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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 is a program to acquire three new PSCs (i.e., heavy polar icebreakers), to be followed years from now by the acquisition of up to three new Arctic Security Cutters (ASCs) (i.e., medium polar icebreakers). The PSC program has received a total of $1,754.6 million (i.e., about $1.8 billion) in procurement funding through FY2021, including $300 million that was provided through the Navy's shipbuilding account in FY2017 and FY2018. With the funding the program has received through FY2021, the first two PSCs are now fully funded. The Coast Guard says the first PSC is to be delivered to the Coast Guard in the spring of 2025.

The Coast Guard's proposed FY2022 budget requests $170.0 million in procurement funding for the PSC program, which would be used for, among other things, procuring long leadtime materials (LLTM) for the third PSC.

The Navy and Coast Guard in 2020 estimated the total procurement costs of the PSCs in then-year dollars as $1,038 million (i.e., about $1.0 billion) for the first ship, $794 million for the second ship, and $841 million for the third ship, for a combined estimated cost of $2,673 million (i.e., about $2.7 billion). Within those figures, the shipbuilder's portion of the total procurement cost is $746 million for the first ship, $544 million for the second ship, and $535 million for the third ship, for a combined estimated shipbuilder's cost of $1,825 million (i.e., about $1.8 billion).

On April 23, 2019, the Coast Guard-Navy Integrated Program Office for the PSC program awarded a $745.9 million fixed-price, incentive-firm contract for the detail design and construction (DD&C) of the first PSC to Halter Marine Inc. (formerly VT Halter Marine) of Pascagoula, MS, a shipyard owned by Singapore Technologies (ST) Engineering. Halter Marine was the leader of one of three industry teams that competed for the DD&C contract. On December 29, 2021, the Coast Guard exercised a $552.7 million fixed price incentive option to its contract with Halter Marine Inc. for the second PSC.

The DD&C contract includes options for building the second and third PSCs. If these options are exercised, the total value of the contract would increase to $1,942.8 million (i.e., about $1.9 billion). The figures of $745.9 million and $1,942.8 million cover only the shipbuilder's portion of the PSCs' total procurement cost; they do not include the cost of government-furnished equipment (or GFE, meaning equipment for the ships that the government purchases and then provides to the shipbuilder for incorporation into the ship), post-delivery costs, costs for Navy-specific equipment, or government program-management costs.

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 plans to extend the service life of *Polar Star* until the delivery of at least the second PSC. The Coast Guard is using *Polar Sea* as a source of spare parts for keeping *Polar Star* operational.

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Introduction

This report provides background information and issues for Congress on the Polar Security Cutter (PSC) program—the Coast Guard's program for acquiring new PSCs (i.e., heavy polar icebreakers). The Coast Guard's proposed FY2022 budget requests $170.0 million in procurement funding for the PSC program.

The issue for Congress is whether to approve, reject, or modify the Administration's FY2022 procurement 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 C**. Separate CRS reports cover acquisition of general-purpose cutters for the Coast Guard[1] and waterways commerce cutters for the Coast Guard.[2] Another CRS report provides an overview of various issues relating to the Arctic.[3]

Background

Missions of U.S. Polar Icebreakers

Statutory Duties and Missions

The permanent statute that sets forth the Coast Guard's primary duties—14 U.S.C. 102—states that among other things, the Coast Guard shall (emphasis added) "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.... "[4]

In addition, Section 888(a) of the Homeland Security Act of 2002 (H.R. 5005/P.L. 107-296 of November 25, 2002)—the law that established the Department of Homeland Security (DHS) and transferred the Coast Guard from the Department of Transportation to DHS—sets forth 11 specific missions for the Coast Guard (often referred to as the Coast Guard's 11 statutory missions), including the mission of "ice operations."[5]

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

[2] CRS In Focus IF11672, *Coast Guard Waterways Commerce Cutter (WCC) Program: Background and Issues for Congress*, by Ronald O'Rourke.

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

[4] 14 U.S.C. 102(4) and 102(5), respectively. This statute was previously 14 U.S.C. 2; it was renumbered as 14 U.S.C. 102 by Section 103 of the Frank LoBiondo Coast Guard Authorization Act of 2018 (S. 140/P.L. 115-282 of December 4, 2018). (Title I of P.L. 115-282, consisting of Sections 101-124, specified a general reorganization of Title 14.)

[5] The 11 missions set forth in Section 888(a) are marine safety; search and rescue; aids to navigation; living marine resources (fisheries law enforcement); marine environmental protection; ice operations; ports, waterways and coastal security; drug interdiction; migrant interdiction; defense readiness; other law enforcement.

