committee finds that although the demand for icebreaking capability is predicted to increase, a fleet of three multimission and one single-mission icebreakers can meet the nation's future polar icebreaking needs through the application of the latest technology, creative crewing models, wise management of ice conditions, and more efficient use of the icebreaker fleet and other assets. The nation should immediately begin to program, design, and construct two new polar icebreakers to replace the POLAR STAR and POLAR SEA.

Building only one new polar icebreaker is insufficient for several reasons. First, a single ship cannot be in more than one location at a time. No matter how technologically advanced or efficiently operated, a single polar icebreaker can operate in the polar regions for only a portion of any year. An icebreaker requires regular maintenance and technical support from shipyards and industrial facilities, must reprovision regularly, and has to effect periodic crew changeouts. A single icebreaker, therefore, could not meet any reasonable standard of active and influential presence and reliable, at-will access throughout the polar regions.

A second consideration is the potential risk of failure in the harsh conditions of polar operations. Despite their intrinsic robustness, damage and system failure are always a risk and the U.S. fleet must have enough depth to provide backup assistance. Having only a

¹⁰⁶ National Research Council, *Polar Icebreakers in a Changing World, An Assessment of U.S. Needs*, Washington, 2007, 122 pp.

¹⁰⁷ H.R. 4567/P.L. 108-334 of October 18, 2004. The related Senate bill was S. 2537. The Senate report on S. 2537 (S.Rept. 108-280 of June 17, 2004) stated:

The Committee expects the Commandant to enter into an arrangement with the National Academy of Sciences to conduct a comprehensive study of the role of Coast Guard icebreakers in supporting United States operations in the Antarctic and the Arctic. The study should include different scenarios for continuing those operations including service life extension or replacement of existing Coast Guard icebreakers and alternative methods that do not use Coast Guard icebreakers. The study should also address changes in the roles and missions of Coast Guard icebreakers in support of future marine operations in the Arctic that may develop due to environmental change, including the amount and kind of icebreaking support that may be required in the future to support marine operations in the Northern Sea Route and the Northwest Passage; the suitability of the Polar Class icebreakers for these new roles; and appropriate changes in existing laws governing Coast Guard icebreaking operations and the potential for new operating regimes. The study should be submitted to the Committee no later than September 30, 2005.

The conference report on H.R. 4567 (H.Rept. 108-774 of October 9, 2004) stated:

As discussed in the Senate report and the Coast Guard authorization bill for fiscal year 2005, the conferees require the National Academy of Sciences to study the role of Coast Guard icebreakers.

The earlier House report on H.R. 4567 (H.Rept. 108-541 of June 15, 2004) contained language directing a similar report from the Coast Guard rather than the National Academies. (See the passage in the House report under the header "Icebreaking.")

single icebreaker would necessarily require the ship to accept a more conservative operating profile, avoiding more challenging ice conditions because reliable assistance would not be available. A second capable icebreaker, either operating elsewhere or in homeport, would provide ensured backup assistance and allow for more robust operations by the other ship.

From a strategic, longer-term perspective, two new Polar class icebreakers will far better position the nation for the increasing challenges emerging in both polar regions. A second new ship would allow the U.S. Coast Guard to reestablish an active patrol presence in U.S. waters north of Alaska to meet statutory responsibilities that will inevitably derive from increased human activity, economic development, and environmental change. It would allow response to emergencies such as search-and-rescue cases, pollution incidents, and assistance to ships threatened with grounding or damage by ice. Moreover, a second new ship will leverage the possibilities for simultaneous operations in widely disparate geographic areas (e.g., concurrent operations in the Arctic and Antarctic), provide more flexibility for conducting Antarctic logistics (as either the primary or the secondary ship for the McMurdo break-in), allow safer multiple-ship operations in the most demanding ice conditions, and increase opportunities for international expeditions. Finally, an up-front decision to build two new polar icebreakers will allow economies in the design and construction process and provide a predictable cost reduction for the second ship....

