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Coast Guard Polar Security Cutter (Polar Icebreaker) Program: Background and Issues for Congress

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Summary

The Coast Guard Polar Security Cutter (PSC) program, previously known as the polar icebreaker (PIB) program, is a program to acquire three new heavy polar icebreakers, to be followed years from now by the acquisition of up to three new medium polar icebreakers. The Coast Guard wants to begin construction of the first new heavy polar icebreaker in FY2019 and have it enter service in 2023. The PSC program has received about $359.6 million in acquisition funding through FY2018, including $300 million provided through the Navy's shipbuilding account and $59.6 million provided through the Coast Guard's acquisition account. The Coast Guard's proposed FY2019 budget requests $750 million in Coast Guard acquisition funding for the program.

The acquisition cost of a new heavy polar icebreaker had earlier been estimated informally at roughly $1 billion, but the Coast Guard and Navy now believe that three heavy polar icebreakers could be acquired for a total cost of about $2.1 billion, or an average of about $700 million per ship. The first ship will cost more than the other two because it will incorporate design costs for the class and be at the start of the production learning curve for the class. When combined with the program's $359.6 million in prior-year funding, the $750 million requested for FY2019 would fully fund the procurement of the first new heavy polar icebreaker and partially fund the procurement of the second.

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*. *Polar Sea*, however, suffered an engine casualty in June 2010 and has been nonoperational 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. The Coast Guard has used *Polar Sea* as a source of spare parts for keeping *Polar Star* operational.

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 March 2, 2018, the U.S. Navy, in collaboration with the U.S. Coast Guard under the polar icebreaker integrated program office, released a request for proposal (RFP) for the advance procurement and detail design for the Coast Guard's heavy polar icebreaker, with options for detail design and construction for up to three heavy polar icebreakers.

Issues for Congress for FY2019 for the PSC program include, inter alia, whether to approve, reject, or modify the Coast Guard's FY2019 acquisition funding request; whether to use a contract with options or a block buy contract to acquire the ships; whether to continue providing at least some of the acquisition funding for the PSC program through the Navy's shipbuilding account; technical, schedule, and cost risk in the PSC program; and whether to procure heavy and medium polar icebreakers to a common basic design.

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Introduction

This report provides background information and issues for Congress on the Coast Guard's program for acquiring new polar icebreakers. The program was previously known as the polar icebreaker (PIB) program. It is now called the Polar Security Cutter (PSC) program, though many observers may continue, as a matter of convenience, to refer to it as the polar icebreaker program. The Coast Guard's proposed FY2019 budget requests $750 million in acquisition funding for the program.

The issue for Congress is whether to approve, reject, or modify the Administration's FY2019 acquisition funding request for the PSC program, and, more generally, whether to approve, reject, or modify the Coast Guard's overall plan for procuring new polar icebreakers. 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.

For a brief discussion of the Coast Guard's Great Lakes icebreakers, see **Appendix F**. 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

The permanent statute that sets forth the Coast Guard's primary duties—14 U.S.C. 2—states that, among other primary duties, the Coast Guard shall "develop, establish, maintain, and operate, with due regard to the requirements of national defense, aids to maritime navigation, icebreaking facilities, and rescue facilities for the promotion of safety on, under, and over the high seas and waters subject to the jurisdiction of the United States," and "pursuant to international agreements, develop, establish, maintain, and operate icebreaking facilities on, under, and over waters other than the high seas and waters subject to the jurisdiction of the United States...."

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;

[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.)

- 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] 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. In terms of the maximum thickness of the ice to be broken, the annual McMurdo resupply mission generally poses the greatest icebreaking challenge for U.S. polar icebreakers, though Arctic ice can frequently pose its own significant icebreaking challenges for U.S. polar icebreakers.

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, and 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, particularly since waters described as "ice free" can actually still have some amount of ice.[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.

[4] This passage, beginning with "The roles of...", originated in an earlier iteration of this CRS report and was later transferred by the Government Accountability Office (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.

[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.

Coast Guard Polar Icebreakers

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. Although usually referred to as icebreakers, they are, more generally speaking, Coast Guard cutters.[8]

Heavy Polar Icebreakers Polar Star and Polar Sea

Polar Star (WAGB-10) and *Polar Sea* (WAGB-11),[9] 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.

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.

[8] Cutters are commissioned Coast Guard vessels greater than 65 feet in length.

[9] 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.

The ships are 399 feet long and displace about 13,200 tons.[10] They are among the world's most powerful nonnuclear-powered icebreakers, with a capability to break through ice up to 6 feet 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.

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.[11] 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.[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, inactive status on October 14, 2011. The Coast Guard transferred certain major equipment from

[10] 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.

[11] 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."

[12] See, for example, Kyung M. Song, "Icebreaker Polar Star Gets $57 Million Overhaul," *Seattle Times*, December 14, 2012.

[13] "Icebreaker POLAR SEA Sidelined By Engine Troubles," *Coast Guard Compass (Official Blog of the U.S. Coast Guard)*, June 25, 2010. See also "USCG Cancels Polar Icebreaker's Fall Deployment," *DefenseNews.com*, June 25, 2010; Andrew C. Revkin, "America's Heavy Icebreakers Are Both Broken Down," *Dot Earth (New York Times blog)*, June 25, 2010.

Polar Sea to *Polar Star* to facilitate *Polar Star's* return to service,[14] and continues to use *Polar Sea* as a source of spare parts for *Polar Star*.

Medium Polar Icebreaker Healy

Healy (WAGB-20) (**Figure 3**) was funded 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).[15] (HII subsequently wound down shipbuilding activities at Avondale, and the facility is no longer building ships.[16])

Figure 3. *Healy*

Source: Coast Guard photo accessed at http://www.uscg.mil/history/webcutters/Healy_CGC_1_300.jpg on April 21, 2011.

Although it is referred to as a medium polar icebreaker, *Healy* is actually a bit larger than *Polar Star* and *Polar Sea*—it is 420 feet long and displaces about 16,000 tons. Compared to *Polar Star*

[14] Source: October 17, 2011, email to CRS from Coast Guard Congressional Affairs office. 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. The business case analysis was submitted to Congress with a cover date of November 7, 2013. For more on the High Latitude Study, see **Appendix A**.

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

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

and *Polar Sea*, *Healy* has less icebreaking capability (which is why it is referred to as 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.

National Science Foundation (NSF) Polar Research Ships

Nathaniel B. Palmer

Nathaniel B. Palmer was built for the NSF in 1992 by North American Shipbuilding, of Larose, LA. Called *Palmer* for short, it is operated for NSF by Edison Chouest Offshore (ECO) of Galliano, LA, a firm that owns and operates research ships and offshore deepwater service ships.[17] *Palmer* is 308 feet long and has a displacement of about 6,500 tons. It has a crew of 22 and can embark a scientific staff of 27 to 37.[18] It was purpose-built as a single-mission ship for conducting and supporting scientific research in the Antarctic. It is capable of breaking ice up to 3 feet thick at speeds of 3 knots, which is sufficient for breaking through the ice conditions found in the vicinity of the Antarctic Peninsula, so as to resupply Palmer Station, a U.S. research station on the peninsula. The ship might be considered less an icebreaker than 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.

Laurence M. Gould

Like *Palmer*, the polar research and supply ship *Laurence M. Gould* was built for NSF by North American Shipping. It was completed in 1997 and is operated for NSF on a long-term charter from ECO. It is 230 feet long and has a displacement of about 3,800 tons. It has a crew of 16 and can embark a scientific staff of 26 to 28 (with a capacity for 9 more in a berthing van). It can break ice up to 1 foot thick with continuous forward motion. Like *Palmer*, it was built to support NSF operations in the Antarctic, particularly operations at Palmer Station on the Antarctic Peninsula.

Sikuliaq

Sikuliaq (see-KOO-lee-auk), which is used for scientific research in polar areas, was built by Marinette Marine of Marinette, WI, and entered service in 2015. It is operated for NSF by the College of Fisheries and Ocean Sciences at the University of Alaska Fairbanks as part of the U.S. academic research fleet through the University National Oceanographic Laboratory System (UNOLS). *Sikuliaq* is 261 feet long and has a displacement of about 3,600 tons. It has a crew of 22 and can embark an additional 26 scientists and students. The ship can break ice 2½ or 3 feet thick at speeds of 2 knots. The ship is considered less an icebreaker than an ice-capable research ship.

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[17] For more on ECO, see the firm's website at http://www.chouest.com/.

[18] Sources vary on the exact number of scientific staff that can be embarked on the ship. 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.pdfprvnews_june03.pdf;

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.

Summary

Table 1 summarizes the above ships. In addition to the ships shown in **Table 1**, another U.S.-registered polar ship with icebreaking capability— the Arctic oil-exploration support ship *Aiviq*— was used by Royal Dutch Shell oil company to support an oil exploration and drilling effort (now ended) in Arctic waters off Alaska. The ship, which completed construction in 2012, is owned by ECO and chartered by Royal Dutch Shell. It was used primarily for towing and laying anchors for drilling rigs, but is also equipped for responding to oil spills.

Table 1. Coast Guard and NSF Polar Ships

	Coast Guard			*NSF*		
	Polar Star	***Polar Sea***	***Healy***	***Palmer***	***Laurence M. Gould***	***Sikuliaq***
Currently operational?	Yes	No	Yes	Yes	Yes	Yes
Entered service	1976	1978	2000	1992	1997	2015
Length (feet)	399	399	420	308	230	261
Displacement (tons)	13,200	13,200	16,000	6,500	3,780	3,665
Icebreaking capability (ice thickness in feet) at 3 knots or other speed	6 feet	6 feet	4.5 feet	3 feet	1 foot at continuous forward motion	2.5 or 3 feet at 2 knots
Icebreaking capability using back and ram (ice thickness in feet)	21 feet	21 feet	8 feet	n/a	n/a	n/a
Operating temperature	-60° Fahrenheit	-60° Fahrenheit	-50° Fahrenheit	n/a	n/a	n/a
Crew (when operational)	155[a]	155[a]	85[b]	22	16	22
Additional scientific staff	32	32	35[c]	27-37	26 to 28[d]	26

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

a. Includes 24 officers, 20 chief petty officers, 102 enlisted, and 9 in the aviation detachment.

b. Includes 19 officers, 12 chief petty officers, and 54 enlisted.

c. In addition to 85 crew members 85 and 35 scientists, the ship can accommodate another 15 surge personnel and 2 visitors.

d. Plus 9 more in a berthing van.

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 the following (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....

> 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 analysis also evaluated employing single and multi-crewing concepts.... Strategic home porting analysis based upon existing infrastructure and distance to operational areas provided the final input to determine icebreaker capacity demand.[19]

While the MNS can be viewed as an authoritative U.S. government statement regarding required numbers of U.S. polar icebreakers, it can be noted that the key sentence in the above-quoted passage from the MNS (i.e., the sentence in bold) includes the terms "potentially" and "up to." These terms, which are often overlooked in discussions of required numbers of U.S. polar icebreakers, make the key sentence less ironclad as a requirements statement than it would have been if the terms had not been included, and could be interpreted as an acknowledgment that the requirement might amount to something less than three heavy and three medium polar icebreakers.

It can also be noted, as stated in the above-quoted passage from the MNS, that the MNS was informed by the High Latitude Mission Analysis Report (HILMAR), and that the HLMAR took into account not only Coast Guard statutory mission requirements, but additional Department of Defense (DOD) requirements for year-round presence in both polar regions as detailed in the 2010 Naval Operations Concept (NOC). This is potentially significant, because DOD appears to have subsequently dropped its 2010 requirement for year-round presence in the polar regions.[20]

The use in the MNS of the terms "potentially" and "up to," combined with DOD's decision to drop its requirement for year-round presence in the polar regions, together raise a question, other things held equal, as to whether required numbers of U.S. polar icebreakers might be something less than three heavy and three medium polar icebreakers. It is also possible, however, that there have been other changes since the MNS was issued in 2013 that would have the effect, other

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[19] 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.