Multiple Missions (Not Just Icebreaking)

The Coast Guard's polar icebreakers do not simply break ice—they are multimission cutters[6] that conduct a variety of other operations that are conducted in lower-latitude waters by the Coast Guard's general-purpose cutters. U.S. polar ice operations conducted in large part by the Coast Guard's polar icebreakers support 9 of the Coast Guard's 11 statutory missions.[7] The roles of U.S. polar icebreakers can be summarized as follows:

- conducting and supporting scientific research in the Arctic and Antarctic;
- defending U.S. sovereignty in the Arctic by helping to maintain a U.S. presence in U.S. territorial waters in the region;
- defending other U.S. interests in polar regions, including economic interests in waters that are within the U.S. exclusive economic zone (EEZ) north of Alaska;
- monitoring sea traffic in the Arctic, including ships bound for the United States; and
- conducting other typical Coast Guard missions (such as search and rescue, law enforcement, and protection of marine resources) in Arctic waters, including U.S. territorial waters north of Alaska.[8]

Polar (Not Just Arctic) Operations

The Coast Guard's large icebreakers are called polar icebreakers rather than Arctic icebreakers because they perform missions in both the Arctic and Antarctic. Operations to support National Science Foundation (NSF) research activities in both polar regions account for a significant portion of U.S. polar icebreaker operations.

Supporting NSF research in the Antarctic focuses on performing an annual mission, called Operation Deep Freeze (ODF), to break through Antarctic sea ice so as to reach and resupply McMurdo Station, the large U.S. Antarctic research station located on the shore of McMurdo Sound, near the Ross Ice Shelf. The Coast Guard states that *Polar Star*, the Coast Guard's only currently operational heavy polar icebreaker, "spends the [northern hemisphere] winter [i.e., the southern hemisphere summer] breaking ice near Antarctica in order to refuel and resupply McMurdo Station. When the mission is complete, the *Polar Star* returns to dry dock [in Seattle] in order to complete critical maintenance and prepare it for the next ODF mission. Once out of dry dock, it's back to Antarctica, and the cycle repeats itself."[9] 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. The Coast Guard's medium

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

[7] For a list of the 11 missions, see footnote 5. The two statutory 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.)

[8] 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.

[9] NyxoLyno Cangemi, "Coast Guard Icebreaker Crew Completes Second Arctic Mission; U.S. Interests in Arctic Domain Depends [sic] on Fleet Recapitalization," *DVIDS (Defense Visual Information Distribution System)*, October 19, 2018.

polar icebreaker, *Healy*, spends most of its operational time in the Arctic supporting NSF research activities and performing other operations.

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.[10] Changing ice conditions in Antarctic waters have made the McMurdo resupply mission more challenging since 2000.[11]

The Coast Guard's Arctic strategic outlook document, released in April 2019, states

> In order to prosecute its missions in the Arctic, the Coast Guard must fully understand and operate freely in this vast and unforgiving environment. Effective capability requires sufficient heavy icebreaking vessels, reliable high-latitude communications, and comprehensive Maritime Domain Awareness. In order to respond to crises in the Arctic, our Nation must also muster adequate personnel, aviation, and logistics resources in the region. The Coast Guard is the sole provider and operator of the U.S. polar capable fleet but currently does not have the capability or capacity to assure access in the high latitudes. Closing the gap requires persistent investment in capabilities and capacity for polar operations, including the Polar Security Cutter.[12]

Current U.S. Polar Icebreakers

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 Sta*r 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 in recent years has invested millions of dollars to overhaul, repair, and extend the service life of *Polar Star*, but as a result of its advancing age, the ship's material condition has nevertheless become increasingly fragile, if not precarious. During its annual deployments to McMurdo Station in Antarctica, shipboard equipment frequently breaks, and shipboard fires sometimes occur.[13] Replacements for many of the ship's components are no longer commercially available. To help keep *Polar Star* operational, the Coast Guard is using *Polar Sea* as a source of replacement parts.

On August 18, 2020, an electrical fire occurred in one of *Healy's* main propulsion motors as the ship was 60 miles off Seward, AK, en route to the Arctic. As a result of the fire, the ship's

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[10] 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.

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

[12] United States Coast Guard, *Arctic Strategic Outlook*, April 2019, p. 6.