The [study] committee finds that both operations and maintenance of the polar icebreaker fleet have been underfunded for many years, and the capabilities of the nation's icebreaking fleet have diminished substantially. Deferred long-term maintenance and failure to execute a plan for replacement or refurbishment of the nation's icebreaking ships have placed national interests in the polar regions at risk. The nation needs the capability to operate in both polar regions reliably and at will. Specifically, the committee recommends the following:

- The United States should continue to project an active and influential presence in the Arctic to support its interests. This requires U.S. government polar icebreaking capability to ensure year-round access throughout the region.
- The United States should continue to project an active and influential presence in the Antarctic to support its interests. The nation should reliably control sufficient icebreaking capability to break a channel into and ensure the maritime resupply of McMurdo Station.
- The United States should maintain leadership in polar research. This requires icebreaking capability to provide access to the deep Arctic and the ice-covered waters of the Antarctic.
- National interests in the polar regions require that the United States immediately program, budget, design, and construct two new polar icebreakers to be operated by the U.S. Coast Guard.
- To provide continuity of U.S. icebreaking capabilities, the POLAR SEA should remain mission capable and the POLAR STAR should remain available for reactivation until the new polar icebreakers enter service.
- The U.S. Coast Guard should be provided sufficient operations and maintenance budget to support an increased, regular, and influential presence in the Arctic. Other agencies should reimburse incremental costs associated with directed mission tasking.
- Polar icebreakers are essential instruments of U.S. national policy in the changing polar regions. To ensure adequate national icebreaking capability into the future, a

Presidential Decision Directive should be issued to clearly align agency responsibilities and budgetary authorities.¹⁰⁸

The Coast Guard stated in 2008 that it “generally supports” the NRC report, and that the Coast Guard “is working closely with interagency partners to determine a way forward with national polar policy that identifies broad U.S. interests and priorities in the Arctic and Antarctic that will ensure adequate maritime presence to further these interests. Identification and prioritization of U.S. national interests in these regions should drive development of associated USCG [U.S. Coast Guard] capability and resource requirements.” The Coast Guard also stated: “Until those broad U.S. interests and priorities are identified, the current USG [U.S. Government] polar icebreaking fleet should be maintained in an operational status.”¹⁰⁹

¹⁰⁸ National Research Council, *Polar Icebreakers in a Changing World, An Assessment of U.S. Needs*, Washington, 2007, pp. 2-3.

¹⁰⁹ Coast Guard point paper provided to CRS on February 12, 2008, and dated with the same date, providing answers to questions from CRS concerning polar icebreaker modernization.

Appendix B. Funding Level in AC&I Account

This appendix presents additional discussion of the funding level of the Coast Guard's Acquisition, Construction, and Improvements (AC&I) account.

Overview

The Coast Guard has testified that funding the AC&I account at a level of about \$1 billion to \$1.2 billion per year would make it difficult to fund various Coast Guard acquisition projects, including a new polar icebreaker and improvements to Coast Guard shore installations. Coast Guard plans call for procuring Offshore patrol Cutters (OPCs) at an eventual rate of two per year.¹¹⁰ If each OPC costs roughly \$400 million, procuring two OPCs per year in an AC&I account of about \$1 billion to \$1.2 billion per year, as programmed under the FY2014-FY2016 budget submissions (see **Table 4**), would leave about \$200 million to \$400 million per year for all other AC&I-funded programs.

Coast Guard officials in 2017 are stating more regularly what they stated only infrequently in previous years: that executing the Coast Guard's various acquisition programs fully and on a timely basis would require the AC&I account to be funded in coming years at a level of about \$2 billion per year. Statements from Coast Guard officials on this issue in past years have sometimes put this figure as high as about \$2.5 billion per year.

An annual AC&I funding level of \$2 billion or \$2.5 billion per year would represent something like a 100% increase over requested amounts for the AC&I account in recent years. By way of comparison, however, it can be noted that the Navy in recent years has testified to a need for substantially increasing the size of the Navy's shipbuilding account—known formally as the Shipbuilding and Conversion, Navy, or SCN, account—and that requested funding levels for this account have increased substantially in recent years, notwithstanding the caps on defense spending under the Budget Control Act (BCA). The Navy's FY2013 budget—the first budget submitted after enactment of the BCA in 2011—requested a total of \$13.58 billion for the SCN account. Five years later, with the BCA, as amended, still in place, the Navy's FY2018 budget, as amended on June 29, 2017, requests a total \$20.40 billion for the SCN account—an increase of about \$6.8 billion, or about 50%, over the FY2013 requested figure.

A 50% increase over the amount requested for the AC&I account for FY2013 (\$1.217 billion) or the amount requested for the AC&I account FY2018 (\$1.204 billion) would equate to an AC&I funding level of about \$1.8 billion, which is fairly close to the figure of \$2 billion being mentioned this year by Coast Guard officials. Under the Coast Guard's FY2013 budget submission, the AC&I account was projected to increase to \$1.722 billion by FY2017; under the service's FY2018 budget submission, it was projected to increase to \$1.687 billion by FY2022.