[20] A September 25, 2017, GAO report on polar icebreakers states the following (emphasis added):

> In December 2016, DOD reported to Congress that it had no specific defense requirement for icebreaking capability because Navy Arctic requirements are met by undersea and air assets which can provide year-round presence.
>
> -- DOD reported in April 2017 that its only potential defense requirement—for the Thule Air Force Base resupply [mission] in Greenland—is met by the Canadian Coast Guard through a Memorandum of Understanding with USCG.
>
> -- USCG's 2013 Polar Icebreaker Mission Needs Statement identified polar icebreaker capacity needs as partly based on the 2010 Naval Operations Concept—[a document that provides] joint maritime security strategy implementation guidance for the Navy, Marine Corps, and USCG—which stated that U.S. naval forces had a demand for year-round polar icebreaking presence in the Arctic and Antarctic.
>
> -- In April 2017, DOD joint staff officials confirmed that DOD and Naval defense strategy had been updated and does not include icebreaking requirements. DOD officials in charge of operations in the Pacific said that although they do not have a requirement for a heavy icebreaker, icebreakers play a key role in aiding the icebreaking mission to McMurdo.
>
> (Government Accountability Office, *Coast Guard: Status of Polar Icebreaking Fleet Capability and Recapitalization Plan*, GAO-17-698R, September 25, 2017, p. 20 (briefing slide 11).)

things held equal, of *increasing* U.S. requirements for polar icebreakers. The net result of this situation appears uncertain.

In addition to HILMAR, a number of other 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 **Appendix A**.

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."[21] During the discussion portion of the hearing, Michel testified that the "Coast Guard needs at least two heavy icebreakers to provide year-round assured access and self-rescueability in the polar regions."[22]

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."[23] Coast Guard officials have reiterated this point from time to time in subsequent testimony.

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."[24]

September 2017 GAO Report

A September 25, 2017, Government Accountability Office (GAO) report on polar icebreakers states that

> the Coast Guard has been unable to address all polar icebreaking requests since 2010. For example, the Coast Guard reported fulfilling 78 percent (25 of 32) of U.S. government agency requests for polar icebreaking services during fiscal year 2010 through 2016. Coast

[21] 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.

[22] Transcript of hearing.

[23] Transcript of hearing.

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

Guard officials cited various factors affecting the Coast Guard's ability to meet all requests, particularly the unavailability of its heavy polar icebreakers.[25]

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 (*Polar Star* and *Polar Sea*; *Polar Sea* not operational)	1 (*Healy*)			1 (*Aiviq*)	1 (*Palmer*)
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)						

[25] Government Accountability Office, *Coast Guard: Status of Polar Icebreaking Fleet Capability and Recapitalization Plan*, GAO-17-698R, September 25, 2017, pp. 2-3. A similar statement appears on page 4.

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.

July 2018 GAO Report

A July 2018 GAO report stated that

> the Coast Guard operates one medium icebreaker, the Healy, which has an expected end of service life in 2029. Despite the requirement for three medium icebreakers, Coast Guard officials said they are not currently assessing acquisition of the medium polar icebreakers because they are focusing on the heavy icebreaker acquisition and plan to assess the costs and benefits of acquiring medium polar icebreakers at a later time.[26]

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 interests and 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 Security Cutter (PSC) Program

Overview

The PSC program was initiated in the Coast Guard's FY2013 budget submission, and envisages the acquisition of three new heavy polar icebreakers, to be followed years from now by the acquisition of up to three new medium polar icebreakers. The Coast Guard wants to begin construction of the first new heavy polar icebreaker in FY2019 and have it enter service in 2023. The Coast Guard's proposed FY2019 budget requests $750 million in Coast Guard acquisition funding for the program.

Program Name

The program was previously known as the polar icebreaker (PIB) program. It is now called the Polar Security Cutter (PSC) program, though many observers may continue, as a matter of convenience, to refer to it as the polar icebreaker program.[27]

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[26] Government Accountability Office, *Coast Guard Acquisitions[:] Actions Needed to Address Longstanding Portfolio Management Challenges*, GAO-18-454, July 2018, p. 13.

[27] A September 27, 2018, press report states the following:

> The U.S. Coast Guard changed the name of its heavy icebreaker program to highlight its importance to national security, as funding for the first-in-class ship may be in jeopardy.
>
> Now dubbed the Polar Security Cutter, Coast Guard leadership and backers on Capitol Hill are determined to secure funding for the planned new class of heavy icebreaker—the first for the Coast Guard in more than four decades—by marketing its vital role protecting the nation's sovereignty.

Desired Capabilities for New Polar Icebreaker

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

- an ability to break through 6 feet of ice at 3 knots (threshold) or 8 feet of ice at 3 knots (objective);[28]
- 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.[29]

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:

> "When we talk about icebreaking capability, that doesn't sell very well to all audiences," Rear Adm. Melvin Bouboulis, the Coast Guard's Assistant Commandant for Engineering and Logistics, said during the recent American Society of Naval Engineers (ASNE) Fleet Maintenance and Modernization Symposium.
>
> "We understand that some folks think just it goes and breaks ice, but we've purposely changed the name of that program to Polar Security Cutter because it is really the U.S. presence in the Arctic regions and preserving our national interest and security in those areas."
>
> The Coast Guard's heavy icebreaker mission has traditionally supported scientific research. But the new icebreaker's request for proposals released earlier this year hinted at a possible future national security mission. After much speculation about whether the ship would be armed, Coast Guard officials said in the RFP [Request for Proposals] they wanted the ability to add deck-mounted weapons to the icebreaker in the future.
>
> The name-change was talked about by Adm. Karl Schultz almost as soon as he became Coast Guard commandant in June....
>
> In August, Schultz suggested a program name change when appearing at an event co-hosted by the U.S. Naval Institute and the Center for Strategic and International Studies.
>
> "You know right now it's the heavy icebreaker, the polar icebreaker. I think the paradigm has shifted a little bit," Schultz said. "I'm having a conversation with my team about, maybe that's the polar security cutter. I mean, that's really what we're talking about: we're talking about national sovereign interests up there, we're talking about competition. ... The Coast Guard is the face of that competition, and we've really got to press into that."...
>
> The Coast Guard's proposed icebreaker is now officially called the Polar Security Cutter, Lt. Amy Midgett, a Coast Guard spokeswoman, confirmed to USNI News. The hull designation will be WMSP. W is the standard prefix for Coast Guard vessels, and MSP stands for Maritime Security-Polar, Brian Olexy, a Coast Guard spokesman, told USNI News. The intended missions of the icebreaker will remain the same—supporting scientific research—and designating the ship a security cutter does not alter how it is funded.
>
> (Ben Werner and Sam LaGrone, "Coast Guard Renames New Icebreaker Program 'Polar Security Cutter,'" *USNI News*, September 27, 2018.

See also Sydney J. Freedberg Jr., "With Funding In Peril, Coast Guard Pushes Icebreaker As 'Polar Security Cutter,'" Breaking Defense, October 29, 2018.

[28] 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).

[29] Coast Guard PSC 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.

- 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.[30]

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:

- 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.[31]

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.[32]

Acquisition Cost

Steps Taken by Coast Guard and Navy to Reduce Acquisition Cost

Coast Guard and Navy have taken certain steps to reduce the time and cost for designing and building new Coast Guard heavy polar icebreakers, including the following:

- The Coast Guard and Navy in August 2016 established an integrated program office for the PSC program, facilitating Navy efforts to share with the Coast Guard ship-design and ship-acquisition best practices that can reduce the time and cost of designing and building ships.[33]

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[30] Coast Guard PSC 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.

[31] Coast Guard PSC 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.

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

[33] A September 25, 2017, GAO report states that "the Coast Guard and Navy formalized this partnership through a January 2017 Memorandum of Understanding." (Government Accountability Office, *Coast Guard: Status of Polar Icebreaking Fleet Capability and Recapitalization Plan*, GAO-17-698R, September 25, 2017, p. 4.) A May 2018 GAO

- All five shipbuilders that have been awarded contracts for design studies and analysis for a new polar icebreaker (see "Recent Acquisition Actions" below) 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).[34] This can reduce the time and cost needed to design a new polar icebreaker, and the technical risk and cost risk involved in building the ship.
- The Coast Guard and Navy have carefully reviewed the specific operational requirements for new heavy polar icebreakers, and have adjusted some of those requirements to help reduce their acquisition cost.
- The design for the heavy polar icebreakers 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.

Estimated Acquisition Cost Has Declined Substantially

As a result of the above steps by the Coast Guard and Navy—and perhaps also model test tank results that have substantially reduced the required power of the new icebreakers' propulsion plant[35]—the estimated acquisition cost for new heavy polar icebreakers has been substantially reduced. The procurement cost of a new heavy polar icebreaker had earlier been estimated informally at roughly $1 billion, but the Coast Guard and Navy informed CRS and CBO in March 2018 that they now believe that three polar icebreakers could be acquired for a total cost of about $2.1 billion, or an average of about $700 million per ship.[36] (The first ship will cost more than the

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report states that "in 2017, DHS, the USCG, and Navy entered into several agreements that outline oversight roles, among other things. For example, these agreements state that the program will follow DHS acquisition policies with DHS leadership serving as the acquisition decision authority for program milestones. However, the Navy will review and approve acquisition documents before the program seeks DHS approval. These agreements also state that the program's contracting actions could be funded by either USCG or Navy appropriations, and the source of the appropriations will award the contract." (Government Accountability Office, *Homeland Security Acquisitions[:] Leveraging Programs' Results Could Further DHS's Progress to Improve Portfolio Management*, GAO-18-339SP, May 2018, p. 86.)

[34] Source: March 16, 2018, Coast Guard-Navy briefing to CRS and the Congressional Budget Office (CBO) on the PSC program.

[35] A June 22, 2018, press report states the following:

> The U.S. Coast Guard is collaborating with the National Research Council of Canada (NRC) to access its renowned ice tank facilities in St. John's, Newfoundland, to model and evaluate the specifications needed to design the new heavy icebreakers....
>
> The testing at the NRC ice tank in St. John's has already led to some critical changes to the ship capability criteria.
>
> "We confirmed that with modern icebreaker hull form and propulsion configuration design we could reduce the estimated required power," [Neil Meister, technical director of the U.S. Coast Guard Polar Icebreaker Acquisition Program] said. "In comparison to polar-class icebreakers they have 60,000 installed horse power and we see that you can meet the same icebreaking capability requirement with about 40 per cent less power."
>
> (Levon Sevunts, "U.S. Coast Guard Turns to Canada for Help with Designing Its New Heavy Icebreaker," Radio Canada International, June 22, 2018.)

[36] Source: March 16, 2018, Coast Guard-Navy briefing to CRS and CBO on the polar icebreaker program. For further discussion, see the section entitled "Estimated Acquisition Cost Has Declined Substantially" in CRS Report RL34391, *Coast Guard Polar Security Cutter (Polar Icebreaker) Program: Background and Issues for Congress*, by Ronald

other two because it will incorporate design costs for the class and be at the start of the production learning curve for the class.) The March 2, 2018, Request for Proposals (RFP) for the PSC program states that "For informational purposes only, the government has established an estimate for the HPIB [heavy polar icebreaker] shipbuilder costs in the amount of $746M [million] for the lead ship... with an average ship price of $615M across three HPIBs...."[37] Other information reported by GAO identifies a smaller reduction in procurement cost, to something more than $900 million per ship.[38]

For additional background information on earlier estimates of polar icebreaker acquisition costs, see **Appendix B**.

Program Funding

The PSC program has received about $359.6 million in acquisition funding through FY2018, including $300 million provided through the Navy's shipbuilding account—$150 million in FY2017, and another $150 million in FY2018—and $59.6 million in funding provided through the Coast Guard's acquisition account. The Coast Guard's proposed FY2019 budget requests $750 million in Coast Guard acquisition funding for the program.

The request for $750 million reflected a change that the Trump Administration made to its proposed FY2019 budget not long before that budget was submitted to Congress. Prior to this change, the Administration's plan was to request $30 million in Coast Guard acquisition funding for the program. Some documents in the Coast Guard's FY2019 budget submission that were prepared before this change occurred reflect this $30 million figure rather than the $750 million figure.

For additional background information on funding for the PSC program, see **Appendix C**.

Contract Type

The baseline plan for the PSC program calls for acquiring new polar icebreakers using a contract with options. Coast Guard and Navy officials, however, are open to the idea of instead using a block buy contract to acquire the ships, and have requested information on this possibility as part

O'Rourke.

[37] Naval Sea Systems Command (HQ), Solicitation N0002418R2210, March 2, 2018, page 257 of 294. See also Government Accountability Office, *Coast Guard Acquisitions[:] Polar Icebreaker Program Needs to Address Risks before Committing Resources*, GAO-18-600, September 2018, pp. 42-43. The GAO report also states that DHS and the Coast Guard estimate the total lifecycle cost of a three-ship PSC program at $8,545 million (objective) and $9,827 million (threshold) (page 13), and that the ships' detail design and construction costs account for about 25% of these figures, with the remaining 75% or so accounted for by remaining acquisition costs, 30 years of annual operating and support (O&S) costs, and end-of-life ship-disposal costs (page 31). Twenty-five percent of $8,545 million and $9,827 million would equate to design and construction costs of $2,136.3 million (an average of about $712 million per ship) and $2,456.8 million (an average of about $819 million per ship).