[13] See, for example, Richard Read, "Meet the Neglected 43-Year-Old Stepchild of the U.S. Military-Industrial Complex," *Los Angeles Times*, August 2, 2019; Melody Schreiber, "The Only Working US Heavy Icebreaker Catches Fire Returning from Antarctica," *Arctic Today*, March 2, 2019; Calvin Biesecker, "Fire Breaks Out On Coast Guard's Aging, and Only, Heavy Icebreaker," *Defense Daily*, March 1, 2019.

starboard propulsion motor and shaft became nonoperational. The ship canceled its deployment to the Arctic and returned to its homeport in Seattle for inspection and repairs.[14]

For additional background information on current U.S. polar icebreakers and polar research ships, see **Appendix A**.

Required Numbers of U.S. Polar/Arctic Icebreakers

At Least Six Ships, Including Three Capable of Breaking Heavy Polar Ice

Coast Guard officials state that the service in coming years will need at least six polar icebreakers, including three capable of breaking heavy polar ice, to perform its various polar missions. The Coast Guard testified in February 2020, for example, that

> The 2010 High Latitude Mission Analysis Report (HL MAR) identified the need for six new polar icebreakers (at least three of which must be heavy) under the assumption that, in the future, the Coast Guard would be required to perform nine of its eleven statutory missions year-round in the Arctic, and meet all icebreaking needs in support of the United States Antarctic Program.
>
> In 2017, the Coast Guard's Center for Arctic Study and Policy completed an addendum to the HL MAR. The objectives were to provide a broad overview of changes in the polar regions over the last seven years and to provide specific information for use in determining potential impacts on mission areas in the polar regions. This addendum provides confidence in the original findings and encourages the sustained reliance on its initial recommendations on the Nation's need for six icebreakers, three of which must be heavy icebreakers.[15]

Starting in January 2021, Admiral Karl Schultz, the Commandant of the Coast Guard, has stated publicly that the Coast Guard would ideally like to have a fleet of six PSCs and three new medium polar icebreakers (which the Coast Guard in late 2020 began referring to publicly as Arctic Security Cutters, or ASCs), for a total fleet of nine PSCs and ASCs.[16]

June 9, 2020, Presidential Memorandum Concerning Polar Icebreakers

On June 9, 2020, President Trump issued a memorandum concerning polar icebreakers that directed DHS, in coordination with the Department of Defense (DOD), the Department of Commerce, the Department of State, and the Office of Management and Budget (OMB), to review required numbers of polar security cutters, U.S. and international basing options for polar security cutters, and options for bridging the gap in polar vessels until new polar security cutters

[14] See, for example, "Coast Guard Icebreaker Healy Suffers Fire on Arctic Mission; All Arctic Operations Cancelled," *USNI News*, August 25, 2020. The article reprints the Coast Guard's August 25 statement about the incident. See also Melody Schreiber, "The Only US Icebreaker Sailing the Arctic Faces Extensive Repairs After an Engine Fire," *Arctic Today*, October 13, 2020. Regarding repair work on the ship, see Paul McLeary, "Crippled Icebreaker Healy to Get Complex Rebuild; Huge Engine Heads to Panama Canal," *Breaking Defense*, October 7, 2020; Cal Biesecker, "Senator Says Decision Could Come Soon to Lease Icebreakers for Coast Guard," *Defense Daily*, December 16, 2020.

[15] Testimony of Admiral Charles W. Ray, Coast Guard Vice Commandant, on "Arctic Security Issues," before the House Homeland Security Subcommittee on Transportation & Maritime Security, February 5, 2020, p. 9.

[16] See Jon Harper, "SNA News: Coast Guard Wants Budget 'Booster Shot,'" *National Defense*, January 13, 2021; Mallory Shelbourne, "Schultz: Nuclear Icebreakers Are Not An Option for Coast Guard," *USNI News*, January 14, 2021; Cal Biesecker, "With More Resources, Coast Guard Sees Need For Nine Polar Icebreakers," *Defense Daily*, January 14, 2021; Stew Magnuson, "Coast Guard Ship Modernization Under Full Steam," *National Defense*, March 3, 2021.

are delivered, and to report back to President Trump within 60 days (i.e., by August 8, 2020) on the results of the review.

Additional Background Information

For additional background information on required numbers of U.S. polar icebreakers, including the text of the above-mentioned June 9, 2020, presidential memorandum, see **Appendix B**.

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 PSCs (i.e., heavy polar icebreakers), to be followed years from now by the acquisition of up to three new ASCs (i.e., medium polar icebreakers). The Coast Guard says the first PSC is to be delivered to the Coast Guard in the spring of 2025.