Using Past AC&I Funding Levels as a Guide for Future AC&I Funding Levels

In assessing future funding levels for executive branch agencies, a common practice is to assume or predict that the figure in coming years will likely be close to where it has been in previous years. While this method can be of analytical and planning value, for an agency like the Coast

¹¹⁰ For more on the OPC program, see CRS Report R42567, *Coast Guard Cutter Procurement: Background and Issues for Congress*, by Ronald O'Rourke.

Guard, which goes through periods with less acquisition of major platforms and periods with more acquisition of major platforms, this approach might not always be the best approach, at least for the AC&I account.

More important, in relation to maintaining Congress's status as a co-equal branch of government, including the preservation and use of congressional powers and prerogatives, an analysis that assumes or predicts that future funding levels will resemble past funding levels can encourage an artificially narrow view of congressional options regarding future funding levels, depriving Congress of agency in the exercise of its constitutional power to set funding levels and determine the composition of federal spending.

Past Coast Guard Statements About Required AC&I Funding Level

At an October 4, 2011, hearing on the Coast Guard's major acquisition programs before the Coast Guard and Maritime Transportation subcommittee of the House Transportation and Infrastructure Committee, the following exchange occurred:

REPRESENTATIVE FRANK LOBIONDO:

Can you give us your take on what percentage of value must be invested each year to maintain current levels of effort and to allow the Coast Guard to fully carry out its missions?

ADMIRAL ROBERT J. PAPP, COMMANDANT OF THE COAST GUARD:

I think I can, Mr. Chairman. Actually, in discussions and looking at our budget—and I'll give you rough numbers here, what we do now is we have to live within the constraints that we've been averaging about \$1.4 billion in acquisition money each year.

If you look at our complete portfolio, the things that we'd like to do, when you look at the shore infrastructure that needs to be taken care of, when you look at renovating our smaller icebreakers and other ships and aircraft that we have, we've done some rough estimates that it would really take close to about \$2.5 billion a year, if we were to do all the things that we would like to do to sustain our capital plant.

So I'm just like any other head of any other agency here, as that the end of the day, we're given a top line and we have to make choices and tradeoffs and basically, my tradeoffs boil down to sustaining frontline operations balancing that, we're trying to recapitalize the Coast Guard and there's where the break is and where we have to define our spending.¹¹¹

An April 18, 2012, blog entry stated:

If the Coast Guard capital expenditure budget remains unchanged at less than \$1.5 billion annually in the coming years, it will result in a service in possession of only 70 percent of the assets it possesses today, said Coast Guard Rear Adm. Mark Butt.

Butt, who spoke April 17 [2012] at [a] panel [discussion] during the Navy League Sea Air Space conference in National Harbor, Md., echoed Coast Guard Commandant Robert Papp in stating that the service really needs around \$2.5 billion annually for procurement.¹¹²

¹¹¹ Source: Transcript of hearing.

¹¹² David Perera, "The Coast Guard Is Shrinking," *FierceHomelandSecurity.com*, April 18, 2012, accessed July 20, 2012, at <http://www.fiercehomelandsecurity.com/story/coast-guard-shrinking/2012-04-18>.

At a May 9, 2012, hearing on the Coast Guard's proposed FY2013 budget before the Homeland Security subcommittee of the Senate Appropriations Committee, Admiral Papp testified, "I've gone on record saying that I think the Coast Guard needs closer to \$2 billion dollars a year [in acquisition funding] to recapitalize—[to] do proper recapitalization."¹¹³

At a May 14, 2013, hearing on the Coast Guard's proposed FY2014 budget before the Homeland Security Subcommittee of the Senate Appropriations Committee, Admiral Papp stated the following regarding the difference between having about \$1.0 billion per year rather than about \$1.5 billion per year in the AC&I account:

Well, Madam Chairman, \$500 million—a half a billion dollars—is real money for the Coast Guard. So, clearly, we had \$1.5 billion in the [FY]13 budget. It doesn't get everything I would like, but it—it gave us a good start, and it sustained a number of projects that are very important to us.

When we go down to the \$1 billion level this year, it gets my highest priorities in there, but we have to either terminate or reduce to minimum order quantities for all the other projects that we have going.