[38] A May 2018 GAO report stated that the acquisition program baseline (APB) approved for the polar icebreaker program in January 2018 estimated the program's acquisition cost at $3,207 million, and that the "current estimate" of the program's acquisition as of January 2018 was $2,789 million, or an average of about $930 million per ship. (Government Accountability Office, *Homeland Security Acquisitions[:] Leveraging Programs' Results Could Further DHS's Progress to Improve Portfolio Management*, GAO-18-339SP, May 2018, p. 85.) See also Government Accountability Office, *Coast Guard Acquisitions[:] Actions Needed to Address Longstanding Portfolio Management Challenges*, GAO-18-454, July 2018, which states on page 18 that "The polar icebreaker program has an estimated total acquisition cost of more than $3 billion...."

of the request for proposals (RFP) for the PSC program that was released on March 2, 2018 (see next section).

Recent Acquisition Actions

Recent acquisition actions in the PSC program include the following:

- On February 22, 2017, the Coast Guard awarded five firm fixed-price contracts for heavy polar icebreaker design studies and analysis. The objective of the studies was to identify design and systems approaches to reduce acquisition cost and production timelines.
- On April 4, 2017, the Coast Guard released its draft heavy polar icebreaker system specifications in a request for information (RFI). The request sought questions, comments and feedback related to heavy polar icebreaker technology risks, sustainability, producibility and affordability.
- In May 2017, the Coast Guard began model testing of potential hull designs and propulsion configurations for the polar icebreaker. The testing was anticipated to be completed by March 2018, with the results to be used to inform the final specifications for the icebreakers.[39]
- On October 19, 2017, the U.S. Navy, in collaboration with the Coast Guard under the polar icebreaker integrated program office, released a draft request for proposal (RFP) for detail design and construction of a heavy polar icebreaker.
- In January 2018, DHS approved the initial acquisition program baseline (APB) for the PSC program. The APB establishes cost, schedule, and performance goals for the program.[40]
- On March 2, 2018, the U.S. Navy, in collaboration with the U.S. Coast Guard under the polar icebreaker integrated program office, released an RFP for the advance procurement and detail design for the Coast Guard's heavy polar icebreaker, with options for detail design and construction for up to three heavy polar icebreakers.

Regarding the February 22, 2017, award of the five contracts for polar icebreaker design studies and analysis, the Coast Guard stated the following:

> 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.

[39] Source: Government Accountability Office, *Homeland Security Acquisitions[:] Leveraging Programs' Results Could Further DHS's Progress to Improve Portfolio Management*, GAO-18-339SP, May 2018, p. 86.

[40] Source: Government Accountability Office, *Homeland Security Acquisitions[:] Leveraging Programs' Results Could Further DHS's Progress to Improve Portfolio Management*, GAO-18-339SP, May 2018, p. 85.

> 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) [aka TAO-205] fleet oiler,[41] 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.[42]

Regarding the March 2, 2018, release of the RFP for the PSC program, the Navy and Coast Guard stated the following:

> The RFP is for Advance Planning and Engineering Efforts, with options for the Detail Design and Construction (DD&C) of up to three (3) Heavy Polar Icebreaker (HPIB) cutters....
>
> To enable ongoing program planning and responses to Congressional inquiries, the Coast Guard and Navy HPIB IPO desire input from prime offerors related to the benefits of Congressional authorization of Block Buy and/or Economic Order Quantity.[43] Submission of this information is voluntary and will not be used to evaluate any proposal submitted by the offeror in response to this RFP. Email submissions providing dollarized estimated savings per ship for authorization provided for 1) all three cutters and 2) only the second and third cutters should be emailed to the Bidders Question contacts identified below with the email title "HPIB Block Buy/EOQ Input—Contractor Name." Submissions within 60 days of RFP release are preferred.[44]

[41] For more on the TAO-205 program, see CRS Report R43546, *Navy John Lewis (TAO-205) Class Oiler Shipbuilding Program: Background and Issues for Congress*, by Ronald O'Rourke.

[42] "Acquisition Update: Coast Guard Awards Multiple Contracts For Heavy Polar Icebreaker Industry Studies," February 22, 2017, accessed March 20, 217, at https://www.uscg.mil/acquisition/newsroom/updates/icebreaker022217.asp.

[43] Economic order quantity (EOQ) purchases, which can take place as part of a block buy contract, are up-front batch orders of selected components of the end items (in this case, ships) that are to be procured under the contract.

[44] Federal Business Opportunities (FedBizOpps.gov), Heavy Polar Icebreaker (HPIB) Detail Design and Construction (DD&C), Solicitation Number: N00024-18-R-2210, March 2, 2018.

Foreign Cooperation and Participation

U.S. Coast Guard Cooperation with Canadian Coast Guard

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

> 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 icebreaker in open water at the Naval Surface Warfare Center, Carderock Division, in Bethesda, Maryland.[45]

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 the following:

> 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

[45] "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.

icebreaker program, for which the Coast Guard early this year plans to award initial design study contracts.[46]

Issues for Congress

FY2019 Funding Request

One issue for Congress for FY2019 is whether to approve, reject, or modify the Coast Guard's FY2019 acquisition funding request for the PSC 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 FY2019.

One potential option for Congress would be to reduce the Coast Guard's FY2019 acquisition funding request so that the total amount of funding provided through FY2019 would be enough to fully fund the procurement of the first new heavy polar icebreaker, but not partially fund the second ship in the program. This might involve reducing the FY2019 acquisition funding request by roughly $150 million.[47] Under this option, funding for the second ship in the program could be provided starting in FY2020 or a subsequent year.

Another potential option for Congress would be to increase the FY2019 acquisition funding request so that the total amount of funding provided through FY2019, in addition to fully funding the procurement of the first new heavy polar icebreaker, would additionally fully fund (rather than partially fund) the procurement of the second ship in the program. Based on a total acquisition cost of $2.1 billion for three heavy polar icebreakers, fully funding the second ship in the program in FY2019 might involve increasing the FY2019 funding request by $400 million to $500 million. Under this option, funding for the third ship in the program could be provided starting in FY2020 or a subsequent year.

Contract with Options vs. Block Buy Contract

Another potential issue for Congress is whether to use a contract with options or a block buy contract to acquire the ships. As noted earlier, the baseline plan for the PSC program calls for acquiring ships using a contract with options, but Coast Guard and Navy officials are open to the idea of instead using a block buy contract to acquire the ships, and have requested information on this possibility as part of the request for proposals (RFP) for the PSC program that was released on March 2, 2018.

Although a contract with options covers multiple years, it operates more like a form of annual contracting, and it does not generate the kinds of savings that are possible with a block buy contract. Compared to a contract with options, a block buy contract would reduce the government's flexibility regarding whether and when to acquire the second and third ships, and

[46] "Icebreaker Team," *Defense Daily*, January 17, 2017: 2. See also Levon Sevunts, "U.S. Coast Guard Turns to Canada for Help with Designing Its New Heavy Icebreaker," *Radio Canada International*, June 22, 2018.

[47] The Coast Guard's proposed FY2019 budget was submitted before Congress finalized action on the Coast Guard's FY2018 budget. In its action on the FY2018 budget, Congress approved the Coast Guard's request for $19 million in Coast Guard acquisition funding for the program, and provided $150 million in unrequested acquisition funding for the program in the Navy's shipbuilding account. If the FY2019 request for $750 million is intended solely to complete the funding for the first ship, and if this figure does not assume that more than $19 million would be provided for the program in FY2018, then approving the $750 million request would provide $150 million more than needed to fully fund the first ship.

what design to build them to,[48] and in return reduce the combined acquisition cost of the ships covered by the contract. The Navy has used block buy contracts to reduce procurement costs of Virginia-class attack submarines and (in more recent years) Littoral Combat Ships (LCSs) and John Lewis (TAO-205) class oilers.[49] 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 $150 million.

A congressionally mandated July 2017 National Academies of Sciences, Engineering, and Medicine (NASEM) report on acquisition and operation of polar icebreakers states the following (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 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.[50]

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[48] 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.

[49] 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 (LCS) 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.

[50] 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.

Funding Coast Guard Polar Icebreakers through Navy's Shipbuilding Account

Another potential issue for Congress is whether to continue providing at least some of the acquisition funding for the PSC program through the Navy's shipbuilding account, known formally as the Shipbuilding and Conversion Navy (SCN) appropriation account. A May 2018 GAO report states that agreements between DHS, the Coast Guard, and the Navy that were made following the establishment of the Coast Guard-Navy integrated program office for the PSC program "state that the program's contracting actions could be funded by either USCG or Navy appropriations, and the source of the appropriations will award the contract."[51] As noted earlier, of the $359.6 million in acquisition funding that has been provided for the PSC program through FY2018, $300 million (about 83%) has been provided through the SCN account—$150 million in FY2017, and another $150 million in FY2018.

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 in the past for funding Coast Guard ships other than heavy polar icebreakers:

- *Healy* was funded largely (about 89%) through the SCN account.[52]
- Thirty-three of the Coast Guard's 49 Island-class 110-foot patrol boats (i.e., about 67% of the 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 nonexpiring funding. During the construction phase of the contract, the Navy exercised options under the contract for the construction 12 additional boats using FY1990 SCN funding.[53]

Subsections (a), (b), and (c) of Section 122 of the FY2018 National Defense Authorization Act (H.R. 2810/P.L. 115-91 of December 12, 2017) state the following:

> SEC. 122. Icebreaker vessel.
>
> (a) Authority to procure one polar-class heavy icebreaker.—

[51] Government Accountability Office, *Homeland Security Acquisitions[:] Leveraging Programs' Results Could Further DHS's Progress to Improve Portfolio Management*, GAO-18-339SP, May 2018, p. 86.

[52] 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 Acquisition, Construction, and Improvements (AC&I) account (as it was known prior to FY2019) 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.)

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

(1) IN GENERAL.—There is authorized to be procured for the Coast Guard one polar-class heavy icebreaker vessel.

(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) Limitation on availability of funds for procurement of icebreaker vessels.—None of the funds authorized to be appropriated by this Act or otherwise made available for the Department of Defense for any fiscal year that are unobligated as of the date of the enactment of this Act may be obligated or expended for the procurement of an icebreaker vessel other than the one polar-class heavy icebreaker vessel authorized to be procured under subsection (a)(1).

(c) Contracting authority.—

(1) COAST GUARD.—If funds are appropriated to the department in which the Coast Guard is operating to carry out subsection (a)(1), the head of contracting activity for the Coast Guard shall be responsible for contracting actions carried out using such funds.

(2) NAVY.—If funds are appropriated to the Department of Defense to carry out subsection (a)(1), the head of contracting activity for the Navy, Naval Sea Systems Command shall be responsible for contracting actions carried out using such funds.

(3) INTERAGENCY ACQUISITION.—Notwithstanding paragraphs (1) and (2), the head of contracting activity for the Coast Guard or head of contracting activity for the Navy, Naval Sea Systems Command (as the case may be) may authorize interagency acquisitions that are within the authority of such head of contracting activity.[54]

Regarding Section 122, the conference report (H.Rept. 115-404 of November 9, 2017) on H.R. 2810/P.L. 115-91 states the following:

Icebreaker vessel (sec. 122)

The House bill contained provisions (sec. 122, 123, and 1012) that would authorize the Secretary of the Navy to act as a general agent for the Secretary of the Department in which the Coast Guard is operating and enter into a contract for icebreaker vessels; prohibit funds for the Department of Defense from being used for the procurement of an icebreaker vessel; and amend section 2218 of title 10, United States Code, to authorize funds associated with the National Defense Sealift Fund for the construction of icebreaker vessels.

The Senate amendment contained a similar provision (sec. 1048).

The Senate recedes with an amendment that would authorize one polar-class heavy icebreaker vessel, prohibit funds for the Department of Defense from being used for the procurement of an icebreaker vessel other than this one polar-class heavy icebreaker vessel, clarify contracting authorities, and require a Comptroller General report.

The conferees recognize the national importance of recapitalizing the U.S. icebreaker fleet and the extraordinary circumstances that necessitated use of Department of Defense funding to procure the first polar-class heavy icebreaker, as partially provided in the Department of Defense Appropriations Act for Fiscal Year 2017. Accordingly, the conferees support the authorization of this icebreaker in this Act.

The conferees note the Undersecretary of Management in the Department of Homeland Security (DHS) serves as the Acquisition Decision Authority for the Polar Icebreaker

[54] Section 122 also includes a subsection (d) that requires a GAO report assessing the cost of, and schedule for, the procurement of new icebreakers.

> Program and that this program is governed in accordance with DHS Acquisition Management Directive 102–01 and Instruction 102–01–001.
>
> The conferees believe maintaining clear lines of authority, responsibility, accountability, and resources with the Secretary and Acquisition Decision Authority of the department in which the U.S. Coast Guard is operating are essential to delivering icebreakers on cost and schedule.
>
> Accordingly, the conferees believe the Secretary of the Department of Homeland Security and the Undersecretary of Management in the DHS should be the officials provided with authorities and resources related to the Polar Icebreaker Program.
>
> Therefore, the conferees expect subsequent icebreakers to be authorized by the congressional committees with jurisdiction over the Coast Guard and funded using Coast Guard appropriations. (Pages 765-766)

Technical, Schedule, and Cost Risk for PSC Program

Another potential issue for Congress concerns technical, schedule, and cost risk in the PSC program. A September 2018 GAO report on the PSC program states that the Coast Guard

> did not have a sound business case in March 2018, when it established the cost, schedule, and performance baselines for its heavy polar icebreaker acquisition program, because of risks in four key areas:
>
> **Design.** The Coast Guard set program baselines before conducting a preliminary design review, which puts the program at risk of having an unstable design, thereby increasing the program's cost and schedule risks. While setting baselines without a preliminary design review is consistent with DHS's current acquisition policy, it is inconsistent with acquisition best practices. Based on GAO's prior recommendation, DHS is currently evaluating its policy to better align technical reviews and acquisition decisions.
>
> **Technology.** The Coast Guard intends to use proven technologies for the program, but did not conduct a technology readiness assessment to determine the maturity of key technologies prior to setting baselines. Coast Guard officials indicated such an assessment was not necessary because the technologies the program plans to employ have been proven on other icebreaker ships. However, according to best practices, such technologies can still pose risks when applied to a different program or operational environment, as in this case. Without such an assessment, the program's technical risk is underrepresented.
>
> **Cost.** The lifecycle cost estimate that informed the program's $9.8 billion cost baseline substantially met GAO's best practices for being comprehensive, well-documented, and accurate, but only partially met best practices for being credible. The cost estimate did not quantify the range of possible costs over the entire life of the program. As a result, the cost estimate was not fully reliable and may underestimate the total funding needed for the program.
>
> **Schedule.** The Coast Guard's planned delivery dates were not informed by a realistic assessment of shipbuilding activities, but rather driven by the potential gap in icebreaking capabilities once the Coast Guard's only operating heavy polar icebreaker—the Polar Star—reaches the end of its service life....
>
> GAO's analysis of selected lead ships for other shipbuilding programs found the icebreaker program's estimated construction time of 3 years is optimistic. As a result, the Coast Guard

> is at risk of not delivering the icebreakers when promised and the potential gap in icebreaking capabilities could widen.[55]

Common Design for Heavy and Medium Polar Icebreakers

Another potential issue for Congress is whether to procure heavy and medium polar icebreakers to a common basic design. As noted earlier (see "June 2013 DHS Polar Icebreaker Mission Need Statement"), the DHS polar icebreaker mission need statement (MNS) 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...." Consistent with this statement, the Coast Guard envisages procuring up to three new medium icebreakers after it procures three new heavy polar icebreakers. The question is whether to develop a separate design for the medium polar icebreakers, or instead build the medium polar icebreakers to the same basic design as the heavy polar icebreakers.

A congressionally mandated July 2017 report from the National Academies of Sciences, Engineering, and Medicine (NASEM) on the acquisition and operation of polar icebreakers concluded that notional operational requirements for new medium polar icebreakers would result in ships that would not be too different in size from new heavy polar icebreakers. (As shown in **Table 1**, the Coast Guard's current medium polar icebreaker, *Healy*, is actually somewhat larger than the Coast Guard's heavy polar icebreaker, *Polar Star*.) Given what it concluded as the probable similarity in size between future U.S. heavy and medium polar icebreakers, the NASEM report recommended building a single medium polar icebreaker to the same common design as three new heavy polar icebreakers. This approach, the report concluded, would reduce the cost of the medium icebreaker by avoiding the cost of developing a new design and by making the medium polar icebreaker the fourth ship on an existing production learning curve rather than the first ship on a new production learning curve. The NASEM report stated the following (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).**
>
> The current Department of Homeland Security (DHS) Mission Need Statement... 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....
>
> **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**

[55] Government Accountability Office, *Coast Guard Acquisitions[:] Polar Icebreaker Program Needs to Address Risks before Committing Resources*, GAO-18-600, summary page.

> **identified in the High Latitude Mission Analysis Report are significantly underestimated**....
>
> 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....
>
> **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.[56]

If policymakers decide to procure a second new medium polar icebreaker or a third new medium polar icebreaker, the same general approach recommended by the NASEM report could be

[56] 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. 2, 4-6.

followed—a second medium polar icebreaker and third medium polar icebreaker could be built to the same common design used for the three new heavy polar icebreakers and the first new medium polar icebreaker.

An April 12, 2018, press report states the following:

> As the Coast Guard prepares to review industry bids for a new heavy polar icebreaker, the service is keeping its options open for the right number and mix of polar icebreakers it will need in the future, Adm. Paul Zukunft, the [then-]commandant of the Coast Guard, said on Wednesday [April 11].
>
> The Coast Guard's program of record is for three heavy and three medium polar icebreakers but Zukunft said the "jury is still out" whether that will remain so. Right now, the service is aiming toward building three new heavy icebreakers, but it might make sense just to keep building these ships, he told reporters at a Defense Writers Group breakfast in Washington, D.C.
>
> Zukunft said that "when you start looking at the business case after you build three, and then you need to look at what is the economy of scale when you start building heavy icebreakers, and would it be less expensive to continue to build heavies and not mediums." He added that the heavy icebreakers provide more capability, and if the price is "affordable" and in "the same range" as building medium icebreakers, then "maybe you end up with one class of heavy icebreakers."
>
> Building only one class of ships has a number of advantages in terms of maintenance, crew familiarity, configuration management, and more, he said. A decision on what the future icebreaker fleet will consist of is "still probably several years out .... but that's one option that we want to keep open going forward," Zukunft said.[57]

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.[58]

Laws Relating to Building Ships in Foreign Shipyards

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.[59] Two

[57] Calvin Biesecker, "Coast Guard Leaving Options Open For Future Polar Icebreaker Fleet Type," *Defense Daily*, April 12, 2018. Ellipse as in original.

[58] See, for example, Yereth Rosen, "Can the U.S. Benefit from Finland and Russia's Icebreaker Expertise?" *Arctic Now*, October 9, 2017. See also Jim Paulin, "Finland Wants In On US Icebreaker Investment," *Alaska Dispatch News*, September 8, 2015.

[59] 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

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 the following:

> §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 the following:

> §7309. Construction of vessels in foreign shipyards: prohibition
>
> (a) Prohibition.-Except as provided in subsection (b), no vessel to be constructed for any of the armed forces,[60] 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).

October 2017 Press Report

An October 9, 2017, press report states the following:

> Finland, the world leader in icebreaker design and construction, could help pull the United States out of its icebreaker crisis, a diplomat said at a business conference in Anchorage last week.
>
> "The U.S. is now in dire straits about its own icebreaker fleet. They only have two and they are both seriously outdated. We can help," Stefan Lindstrom, Finland's Los Angeles-based

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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, CPB 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.

[60] 14 U.S.C. 1, which establishes the Coast Guard, states the following: "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."

> consul general, said in a presentation at last week's Arctic Ambitions conference held by the World Trade Center of Alaska....
>
> If the U.S. makes a decision to buy a replacement from overseas, Finnish shipbuilders could respond quickly, Lindstrom said.
>
> In Finland, a shipyard can build and deliver a polar-class icebreaker within 24 months after a contract is signed—a sharp contrast, Lindstrom said, to the extended discussions that the U.S. Coast Guard and Congress have had over planning for potential new icebreakers.
>
> And the costs for a Finnish-designed and Finnish-built polar-class icebreaker is about 200 million to 220 million Euros ($235 [million] to [$]258 million), he said. That's far lower than the price tag being discussed in the US.
>
> "I have serious difficulties, however, understanding how you can pay a billion for an icebreaker that costs one-fifth of it if you order it from abroad," Lindstrom said. "But I'm not going to go into those political situations."[61]

It is unclear from the above-quoted remarks whether the €220-million polar-class icebreaker being referred to would qualify as a heavy, medium, or light polar icebreaker, or to what degree it would meet the Coast Guard's desired capabilities for a heavy polar icebreaker (see "Desired Capabilities for New Polar Icebreaker"). Of the six Russian heavy polar icebreakers shown in **Table 2** (all of which are nuclear-powered), four were built in Russia, while the other two—sister ships named *Taymyr* and *Vaygach* that entered service around 1989 and 1990—were mostly built in Finland and then moved to a Russian shipyard for the installation of their nuclear reactors. All other Finnish-built icebreakers shown in **Table 2** (whether operated by Finland or other countries) could be considered, based on their brake horsepower (BHP), to be medium or light polar icebreakers.

Short-Term Bridge to One or More New Polar Icebreakers

Overview: Two Basic Options

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.[62] Consequently, another potential issue for Congress concerns how to bridge a potential gap in 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,[63] there are at least two options for bridging this time period: One would be to further extend the service life of *Polar Star*. 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

[61] Yereth Rosen, "Can the U.S. Benefit from Finland and Russia's Icebreaker Expertise?" *Arctic Now*, October 9, 2017.

[62] The September 25, 2017, GAO report on polar icebreakers states the following: "According to Coast Guard planning documents, the *Polar Star's* useful service life will end between fiscal years 2020 and 2023." (Government Accountability Office, *Coast Guard: Status of Polar Icebreaking Fleet Capability and Recapitalization Plan*, GAO-17-698R, September 25, 2017, p. 6.

[63] See CRS Testimony TE10012, *Coast Guard Arctic Implementation Capabilities*, by Ronald O'Rourke.

icebreakers. The United States has used both of these approaches in the past to mitigate polar icebreaking capacity gaps.[64]

Coast Guard Plan is to Further Extend Life of Polar Star

The Coast Guard plans to pursue the first of the two options outlined above—further extend the service life of *Polar Star*—and has requested funding in its FY2019 budget for service life extension work on *Polar Star*. A September 25, 2017, GAO report on polar icebreakers states the following:

> While the Coast Guard considered various options to bridge this potential heavy icebreaker gap, in a January 2017 study the Coast Guard reported that it was planning for a limited service life extension of the Polar Star to keep it operational until fiscal year 2025, at an initial cost estimate of $75 million. However, the Coast Guard has not completed a formal cost estimate for this effort and we have previously reported that the $75 million estimate may be unrealistic....
>
> The Coast Guard's Capital Investment Plan for fiscal years 2018-2022 includes $60 million of a planned $75 million for polar icebreaker sustainment, which officials reported as being the rough estimate for the Polar Star's limited service life extension. Coast Guard officials stated that the $75 million rough estimate is based on the cost of the Polar Star's prior 7-10 year service life extension which was completed in fiscal year 2013. However, in July 2017 we reported that the Coast Guard has not completed a cost estimate for this effort, and that the $75 million estimate may be unrealistic based on the assumptions the Coast Guard used, such as continuing to use parts from the Polar Sea as has been done in previous maintenance events.[65]

A July 2018 GAO report states the following:

> The Coast Guard is planning a SLEP on the Polar Star to keep it operational until the first and second new heavy polar icebreakers are delivered (planned for 2023 and 2025, according to current acquisition plans) in order to bridge a potential operational gap. This approach would allow the Coast Guard to operate a minimum of two heavy icebreakers once the first polar icebreaker is delivered. The approach would also provide the Coast Guard with a self-rescue capability—the ability for one icebreaker to rescue the other if it became incapacitated while performing icebreaking operations.
>
> The Coast Guard's plan to conduct the Polar Star SLEP during its existing annual depot-level maintenance periods may not be feasible given the amount of maintenance already required on the cutter. The Polar Star's mission capable rating has been decreasing in recent years and reached a low point of 29 percent—well below the target of 41 percent—from

[64] Regarding the first option, the Coast Guard, in addition to the work done to extend the service life of *Polar Star* by an additional 7 to 10 years, also mitigated a polar icebreaking capacity gap in the 1970s by putting two of its older Wind-class icebreakers through a vessel rehabilitation and modernization (VRAM) program. (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.)

Regarding the second option, 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. (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.)