If we're going to stay with our program of record, things that have been documented that we need for our service, we're going to have to just stretch everything out to the right. And when we do that, you cannot order in economic order quantities. It defers the purchase. Ship builders, aircraft companies—they have to figure in their costs, and it inevitably raises the cost when you're ordering them in smaller quantities and pushing it off to the right.

Plus, it almost creates a death spiral for the Coast Guard because we are forced to sustain older assets—older ships and older aircraft—which ultimately cost us more money, so it eats into our operating funds, as well, as we try to sustain these older things.

So, we'll do the best we can within the budget. And the president and the secretary have addressed my highest priorities, and we'll just continue to go on the—on an annual basis seeing what we can wedge into the budget to keep the other projects going.¹¹⁴

At a March 12, 2014, hearing on the Coast Guard's proposed FY2015 budget before the Homeland Security subcommittee of the House Appropriations Committee, Admiral Papp stated:

Well, that's what we've been struggling with, as we deal with the five-year plan, the capital investment plan, is showing how we are able to do that. And it will be a challenge, particularly if it sticks at around \$1 billion [per year]. As I've said publicly, and actually, I said we could probably—I've stated publicly before that we could probably construct comfortably at about 1.5 billion [dollars] a year. But if we were to take care of all the

¹¹³ Source: transcript of hearing. Papp may have been referring to remarks he made to the press before giving his annual state of the Coast Guard speech on February 23, 2012, in which reportedly stated that the Coast Guard would require about \$2 billion per year in acquisition funding to fully replace its current assets. (See Adam Benson, "Coast Guard Cutbacks Will Cost 1,000 Jobs," *Norwich Bulletin*, February 23, 2012, accessed May 31, 2012, at <http://www.norwichbulletin.com/news/x1138492141/Coast-Guard-cutbacks-will-cost-1-000-jobs#axzz1wSDAFCzX>. See also "Coast Guard Leader Calls For More Ships," *MilitaryFeed.com*, February 24, 2012, accessed May 31, 2012, at <http://militaryfeed.com/coast-guard-leader-calls-for-more-ships-5/>; Associated Press, "Coast Guard Commandant Calls for New Ships," *TheLog.com*, March 10, 2012, accessed May 31, 2012, at <http://www.thelog.com/SNW/Article/Coast-Guard-Commandant-Calls-for-New-Ships-to-Replace-Aging-Fleet>; Mickey McCarter, "Congress Poised to Give Coast Guard More Money Than Requested for FY 2013," *HSToday.us*, May 10, 2012, accessed May 31, 2012, at <http://www.hstoday.us/focused-topics/customs-immigration/single-article-page/congress-poised-to-give-coast-guard-more-money-than-requested-for-fy-2013.html>.) See also "Interview, Adm. Robert Papp, US Coast Guard Commandant," *Defense News*, November 11, 2013: 30.

¹¹⁴ Transcript of hearing. The remarks were made in response to a question from Sen. Mary Landrieu.

Coast Guard's projects that are out there, including shore infrastructure that that fleet that takes care of the Yemen [sic: inland] waters is approaching 50 years of age, as well, but I have no replacement plan in sight for them because we simply can't afford it. Plus, we need at some point to build a polar icebreaker. Darn tough to do all that stuff when you're pushing down closer to 1 billion [dollars per year], instead of 2 billion [dollars per year].

As I said, we could fit most of that in at about the 1.5 billion [dollars per year] level, but the projections don't call for that. So we are scrubbing the numbers as best we can.¹¹⁵

At a March 24, 2015, hearing on the Coast Guard's proposed FY2016 budget before the Homeland Security subcommittee of the House Appropriations Committee, Admiral Paul Zukunft, Admiral Papp's successor as Commandant of the Coast Guard, stated:

I look back to better years in our acquisition budget when we had a—an acquisition budget of—of \$1.5 billion. That allows me to move these programs along at a much more rapid pace and, the quicker I can build these at full-rate production, the less cost it is in the long run as well. But there's an urgent need for me to be able to deliver these platforms in a timely and also in an affordable manner. But to at least have a reliable and a predictable acquisition budget would make our work in the Coast Guard much easier. But when we see variances of—of 30, 40% over a period of three or four years, and not knowing what the Budget Control Act may have in store for us going on, yes, we are treading water now but any further reductions, and now I am—I am beyond asking for help. We are taking on water.¹¹⁶

An April 13, 2017, press report states (emphasis added):

Coast Guard Commandant Adm. Paul Zukunft on Wednesday [April 12] said that for the Coast Guard to sustain its recapitalization plans and operations the service needs a \$2 billion annual acquisition budget that grows modestly overtime to keep pace with inflation.