[65] Government Accountability Office, *Coast Guard: Status of Polar Icebreaking Fleet Capability and Recapitalization Plan*, GAO-17-698R, September 25, 2017, pp. 3, 8.

October 2016 to September 2017. Based on mission capable data, we found this is mostly due to additional time spent in depot-level maintenance, which has increased in recent years from about 6 months in 2015 to more than 8 months in 2017.

Additionally, the Polar Star has required extensions of about 3 months for its annual dry dock periods—the period of time when a cutter is removed from the water so that maintenance can be conducted—in 2016 and 2017 to complete required maintenance activities. These dry docks were originally planned to last between 2-1/2 months and 4 months. These extensions also compressed the amount of time that the crew had to prepare for its annual mission to Antarctica, which, according to members of the Polar Star crew, placed a large stress on the crew, risked the quality of work, and reduced or eliminated the crews' planned rest and personal preparation for their roughly 4-month deployment. Based on our analysis, these delays and extensions are likely to continue as the cutter ages. According to Coast Guard officials, the Polar Star's SLEP work will be conducted during the annual dry dock periods by adding an additional 1 or 2 months to the annual dry docks. However, if the work is unable to be completed during this time frame, it could force the Coast Guard to miss its commitment to conduct the annual Antarctica mission. Coast Guard maintenance officials stated that until the Polar Star completes the SLEP, its repairs will likely continue to get more expensive and time consuming. We will continue to monitor the Polar Star's SLEP through our annual review of DHS programs.

As we found in July 2017, the Polar Star SLEP effort has a rough order cost estimate of $75 million, which is based on the reactivation work completed in 2013.41 However, this estimate may be unrealistic based on assumptions the Coast Guard used, such as that it would continue to use parts from the Coast Guard's other heavy polar icebreaker, the Polar Sea, which has been inactive since 2010.42 The Coast Guard's recent assessment of the Polar Star's material condition—the physical condition of the cutter, which includes the hull structure, habitability, major equipment systems, and spare parts availability—was completed in January 2018.43 The material assessment stated that many of the available parts from the Polar Sea have already been removed and installed on the Polar Star. As a result of the finite parts available from the Polar Sea, the Coast Guard may have to acquire new parts for the Polar Star that could increase the $75 million SLEP estimate. The Polar Star's recent material assessment will form the basis to determine which systems will be overhauled during the SLEP and for a more detailed cost estimate. The Coast Guard expects the program to reach the obtain phase of the acquisition life cycle by December 2019, at which time the Polar Star could reach the end of its current useful service life (currently projected to be between 2020 to 2023). This timeline contains risk that the Polar Star could be rendered inoperable before the cutter is able to undergo a SLEP.[66]

Another Option: Chartering an Icebreaker

Overview

The feasibility of the second of the two options outlined above—charter (i.e., lease) one or more other 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 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,

[66] Government Accountability Office, *Coast Guard Acquisitions[:] Actions Needed to Address Longstanding Portfolio Management Challenges*, GAO-18-454, July 2018, pp. 29-31.

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* (**Figure 4**), an Arctic oil-exploration support ship owned by Edison Chouest Offshore (ECO). 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.[67]

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, [THEN-]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.[68]

[67] See for example, "More Sparks Fly in Canada Shipbuilding Controversy," *Marine Log*, March 18, 2016; Pierre Leblanc, "An Out-of-the-Blue Icebreaker Opportunity," *Maritime Executive*, January 2, 2018.

[68] Source: Transcript of hearing.

Figure 4. *Aiviq*

Source: "Arctic Supply Vessel Aiviq," accessed September 14, 2017, at http://www.mascoat.com/arctic-supply-vessel-aiviq1.html.

Later in the same hearing, the following exchange occurred:

> REPRESENATIVE 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.[69]

At a June 14, 2016, hearing on Coast Guard mission needs and resource allocation 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 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:

[69] Source: Transcript of hearing.

> ... 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.[70]

The Coast Guard stated in July 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 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.[71]

Acquisition vs. Leasing

In addition to the issues for Congress discussed earlier in this report, another potential issue for Congress that arises from time to time 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). For additional information on this issue, see **Appendix E**.

[70] Transcript of hearing.

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

Legislative Activity for FY2019

Summary of Appropriation Action on FY2019 Funding Request

The Coast Guard's proposed FY2019 budget requests $750 million in Coast Guard acquisition funding for the PSC program. **Table 3** summarizes congressional appropriation action on the program's FY2019 funding request.

Table 3. Summary of Congressional Appropriations Action on FY2019 Funding Request

(millions of dollars)

Polar icebreaker	Request	HAC	SAC	Conf.
New polar icebreaker				
Coast Guard acquisition account	750	0	750	675
Navy shipbuilding account	0	0	0	0
Subtotal	***750***	***0***	***750***	***675***
Polar sustainment (service life extension of* Polar Star*)				
Coast Guard acquisition account	15	15	15	15
Total	**765**	**15**	**765**	**690**

Source: Table prepared by CRS, based on Coast Guard's FY2019 budget submission and HAC committee report, SAC chairman's recommendation and explanatory statement on FY2019 DHS Appropriations Act and FY2019 DOD Appropriations Act, joint explanatory statement for H.J.Res 31, and committee and conference reports on the FY2019 DOD appropriations act. **HAC** is House Appropriations Committee; **SAC** is Senate Appropriations Committee; **Conf.** is conference agreement.

FY2019 DHS Appropriations Act (Division A of H.J.Res 31/H.R. XXXX/S. 3109)

House

The House Appropriations Committee marked up the FY2019 DHS Appropriations Act (referred to here as H.R. XXXX) on July 25, 2018. The text of the bill as marked up, and the committee's report reflecting the markup, were not available as of August 3, 2018. The figures shown in the HAC column of **Table 3** and the discussion below are based on the bill text and draft committee report (referred to here as H.Rept. 115-XXX) going into July 25, 2018, markup meeting, combined with a summary of the amendments adopted at the markup meeting, which were posted on the committee's website in conjunction with the pre-markup bill text and draft committee report.[72]

H.Rept. 115-XXX recommends the funding levels shown in the HAC column of **Table 3**. H.Rept. 115-XXX states the following:

[72] Houser Appropriations Committee, "Appropriations Committee Approves Fiscal Year 2019 Homeland Security Funding Bill," July 25, 2019, accessed August 3, 2018, at https://appropriations.house.gov/news/documentsingle.aspx?DocumentID=395388.

> *Polar Ice Breaking Vessel*. The Committee recognizes that Polar icebreakers are essential to securing the nation's security and economic interests in the Polar regions. While the recommendation does not include the requested funding for the construction of a new Polar Icebreaker, the Committee plans to work with the Coast Guard to determine what is needed in fiscal year 2019 to advance this program. The Coast Guard's existing operational icebreaking fleet consists of just one heavy icebreaker, the *POLAR STAR*, which entered into service in 1976. The Coast Guard has testified that it will need to sustain the *POLAR STAR* beyond two years after delivery of the first of the new class of icebreakers to ensure mission readiness, thus the Committee recommends $15,000,000, as requested. The Committee looks forward to the updated cost estimate for the *POLAR STAR*'s service life extension project (SLEP) that is anticipated this summer. (Pages 38-39)

H.Rept. 115-XXX also states the following:

> The Coast Guard is directed to brief the Committee not later than 90 days after the date of enactment of this Act with an update on the results of the examination, for which up to $5,000,000 was provided in the fiscal year 2018 DHS Appropriations Act, on whether the Coast Guard's heavy icebreaking requirements can be met by existing vessels using short-term procurement strategies. (Page 40)

Senate

The Senate Appropriations Committee, in its report (S.Rept. 115-283 of June 21, 2018) on S. 3109, recommends the funding levels shown in the SAC column of **Table 3**. S.Rept. 115-283 states the following:

> *Polar Ice Breaking Vessel*.—The recommendation includes $750,000,000, as requested, to maintain the accelerated acquisition schedule for a new class of heavy polar icebreakers that was established in fiscal year 2018. These funds will be used to request proposals and award contracts for detail design and construction near the beginning of fiscal year 2020. Heavy polar icebreakers are essential to securing the national security and economic interests of the United States in the Arctic and Antarctic. To ensure the United States is able to achieve this objective in the most expeditious and efficient manner possible, the Coast Guard should explore block buy pricing for the heavy polar icebreakers. Not later than 180 days after the date of the enactment of this act, the Coast Guard shall submit a report to the Committee on the feasibility of block buy contracting for the acquisition of heavy polar icebreakers.
>
> *Polar Star*.—The recommendation includes $15,000,000 to carry out a service life extension program [SLEP] for the POLAR STAR to extend its service life so that it remains operational until the delivery of the second new heavy polar icebreaker. The Coast Guard's two existing heavy polar icebreakers are over 45 years old and well past their planned service life. Currently, only one heavy polar icebreaker is in active service [POLAR STAR], and the other vessel [POLAR SEA] is in an inactive status serving to provide specialty parts to help sustain POLAR STAR. Continued funding for its SLEP will ensure the POLAR STAR can meet and support national interests and provide assured surface presence in the Arctic and Antarctic. (Pages 68-69)

S.Rept. 115-283 also states the following (emphasis added):

> *Full-Funding Policy*.—The Committee again directs an exception to the administration's current acquisition policy that requires the Coast Guard to attain the total acquisition cost for a vessel, including long lead time materials [LLTM], production costs, and postproduction costs, before a production contract can be awarded. This policy has the potential to make shipbuilding less efficient, to force delayed obligation of production funds, and to require post-production funds far in advance of when they will be used. The Department should position itself to acquire vessels in the most efficient manner within the guidelines of strict governance measures. The Committee expects the administration to

> adopt a similar policy for the acquisition of the Offshore Patrol Cutter [OPC] and **heavy polar icebreaker**. (Page 67)

Conference

In final action, the FY2019 DHS Appropriations Act became Division A of H.J.Res 31 of the 116th Congress, a bill making consolidated appropriations for the fiscal year ending September 30, 2019, and for other purposes. The joint explanatory statement for H.J.Res 31 provides the funding levels shown in the conference column of **Table 3**. The total of $675 million for the PSC program includes $655 million for production of the first PSC and $20 million for long lead time materials for a second PSC. (PDF pages 26 and 67 of 609)

Frank LoBiondo Coast Guard Authorization Act of 2018 (S. 140/P.L. 115-282)

S. 140 was introduced in the Senate on January 12, 2017, as a bill to amend the White Mountain Apache Tribe [WMAT] Water Rights Quantification Act of 2010 to clarify the use of amounts in the WMAT Settlement Fund. The bill retained that purpose and was acted on by Congress into 2018. Later in 2018, S. 140 became a bill to authorize appropriations for the Coast Guard, and for other purposes. On November 14, 2018, the Senate concurred, 94-6, in the House amendment to S. 140 with an amendment (S.Amdt. 4054 as modified). On November 27, 2018, the House agreed to by voice vote a motion that the House suspend the rules and agree to the Senate amendment to the House amendment. S. 140 was signed into law as P.L. 115-282 on December 4, 2018.

Section 311 of S. 140/P.L. 115-282 states the following:

> SEC. 311. Contracting for major acquisitions programs.
>
> (a) General acquisition authority.—Section 501(d) of title 14, United States Code, is amended by inserting "aircraft, and systems," after "vessels,".
>
> (b) Contracting authority.—Chapter 11 of title 14, United States Code, as amended by this Act, is further amended by inserting after section 1136 the following:
>
> "§ 1137. Contracting for major acquisitions programs
>
> "(a) In general.—In carrying out authorities provided to the Secretary to design, construct, accept, or otherwise acquire assets and systems under section 501(d), the Secretary, acting through the Commandant or the head of an integrated program office established for a major acquisition program, may enter into contracts for a major acquisition program.
>
> "(b) Authorized methods.—Contracts entered into under subsection (a)—
>
> "(1) may be block buy contracts;
>
> "(2) may be incrementally funded;
>
> "(3) may include combined purchases, also known as economic order quantity purchases, of—
>
> "(A) materials and components; and
>
> "(B) long lead time materials; and
>
> "(4) as provided in section 2306b of title 10, may be multiyear contracts.
>
> "(c) Subject to appropriations.—Any contract entered into under subsection (a) shall provide that any obligation of the United States to make a payment under the contract is

subject to the availability of amounts specifically provided in advance for that purpose in subsequent appropriations Acts.".

(c) Clerical amendment.—The analysis for chapter 11 of title 14, United States Code, as amended by this Act, is further amended by inserting after the item relating to section 1136 the following:

"1137. Contracting for major acquisitions programs.".

(d) Conforming amendments.—The following provisions are repealed:

(1) Section 223 of the Howard Coble Coast Guard and Maritime Transportation Act of 2014 (14 U.S.C. 1152 note), and the item relating to that section in the table of contents in section 2 of such Act.

(2) Section 221(a) of the Coast Guard and Maritime Transportation Act of 2012 (14 U.S.C. 1133 note).

(3) Section 207(a) of the Coast Guard Authorization Act of 2016 (14 U.S.C. 561 note).

(e) Internal regulations and policy.—Not later than 180 days after the date of enactment of this Act, the Secretary of the department in which the Coast Guard is operating shall establish the internal regulations and policies necessary to exercise the authorities provided under this section, including the amendments made in this section.

(f) Multiyear contracts.—The Secretary of the department in which the Coast Guard is operating is authorized to enter into a multiyear contract for the procurement of a tenth, eleventh, and twelfth National Security Cutter and associated government-furnished equipment.

Section 821 of S. 140/P.L. 115-282 states the following:

SEC. 821. Polar icebreakers.

(a) Enhanced maintenance program for the Polar Star.—

(1) IN GENERAL.—Subject to the availability of appropriations, the Commandant of the Coast Guard shall conduct an enhanced maintenance program on Coast Guard Cutter Polar Star (WAGB–10) to extend the service life of such vessel until at least December 31, 2025.

(2) REQUIREMENT FOR REPORT.—Not later than 180 days after the date of the enactment of the Coast Guard Authorization Act of 2017, the Secretary of the department in which the Coast Guard is operating, in consultation with Naval Sea Systems Command, shall submit to the Committee on Commerce, Science, and Transportation and the Committee on Armed Services of the Senate and the Committee on Transportation and Infrastructure and the Committee on Armed Services of the House of Representatives a detailed report describing a plan to extend the service life of the Coast Guard Cutter Polar Star (WAGB–10) until at least December 31, 2025, through an enhanced maintenance program.

(3) CONTENT.—The report required by paragraph (2) shall include the following:

(A) An assessment and discussion of the enhanced maintenance program recommended by the National Academies of Sciences, Engineering, and Medicine's Committee on Polar Icebreaker Cost Assessment in the letter report "Acquisition and Operation of Polar Icebreakers: Fulfilling the Nation's Needs".

(B) An assessment and discussion of the Government Accountability Office's concerns and recommendations regarding service life extension work on Coast Guard Cutter Polar Star (WAGB–10) in the report "Status of the Coast Guard's Polar Icebreaking Fleet Capability and Recapitalization Plan".

(C) Based upon a materiel condition assessment of the Coast Guard Cutter Polar Star (WAGB–10)—

(i) a description of the service life extension needs of the vessel;

(ii) detailed information regarding planned shipyard work for each fiscal year to meet such needs; and

(iii) an estimate of the amount needed to be appropriated to complete the enhanced maintenance program.

(D) A plan to ensure the vessel will maintain seasonally operational status during the enhanced maintenance program.

(4) AUTHORIZATION OF APPROPRIATIONS.—The Commandant of the Coast Guard may use funds made available pursuant to section 4902 of title 14, United States Code, as amended by section 202 of this Act, for the enhanced maintenance program described in the report required by subsection (a).

(b) Coast Guard and Maritime Transportation Act of 2012; amendment.—Section 222 of the Coast Guard and Maritime Transportation Act of 2012 (Public Law 112–213), as amended, is further amended as follows:

(1) by striking subsections (a) through (d);

(2) by redesignating subsections (e) through (g) as subsections (a) through (c), respectively;

(3) in subsection (a), as redesignated—

(A) in the matter preceding paragraph (1), by striking "Except as provided in subsection (c), the Commandant" and inserting "The Commandant";

(B) in paragraph (1) by striking "Polar Sea or";

(C) in paragraph (2) by striking "either of the vessels" and inserting "the Polar Star or the Polar Sea"; and

(D) in paragraph (3) by striking "either of the vessels" each place it appears and inserting "the Polar Star".

National Defense Authorization Act for Fiscal Year 2019/John S. McCain National Defense Authorization Act for Fiscal Year 2019 (H.R. 5515/S. 2987)

House Committee Report

In H.R. 5515 as reported by the House Armed Services Committee (H.Rept. 115-676 of May 15, 2018), **Section 841** states the following (emphasis added):

SEC. 841. Requirement that certain ship components be manufactured in the national technology and industrial base.

(a) Additional procurement limitation.—Section 2534(a) of title 10, United States Code, is amended by adding at the end the following new paragraph:

"(6) COMPONENTS FOR AUXILIARY SHIPS.—Subject to subsection (k), the following components:

"(A) Auxiliary equipment, including pumps, for all shipboard services.

"(B) Propulsion system components, including engines, reduction gears, and propellers.

"(C) Shipboard cranes.

"(D) Spreaders for shipboard cranes.".

(b) Implementation.—Such section is further amended by adding at the end the following new subsection:

"(k) Implementation of auxiliary ship component limitation.—Subsection (a)(6) applies only with respect to contracts awarded by the Secretary of a military department for new construction of an auxiliary ship after the date of the enactment of the National Defense Authorization Act for Fiscal Year 2019 using funds available for National Defense Sealift Fund programs or Shipbuilding and Conversion, Navy. **For purposes of this subsection, the term 'auxiliary ship' does not include an icebreaker**.".

House Floor Action (Adding Coast Guard Authorization Act of 2017)

On May 22, 2018, as part of its consideration of the National Defense Authorization Act for Fiscal Year 2019 (H.R. 5515), the House agreed to by voice vote H.Amdt. 641, an en bloc amendment that included, inter alia, amendment number 52 as printed in H.Rept. 115-702 of May 22, 2018, on H.Res. 908, providing for the further consideration of H.R. 5515. Amendment number 52 added to H.R. 5515, as a new Division D, the **Coast Guard Authorization Act of 2017**.

Section 4311 within Division D states the following:

SEC. 4311. Contracting for major acquisitions programs.

(a) General acquisition authority.—Section 501(d) of title 14, United States Code, is amended by inserting "aircraft, and systems," after "vessels,".

(b) Contracting authority.—Chapter 11 of title 14, United States Code, as amended by this division, is further amended by inserting after section 1136 the following:

"§ 1137. Contracting for major acquisitions programs

"(a) In general.—In carrying out authorities provided to the Secretary to design, construct, accept, or otherwise acquire assets and systems under section 501(d), the Secretary, acting through the Commandant or the head of an integrated program office established for a major acquisition program, may enter into contracts for a major acquisition program.

"(b) Authorized methods.—Contracts entered into under subsection (a)—

"(1) may be block buy contracts;

"(2) may be incrementally funded;

"(3) may include combined purchases, also known as economic order quantity purchases, of—

"(A) materials and components; and

"(B) long lead time materials; and

"(4) as provided in section 2306b of title 10, may be multiyear contracts.

"(c) Subject to appropriations.—Any contract entered into under subsection (a) shall provide that any obligation of the United States to make a payment under the contract is subject to the availability of amounts specifically provided in advance for that purpose in subsequent appropriations Acts.".

(c) Clerical amendment.—The analysis for chapter 11 of title 14, United States Code, as amended by this division, is further amended by inserting after the item relating to section 1136 the following:

"1137. Contracting for major acquisitions programs.".

(d) Conforming amendments.—The following provisions are repealed:

(1) Section 223 of the Howard Coble Coast Guard and Maritime Transportation Act of 2014 (14 U.S.C. 1152 note), and the item relating to that section in the table of contents in section 2 of such Act.

(2) Section 221(a) of the Coast Guard and Maritime Transportation Act of 2012 (14 U.S.C. 1133 note).

(3) Section 207(a) of the Coast Guard Authorization Act of 2016 (14 U.S.C. 561 note).

(e) Internal regulations and policy.—Not later than 180 days after the date of enactment of this Act, the Secretary of the department in which the Coast Guard is operating shall establish the internal regulations and policies necessary to exercise the authorities provided under this section, including the amendments made in this section.

(f) Multiyear contracts.—The Secretary of the department in which the Coast Guard is operating is authorized to enter into a multiyear contract for the procurement of a tenth, eleventh, and twelfth National Security Cutter and associated government-furnished equipment.

Section 4822 within Division D states the following:

SEC. 4821. Polar icebreakers.

(a) Enhanced maintenance program for the Polar Star.—

(1) IN GENERAL.—Subject to the availability of appropriations, the Commandant of the Coast Guard shall conduct an enhanced maintenance program on Coast Guard Cutter Polar Star (WAGB–10) to extend the service life of such vessel until at least December 31, 2025.

(2) REQUIREMENT FOR REPORT.—Not later than 180 days after the date of the enactment of the Coast Guard Authorization Act of 2017, the Secretary of the department in which the Coast Guard is operating, in consultation with Naval Sea Systems Command, shall submit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Transportation and Infrastructure of the House of Representatives a detailed report describing a plan to extend the service life of the Coast Guard Cutter Polar Star (WAGB–10) until at least December 31, 2025, through an enhanced maintenance program.

(3) CONTENT.—The report required by paragraph (2) shall include the following:

(A) An assessment and discussion of the enhanced maintenance program recommended by the National Academies of Sciences, Engineering, and Medicine's Committee on Polar Icebreaker Cost Assessment in the letter report "Acquisition and Operation of Polar Icebreakers: Fulfilling the Nation's Needs".

(B) An assessment and discussion of the Government Accountability Office's concerns and recommendations regarding service life extension work on Coast Guard Cutter Polar Star (WAGB–10) in the report "Status of the Coast Guard's Polar Icebreaking Fleet Capability and Recapitalization Plan".

(C) Based upon a materiel condition assessment of the Coast Guard Cutter Polar Star (WAGB–10)—

(i) a description of the service life extension needs of the vessel;

(ii) detailed information regarding planned shipyard work for each fiscal year to meet such needs; and

(iii) an estimate of the amount needed to be appropriated to complete the enhanced maintenance program.

(D) A plan to ensure the vessel will maintain seasonally operational status during the enhanced maintenance program.

(4) AUTHORIZATION OF APPROPRIATIONS.—The Commandant of the Coast Guard may use funds made available pursuant to section 4902 of title 14, United States Code, as amended by section 4202 of this division, for the enhanced maintenance program described in the report required by subsection (a).

(b) Overdue report.—Upon the date of enactment of the Coast Guard Authorization Act of 2017, the Secretary of the department in which the Coast Guard is operating shall submit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Transportation and Infrastructure of the House of Representatives the polar icebreaker recapitalization plan required under section 3523 of the National Defense Authorization Act for Fiscal Year 2017 (Public Law 114–328).

(c) Coast Guard and Maritime Transportation Act of 2012; amendment.—Section 222 of the Coast Guard and Maritime Transportation Act of 2012 (Public Law 112–213), as amended, is further amended as follows:

(1) by striking subsections (a) through (d);

(2) by redesignating subsections (e) through (g) as subsections (a) through (c), respectively;

(3) in subsection (a), as redesignated—

(A) in the matter preceding paragraph (1), by striking "Except as provided in subsection (c), the Commandant" and inserting "The Commandant";

(B) in paragraph (1) by striking "Polar Sea or";

(C) in paragraph (2) by striking "either of the vessels" and inserting "the Polar Star or the Polar Sea"; and

(D) in paragraph (3) by striking "either of the vessels" each place it appears and inserting "the Polar Star".

Senate

In S. 2987 as reported by the Senate Armed Services Committee (S.Rept. 115-262 of June 5, 2018), **Section 153** states the following:

SEC. 153. Authority to procure additional polar-class icebreakers.

Section 122 of the National Defense Authorization Act for Fiscal Year 2018 (Public Law 115–91) is amended—

(1) in the section heading, by striking "Icebreaker vessel" and inserting "Authorization to procure up to six polar-class icebreakers";

(2) by striking subsections (a) and (b);

(3) by inserting before subsection (c) the following new subsection:

"(a) Authority To procure icebreakers.—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—

"(1) polar-class heavy icebreakers; and

"(2) polar-class medium icebreakers.";

(4) by redesignating subsections (c) and (d) as subsections (b) and (c), respectively; and

(5) in paragraph (1) of subsection (b), as redesignated by paragraph (4) of this section, by striking "subsection (a)(1)" and inserting "subsection (a)".

S.Rept. 115-262 states the following:

Navy equipment for the Heavy Polar Icebreaker program

The committee notes the Government Accountability Office (GAO) published a report on April 13, 2017, titled "Status of Coast Guard's Heavy Polar Icebreaker Acquisition" (GAO–18–385R), which noted added space, weight, and power reservations for Navy equipment, such as a multi-mode radar and minor caliber weapons, were incorporated in the Department of Homeland Security-approved Operational Requirements Document for the Heavy Polar Icebreaker (HPIB) in January 2018. The committee is interested in better understanding the plan for Navy equipment to be incorporated on HPIBs.