The Coast Guard needs a “predictable, reliable” acquisition budget “and within that we need 5 percent annual growth to our operations and maintenance (O&M) accounts,” Zukunft told reporters at a Defense Writers Group breakfast. Inflation will clip 2 to 3 percent from that, but “at 5 percent or so it puts you on a moderate but positive glide slope so you can execute, so you can build the force,” he said.¹¹⁷

In an interview published on June 1, 2017, Zukunft said (emphasis added):

We cannot be more relevant than we are now. But what we need is predictable funding. We have been in over 16 continuing resolutions since 2010. I need stable and repeatable funding. **An acquisition budget with a floor of \$2 billion.** Our operating expenses as I said, they've been funded below the Budget Control Act floor for the past five years. I need 5 percent annualized growth over the next five years and beyond to start growing some of this capability back.

But more importantly, we [need] more predictable, more reliable funding so we can execute what we need to do to carry out the business of the world's best Coast Guard.¹¹⁸

¹¹⁵ Transcript of hearing.

¹¹⁶ Transcript of hearing. The remarks were made in response to a question from Rep. John Culberson.

¹¹⁷ Calvin Biesecker, “Zukunft Wants \$2 Billion Baseline Acquisition Budget; Sustained Growth In O&M Funding,” *Defense Daily*, April 13, 2017: 1.

¹¹⁸ Jill Aitoro, “Interview: Adm. Paul Zukunft Demands Coast Guard Respect,” *Defense News*, June 1, 2017.

Comparison with Navy Budget

Although the annual amounts of acquisition funding that the Coast Guard has received in recent years are one potential guide to what Coast Guard acquisition funding levels might or should be in coming years, there may be other potential guides. For example, one could envision potential guides that focus on whether Coast Guard funding for ship acquisition and sustainment is commensurate with Coast Guard funding for the personnel that in many cases will operate the ships. Observations that might be made in connection with this example based on the Coast Guard and Navy budget submissions include the following:

- Using figures from the FY2014 budget submission, the Coast Guard has about 12.9% as many active-duty personnel as the Navy.¹¹⁹ If the amount of funding for the surface ship acquisition and sustainment part of the AC&I account were equivalent to 12.9% of the amount of funding in the Navy's shipbuilding account, the surface ship acquisition and sustainment part of the AC&I account would be about \$1.8 billion per year.¹²⁰ Navy surface ship acquisition, unlike Coast Guard surface ship acquisition, includes substantial numbers of large and complex ships, including nuclear-powered aircraft carriers, highly capable surface combatants, and large amphibious and auxiliary ships. Accounting for this difference in Navy and Coast Guard surface ship acquisition by reducing the \$1.8 billion figure by, say, one-half or one-third would produce an adjusted figure of about \$900 million to about \$1.2 billion per year for surface ship acquisition and sustainment.
- Again using figures from the FY2014 budget submission, funding in the Navy's shipbuilding account is equivalent to about 51% of the Navy's funding for active-duty personnel.¹²¹ If Coast Guard funding for surface ship acquisition and sustainment were equivalent to 51% of Coast Guard funding for military pay and allowances, the surface ship acquisition and sustainment part of the AC&I account would be about \$1.7 billion per year.¹²² Reducing the \$1.8 billion figure by, say, one-half or one-third to account for differences in the types of surface ships acquired by the Navy and Coast Guard (see previous bullet point) would produce an adjusted figure of about \$850 million to about \$1.1 billion per year for surface ship acquisition and sustainment.

¹¹⁹ The Coast Guard for FY2014 appears to be requesting an active-duty end strength—the number of active-duty military personnel—of 41,594 (measured by the Coast Guard in full-time equivalent [FTE] positions); the Navy for FY2014 is requesting an active-duty end strength of 323,600.

¹²⁰ The Navy's proposed FY2014 budget requests \$14,078 million for the Shipbuilding and Conversion, Navy (SCN) appropriation account.

¹²¹ The Navy's proposed FY2014 budget requested \$27,824 million for the Military Personnel, Navy (MPN) appropriation account.

¹²² The Coast Guard's proposed FY2014 budget requested \$3,425.3 million for military pay and allowances.

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