Accordingly, not later than December 1, 2018, the Secretary of the Navy, in consultation with the Under Secretary of Homeland Security for Management, shall submit to the Committees on Armed Services of the Senate and the House of Representatives an unclassified report, which may include a classified annex, containing the following: (1) A detailed description of Navy equipment planned to be included in HPIBs, including Navy-Type, Navy-Owned equipment; (2) The estimated space, weight, power, and cost for the equipment described in paragraph (1); (3) A description of Navy equipment under consideration to be included in HPIBs; (4) The estimated space, weight, power, and cost for the equipment described in paragraph (3); (5) An explanation of the capability of the equipment listed in paragraphs (1) and (3) to assist or augment the missions of the Combatant Commanders and the execution of the Department of Defense's 2016 Arctic Strategy; and (6) A description of how the equipment listed in paragraphs (1) and (3) will meet a modular open systems approach to allow for future mission expansion. (Page 47)

Conference

In the conference report (H.Rept. 115-874 of July 25, 2018) on H.R. 5515, **Section 151** states the following:

SEC. 151. PROCUREMENT AUTHORITY FOR ADDITIONAL ICEBREAKER VESSELS.

(a) PROCUREMENT AUTHORITY.—

(1) IN GENERAL.—In addition to the icebreaker vessel authorized to be procured under section 122(a) of the National Defense Authorization Act for Fiscal Year 2018 (Public Law 115–91), the Secretary of the department in which the Coast Guard is operating may enter into one or more contracts for the procurement of up to five additional polar-class icebreaker vessels.

(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 2019 is subject to the availability of appropriations or funds for that purpose for such later fiscal year.

(b) SENSE OF CONGRESS.—It is the sense of Congress that the Coast Guard should maintain an inventory of not fewer than six polar-class icebreaker vessels beginning not later than fiscal year 2029 and, to achieve such inventory, should—

(1) award a contract for the first new polar-class icebreaker not later than fiscal year 2019;

(2) deliver the first new polar-class icebreaker not later than fiscal year 2023;

(3) start construction on the second through sixth new polar-class icebreakers at a rate of one vessel per year in fiscal years 2022 through 2026; and

(4) accept delivery of the second through sixth new polar-class icebreakers at a rate of one vessel per year in fiscal years 2025 through 2029.

Regarding Section 151, H.Rept. 115-874 states the following:

Procurement authority for additional icebreaker vessels (sec. 151)

The Senate amendment contained a provision (sec. 153) that would amend section 122 of the National Defense Authorization Act for Fiscal Year 2018 (Public Law 115–91) by striking subsections (a) and (b), as well as providing authority to enter into a contract or contracts for up to six polar-class icebreakers.

The House bill contained no similar provision.

The House recedes with an amendment that would provide the secretary of the department in which the Coast Guard is operating the authority to enter into a contract or contracts for the procurement of up to five additional polar-class icebreakers and express the sense of Congress regarding polar-class icebreakers.

The conferees note that section 207 of the Coast Guard Authorization Act of 2015 (Public Law 114–120) provided authority for the Commandant of the Coast Guard to enter into a contract or contracts for the acquisition of polar icebreakers and associated equipment using incremental funding. The conferees further note the Fiscal Years 2019 through 2023 Future Years Homeland Security Program includes $1.8 billion to fully fund 3 icebreakers. The conferees understand that additional Department of Defense funds are not required to procure icebreakers for the foreseeable future. The conferees support the Coast Guard's stated goal of building six icebreakers and believe achieving this objective should be accomplished as expeditiously as possible. (Page 806)

H.Rept. 115-874 also states the following:

Coast Guard Authorization Act of 2018

The House bill contained a division (Division D) that would authorize certain aspects of the Coast Guard.

The Senate amendment contained no similar provisions.

The House recedes. (Page 1137)

Appendix A. Studies in Recent Years 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 (NASEM) Report

A July 2017 report on the acquisition and operation of polar icebreakers by the National Academies of Sciences, Engineering, and Medicine (NASEM) 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.[73]

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....
>
> 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

[73] 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.

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.[74]

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 in 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, OCEANORGRAPHER 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 comments on the high latitude study but we have been working very closely with the Coast Guard.[75]

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 following:

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

[75] Source: Transcript of hearing.

> 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.[76]

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

> 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	—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
Department of Defense	Assured access to ice-impacted waters through a persistent icebreaker presence in the Arctic and Antarctic[77]

The report also states the following:

[76] 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 https://www.oig.dhs.gov/assets/Mgmt/OIG_11-31_Jan11.pdf.

[77] 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.

> 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.[78]

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

> 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[79]

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**

[78] 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.

[79] 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.

> 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.[80]

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.[81]

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 the following:

> 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.[82]

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.[83] The study was required by report language accompanying the FY2005 DHS appropriations act (H.R. 4567/P.L. 108-334).[84] The study was completed in 2006 and published in 2007. Some

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[80] 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.

[81] 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.

[82] 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 https://storage.googleapis.com/arcticgov-static/publications/goals/usarc_goals_2009-10.pdf.

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

[84] 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 following:

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 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

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> 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 the following:

> 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.")

> 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.[85]

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 the following: "Until

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

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."[86]

[86] 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. Earlier Estimates of Polar Icebreaker Acquisition Costs

This appendix presents information on earlier estimates of polar icebreaker acquisition costs. These earlier estimates are provided primarily for reference purposes, since they can be viewed as having been overtaken by the more-recent cost estimates presented in the main body of this report.

2008 Coast Guard Estimate

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.[87] 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.[88]

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

Estimate in Coast Guard High Latitude Study Provided to Congress in July 2011

The High Latitude Study that was provided to Congress in July 2011[89] 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;
- $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.

[87] 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.

[88] 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.

[89] For more on the High Latitude Study, see **Appendix A**.

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."[90]

2017 NASEM Report

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.[91] More specifically, the NASEM study stated the following:

> 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 $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....[92]

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

[91] 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**. As mentioned earlier, the September 25, 2017, GAO report on polar icebreakers states the following:

> According [a January 2017] analysis, the Coast Guard and Navy estimated a preliminary $1.15 billion cost for the lead heavy icebreaker (in fiscal year 2019 dollars). In July 2017, officials said they had reduced the estimated cost to less than $1 billion.
>
> (Government Accountability Office, Coast Guard: Status of Polar Icebreaking Fleet Capability and Recapitalization Plan, GAO-17-698R, September 25, 2017, p. 5.)

[92] 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.

Appendix C. PSC program Funding

This appendix presents additional background information on funding for the PSC program.

Summary of Funding in FY2013-FY2018 Budget Submissions

Table C-1 shows requested and projected funding for the PSC program in the Coast Guard's budget submissions from the initiation of the PSC program in the FY2013 submission through the FY2018 submission.

Table C-1. 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; $6.0 million in FY2016; and $175 million in FY2017, for a total of $190.609 million for the period FY2013-FY2017. (An additional $30 million in FY2016 funding was subsequently reprogrammed to other uses.)

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."[93]

The reduction in programmed five-year funding for a new polar icebreaker during the FY2014-FY2016 budget submissions shown in **Table C-1** 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[94] in those budget submission that is shown in **Table C-2**. Prior to the release of the 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

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

[94] Prior to FY2019, the PC&I account was called the Acquisition, Construction, and Improvements (AC&I) account.

Transportation Committee, Admiral Paul Zukunft, the then-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.[95]

Table C-2. Funding in Procurement, Construction, and Improvements (PC&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. Prior to FY2019, the PC&I account was called the Acquisition, Construction, and Improvements (AC&I) account.

For additional discussion of the issue of the funding level of the Procurement, Construction, and Improvements (PC&I) account, see **Appendix D**. 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 C-1**)—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).[96]

[95] Source: Transcript of hearing.

[96] 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 C-1**)—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).[97]

FY2015 Submission

The Administration's FY2015 budget submission maintained five-year funding for a new polar icebreaker at $230 million (**Table C-1**), but did not state when a construction contract for the ship might be awarded, creating uncertainty about the timing of the project.[98]

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 C-1**)—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.[99]

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.[100] The newly announced construction start date of FY2020 was

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

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

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

[100] 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 the following:

> **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,

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 PSC 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.[101] 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.[102]

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 was embedded in the personnel and management line in the AC&I account.[103] 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 C-1**, 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 requested $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

and tribal relationships.

[101] "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&=.

[102] "Heavy Polar Icebreaker Industry Engagement Activities," accessed April 4, 2016, at http://www.uscg.mil/ACQUISITION/icebreaker/Industry_Day_031816.asp.

[103] 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).

> Studies to identify solutions to minimize cost, schedule, production and technology risks. Industry Studies are focusing on leveraging industry perspectives, existing vessel designs, 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.[104]

Actual Prior-Year Funding in FY2013-FY2018

In each line of **Table C-1**, 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; $6.0 million in FY2016; $175 million in FY2017; and $169 million for FY2018, for a total of $359.609 million for the period FY2013-FY2018. (An additional $30 million in FY2016 funding was subsequently reprogrammed to other uses.)

[104] 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.

Appendix D. Funding Level in PC&I Account

This appendix presents additional discussion of the funding level of the Coast Guard's Procurement, Construction, and Improvements (PC&I) account.[105]

Overview

The Coast Guard has testified that funding the PC&I account at a level of about $1 billion to $1.2 billion per year—the approximate average annual funding level programmed in the FY2014, FY2015, and FY2016 budget submissions, as shown in **Table C-2**—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.[106] If each OPC costs roughly $400 million, procuring two OPCs per year in an PC&I account of about $1 billion to $1.2 billion per year would leave about $200 million to $400 million per year for all other PC&I-funded programs.

Since 2017, Coast Guard officials have been stating more regularly what they stated only infrequently in earlier years: that executing the Coast Guard's various acquisition programs fully and on a timely basis would require the PC&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.

Using Past PC&I Funding Levels as a Guide for Future PC&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 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 PC&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 PC&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:

[105] Prior to FY2019, the PC&I account was called the Acquisition, Construction, and Improvements (AC&I) account.

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

> REPRESENATIVE 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.[107]

An April 18, 2012, blog entry stated the following:

> 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.[108]

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."[109]

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 PC&I account:

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[107] Source: Transcript of hearing.

[108] 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.

[109] 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/x1138492141/Coast-Guard-cutbacks-will-cost-1-000-jobs. 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.

> 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.[110]

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 the following:

> 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 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.[111]

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 the following:

> 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

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

[111] Transcript of hearing.

> but any further reductions, and now I am—I am beyond asking for help. We are taking on water.[112]

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

> [Then-]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.[113]

In an interview published on June 1, 2017, Zukunft said the following (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.[114]

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

[113] Calvin Biesecker, "Zukunft Wants $2 Billion Baseline Acquisition Budget; Sustained Growth In O&M Funding," *Defense Daily*, April 13, 2017: 1.

[114] Jill Aitoro, "Interview: Adm. Paul Zukunft Demands Coast Guard Respect," *Defense News*, June 1, 2017.

Appendix E. Acquisition vs. Leasing

In addition to the issues for Congress discussed earlier in this report, another potential issue for Congress that arises from time to time 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). This appendix provides background information on this issue.

Factors to consider in assessing whether future polar icebreakers should be acquired through a traditional acquisition or a leasing arrangement 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.

As mentioned earlier, U.S. polar ice operations support 9 of the Coast Guard's 11 statutory missions. Of these nine missions, the Coast Guard states that a leased ship would be able to execute four (search and rescue, aids to navigation, ice operations, and marine environmental protection) and would not be able to execute five (ports, waterways, and costal security; living marine resources; other law enforcement; marine safety; and defense readiness).[115]

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 the following:

> 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.[116]

At another point in the hearing, Admiral Papp stated the following:

> 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.

[115] Government Accountability Office, *Coast Guard: Status of Polar Icebreaking Fleet Capability and Recapitalization Plan*, GAO-17-698R, September 25, 2017, p. 22 (briefing slide 13).

[116] Source: Transcript of hearing.

> 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.[117]

At another point in the hearing, he stated the following:

> 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.[118]

At another point in the hearing, he stated the following:

> 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.[119]

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

> [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.[120]

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

> 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 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.

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[117] Source: Transcript of hearing.

[118] Source: Transcript of hearing.

[119] Source: Transcript of hearing.

[120] 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.

> 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.[121]

When asked why this was the finding, Garrett stated the following:

> 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.[122]

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

> 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 Guard. Additionally, an initial cost-benefit analysis of one type of available leasing option

[121] Source: Transcript of hearing.

[122] Source: Transcript of hearing.

> 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.[123]

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.[124]

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)
>
> Mm-hmm.
>
> HUNTER:

[123] 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.

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

> 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.[125]

The congressionally mandated July 2017 NASEM report on acquisition and operation of polar icebreakers states the following (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 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....[126]

[125] Transcript of hearing.

[126] 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.

Appendix F. Great Lakes Icebreakers

This appendix provides a brief discussion of the Coast Guard's Great Lakes icebreakers.[127]

The Coast Guard's current Great Lakes icebreaker fleet consists of nine cutters:

- one heavy icebreaker—*Mackinaw* (WLBB-30), a 240-foot ship displacing 3,500 tons;
- six 140-foot *Bay*-class icebreaking tugs displacing 662 tons each; and
- two 225-foot *Juniper*-class seagoing buoy tenders displacing about 2,000 tons each that have a light icebreaking capability.[128]

Although *Mackinaw* is referred to as a heavy icebreaker, the word *heavy* in this instance is being used in the context of Great Lakes icebreaking—*Mackinaw* is much larger and has more icebreaking capability than the eight other ships listed above.[129] *Mackinaw* would not, however, qualify as a heavy polar icebreaker, as it is much smaller and has much less icebreaking capability than a heavy polar icebreaker.[130]

Coast Guard officials have stated that they do not view the procurement of additional Great Lakes icebreakers as an urgent near-term acquisition need. In support of this assessment, they cite the capabilities of the current Great Lakes icebreaking fleet, the relatively young age of *Mackinaw* (which entered service in 2006), service life extension work being done on the ice-breaking tugs that is designed to add 15 years to their service lives,[131] and Canada's own Great Lakes icebreaking capabilities. A 2016 Coast Guard report to Congress on the Great Lakes icebreaking mission stated the following:

> The current mix of heavy and medium [Great Lakes] icebreakers is capable of managing priorities and requests for icebreaking in Tier 1 and 2 waterways. When a severe ice season stresses Coast Guard asset capabilities, the existing agreement and partnership with Canada fills the capability gap and brings in extra heavy-icebreaking resources to manage the ice.... [T]he 2014 and 2015 ice seasons were a 20-year anomaly, consuming almost twice as many cutter resource hours as in any other year since 2005.

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[127] This appendix is adapted from the section entitled "Great Lakes Icebreakers" on pages 7-10 of CRS Testimony TE10030, *Icebreaker Acquisition and the Need for a National Maritime Strategy*, by Ronald O'Rourke.

[128] Source: U.S. Coast Guard, "Ninth Coast Guard District Units," accessed November 19, 2018, at https://www.atlanticarea.uscg.mil/Atlantic-Area/Units/District-9/Ninth-District-Units/. A total of 10 cutters are assigned to the Ninth District, which is responsible for the Great Lakes, the Saint Lawrence Seaway, and parts of the surrounding states. The tenth cutter assigned to the Ninth District is a 100-foot inland buoy tender whose primary missions do not include icebreaking.

[129] At continuous speeds of 3 knots, *Mackinaw* can break ice up to 32 inches thick, the 140-foot icebreaking tugs can break ice up to 22 inches thick, and the 225-foot seagoing buoy tenders can break ice up to 14 inches thick.

[130] As discussed earlier in this report, the Coast Guard's two heavy polar icebreakers—the operational *Polar Star* and the non-operational *Polar Sea*, are 399 feet long and displace about 13,200 tons each. *Polar Star* can break ice up to six feet (72 inches) thick at a continuous speed of 3 knots. The Coast Guard states that *Mackinaw* is equivalent to the Canadian Coast Guard ship *Samuel Risley*, a Great Lakes-homeported icebreaker and buoy tender that Canada classifies as a light icebreaker in a comparison conducted across its entire icebreaking fleet, including its Arctic icebreakers. (U.S. Coast Guard, *Great Lakes Icebreaking Mission Analysis, Fiscal Year 2016 Report to Congress*, August 30, 2016, p. 5.)

[131] For more on this service life extension work, see U.S. Coast Guard, "In-Service Vessel Sustainment Program," accessed November 19, 2018, at https://www.dcms.uscg.mil/Our-Organization/Assistant-Commandant-for-Acquisitions-CG-9/Programs/Surface-Programs/In-Service-Vessel-Sustainment-Program/.

> The Coast Guard cannot reliably predict the economic impact of maintaining a single heavy Great Lakes icebreaker. Additionally, given the extreme conditions when ice coverage exceeds 90 percent, it is not clear that shipping delays would be significantly mitigated by an increase in icebreaking capability. Delays can be associated with several factors such as slow transit speeds, availability of pilots, and simultaneous and competing demand signals for icebreaking services across the Great Lakes.[132]

The Coast Guard's position notwithstanding, some Members of Congress in recent years have expressed interest in the possibility of bolstering the Coast Guard's Great Lakes icebreaking fleet by procuring a second icebreaker with capabilities generally similar to those of *Mackinaw*. Interest in this option was reinforced by the winters of 2013-2014 and 2014-2015, which featured particularly high levels of ice coverage on the Great Lakes.[133] The committee report language requiring the above-quoted Coast Guard report to Congress is one example of this interest.[134] Another example is Section 820 of the Frank LoBiondo Coast Guard Authorization Act of 2018 (S. 140/P.L. 115-282 of December 4, 2018), which states the following:

> SEC. 820. Great Lakes icebreaker acquisition.
>
> (a) Icebreaking on the Great Lakes.—For fiscal years 2018 and 2019, the Commandant of the Coast Guard may use funds made available pursuant to section 4902 of title 14, United States Code, as amended by this Act, for the construction of an icebreaker that is at least as capable as the Coast Guard Cutter Mackinaw to enhance icebreaking capacity on the Great Lakes.
>
> (b) Acquisition plan.—Not later than 45 days after the date of enactment of this Act, the Commandant shall submit a plan to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Transportation and Infrastructure of

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[132] U.S. Coast Guard, *Great Lakes Icebreaking Mission Analysis, Fiscal Year 2016 Report to Congress*, August 30, 2016, p. 11. The report was required by S.Rept. 114-68 of June 18, 2015, the Senate Appropriations Committee's report on S. 1619, the Department of Homeland Security Appropriations Bill, 2016 (see page 75).

[133] Although interest in procuring a second heavy Great Lakes icebreaker was reinforced by high levels of ice coverage in the winters of 2013-2014 and 2014-2015, interest in Congress in procuring such a ship dates back further than 2013. See, for example, H.R. 1747 of the 111th Congress, the Great Lakes Icebreaker Replacement Act, which was introduced on March 26, 2009, reported by the Committee on Transportation and Infrastructure on April 21, 2009 (H.Rept. 111-81), and agreed to by the House by voice vote on April 27, 2009. A similar bill, S. 1024, was introduced in the Senate on May 12, 2009.

[134] S.Rept. 114-68 stated the following:

> GREAT LAKES ICEBREAKING CAPACITY
>
> The Coast Guard is required by law to maintain a heavy icebreaking capability on the Great Lakes to assist in keeping channels and harbors open to navigation in response to the reasonable demands of commerce to meet the winter shipping needs of industry. The Committee is concerned that the Coast Guard does not possess adequate capacity to meet its statutorily required icebreaking mission on the Great Lakes, with negative consequences to the regional and national economy as well as to the safety of local communities. While the Committee fully supports the Coast Guard's Service Life Extension Project for its nine-vessel 140-foot icebreaking tugs as part of the In-Service Vessel Sustainment Program, it notes that additional assets may be necessary to successfully operate in the heavy ice conditions often experienced by the Great Lakes. The Committee directs the Coast Guard to undertake an updated mission analysis study to determine the assets necessary to effectively carry out its icebreaking requirements on the Great Lakes, including consideration of a second heavy icebreaker for the Great Lakes, consistent with the capabilities of the Mackinaw. The updated mission analysis should factor in recent historically high levels of ice coverage and the economic costs of reduced Great Lakes shipping associated with maintaining only one heavy icebreaker. The updated mission analysis shall be submitted to the Committee not later than 180 days after the date of enactment of this act. (Page 75)

> the House of Representatives for acquiring an icebreaker described in subsections (a) and (b). Such plan shall include—
>
> (1) the details and schedule of the acquisition activities to be completed; and
>
> (2) a description of how the funding for Coast Guard acquisition, construction, and improvements that was appropriated under the Consolidated Appropriations Act, 2017 (Public Law 115–31) will be allocated to support the acquisition activities referred to in paragraph (1).[135]

An examination of procurement costs for *Mackinaw*, the National Science Foundation's ice-capable research ship *Sikuliaq*, new oceanographic research ships being procured for NOAA, and OPCs suggests that a new *Mackinaw*-sized heavy Great Lakes icebreaker built in a U.S. shipyard might have a design and construction cost between $175 million and $300 million, depending on its exact capabilities and the acquisition strategy employed.[136] The design portion of the ship's

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[135] In addition, Section 819 of S. 140/P.L. 115-282 states the following:

> SEC. 819. Acquisition plan for inland waterway and river tenders and bay-class icebreakers.
>
> (a) Acquisition plan.—Not later than 270 days after the date of the enactment of this Act, the Commandant of the Coast Guard shall submit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Transportation and Infrastructure of the House of Representatives a plan to replace or extend the life of the Coast Guard fleet of inland waterway and river tenders, and the Bay-class icebreakers.
>
> (b) Contents.—The plan under subsection (a) shall include—
>
> (1) an analysis of the work required to extend the life of vessels described in subsection (a);
>
> (2) recommendations for which, if any, such vessels it is cost effective to undertake a ship-life extension or enhanced maintenance program;
>
> (3) an analysis of the aids to navigation program to determine if advances in navigation technology may reduce the needs for physical aids to navigation;
>
> (4) recommendations for changes to physical aids to navigation and the distribution of such aids that reduce the need for the acquisition of vessels to replace the vessels described in subsection (a);
>
> (5) a schedule for the acquisition of vessels to replace the vessels described in subsection (a), including the date on which the first vessel will be delivered;
>
> (6) the date such acquisition will be complete;
>
> (7) a description of the order and location of replacement vessels;
>
> (8) an estimate of the cost per vessel and of the total cost of the acquisition program of record; and
>
> (9) an analysis of whether existing vessels can be used.

[136] Source: CRS analysis of cost per weight for *Mackinaw* (adjusted for inflation), *Sikuliaq*, new NOAA oceanographic research ships now being procured, and OPCs.

Some press reports in 2015 and 2016 cited a cost of about $200 million for a new heavy Great Lakes icebreaker. (See, for example, Todd Spangler, "A New Icebreaker for the Great Lakes? It's Far from Certain," *Detroit Free Press*, August 7, 2015; "Frozen Commerce: Great Lakes Businesses Need a New Icebreaker," *Pittsburgh Post-Gazette*, August 17, 2015; Todd Spangler, "Call for Arctic Icebreakers Could Hurt Great Lakes," *Detroit Free Press*, September 1, 2015; Bob Gross, "Congress Authorizes New Icebreaker for Great Lakes," *Times Herald (Port Huron, MI)*, February 3, 2016; "Task Force Calls Anew for More Great Lakes Icebreakers, Second Poe-Sized Lock," *Professional Mariner*, February 17, 2016 [the article states that it presents the text of a news release from the Great Lakes Maritime Task Force].) An opinion column in 2016 cited a figure of $240 million. (John Hageman, "Is Winter Great Lakes Shipping Necessary?" *Sandusky Register*, February 18, 2016.)

The Great Lakes Maritime Task Force, an organization that states that it "was founded in 1992 in Toledo, Ohio, to promote waterborne commerce and related industries on the Great Lakes" (see Great Lakes Maritime Task Force, "About Us," accessed November 26, 2018, at http://www.glmtf.org/about), states in its annual report for 2017 that a second heavy Great Lakes icebreaker "is projected to cost $240 million." (*2017 Annual Report of Great Lakes Maritime Task Force*, PDF page 3 of 6, accessed November 26, 2018, at http://www.glmtf.org/wp-content/uploads/2018/05/2017-Annual-Report.pdf.) The same figure is cited in the organization's annual report for 2016. The organization's annual report for 2015 cited a figure of approximately $200 million.

cost might be reduced if *Mackinaw's* design or the design of some other existing icebreaker were to be used as the parent design. Depending on the capabilities and other work load of the shipyard selected to build the ship, the construction time for a new heavy Great Lakes icebreaker might be less than that of a new heavy polar icebreaker.

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