Program Name and Name of First Ship

The PSC program was previously known as the polar icebreaker (PIB) program. Changing the program's name to the PSC program is intended to call attention to the fact that the Coast Guard's polar icebreakers perform a variety of missions relating to national security, not just icebreaking.[17] Although it is now called the PSC program, observers as a matter of convenience might refer to it as the polar icebreaker program.

On February 24, 2022, the Coast Guard announced that the first PSC will be named *Sentinel*, and that the Coast Guard has candidate names in mind for the second and third and third PSCs.[18]

Home Port

On June 17, 2019, the Coast Guard announced that it intends to homeport its PSCs at Seattle, WA, where the Coast Guard's current polar icebreakers are homeported.[19]

Coast Guard-Navy Integrated Program Office (IPO)

The PSC program is managed by a Coast Guard-Navy Integrated Program Office (IPO). A key aim in establishing the IPO was to permit the Navy to share its ship-procurement best practices with the Coast Guard so as to help the Coast Guard reduce the time and cost needed to design and procure the PSCs.

[17] See, for example, 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.

[18] See, for example, Patricia Kime, "The Coast Guard's Next Icebreaker Has a Name," *Military.com*, February 24, 2022.

[19] See, for example, Ben Werner, "Coast Guard Polar Security Cutter Will Be Homeported in Seattle," *USNI News*, June 17, 2019; Navy Times Staff, "Coast Guard Picks Homeport for New Icebreaker Fleet," *Navy Times*, June 17, 2019.

Program Schedule

As noted earlier, the Coast Guard says the first PSC is to be delivered to the Coast Guard in the spring of 2025.[20]

Estimated Procurement Cost

As shown in **Table 1**, the Navy and Coast Guard in 2020 estimated the total procurement costs of the PSCs in then-year dollars as $1,038 million (i.e., about $1.0 billion) for the first ship, $794 million for the second ship, and $841 million for the third ship, for a combined estimated cost of $2,673 million (i.e., about $2.7 billion). As also shown in **Table 1**, within those figures, the shipbuilder's portion of the total procurement cost is $746 million for the first ship, $544 million for the second ship, and $535 million for the third ship, for a combined estimated shipbuilder's cost of $1,825 million (i.e., about $1.8 billion). The shipbuilder's contract-award cost for the first ship is $745.9 million, with options for the second and third ships that, if exercised, would increase the total value of the contract to $1,942.8 million (i.e., about $1.9 billion).

Table 1. Estimated PSC Procurement Costs

(In millions of then-year dollars)

Cost element	1st PSC	2nd PSC	3rd PSC	Total
Target contract price	746	544	535	1,825
Program costs (including GFE)	218	175	228	621
Post-delivery costs	46	47	49	142
Costs for Navy-Type, Navy-Owned (NTNO) equipment	28	28	29	85
TOTAL	**1,038**	**794**	**841**	**2,673**

Source: U.S. Navy information paper on PSC program, August 18, 2021, received from Navy Office of Legislative Affairs, August 31, 2021, which states that costs shown are from the PSC program 2020 Life Cycle Cost Estimate.

Notes: Target contract price includes detail design, construction, and long lead-time materials (LLTM), and does not reflect potential costs rising to the contract ceiling price. GFE is government-furnished equipment—equipment that the government procures and then provides to the shipbuilder for installation on the ship. NTNO equipment is GFE that the Navy provides—such as combat weapons systems, sensors and communications equipment and supplies—for meeting Coast Guard/Navy naval operational capabilities wartime readiness requirements. (For additional discussion, see Coast Guard Commandant Instruction (COMDTINST) 7100.2G, May 16, 2013, accessed August 31, 2021, at https://media.defense.gov/2017/Mar/15/2001716816/-1/-1/0/CI_7100_2G.PDF.)

Competition and Contract Award

On April 23, 2019, the Coast Guard-Navy Integrated Program Office for the PSC program awarded a $745.9 million fixed-price, incentive-firm contract for the detail design and construction (DD&C) of the first PSC to Halter Marine Inc. (formerly VT Halter Marine) of Pascagoula, MS, a shipyard owned by Singapore Technologies (ST) Engineering. Halter Marine was the leader of one of three industry teams that competed for the DD&C contract; the other two bidders reportedly were Bollinger Shipyards of Lockport, Louisiana, and a partnership between

[20] See, for example, Patricia Kime, "The Coast Guard's Next Icebreaker Has a Name," *Military.com*, February 24, 2022; Gidget Fuentes, "Coast Guard Weathering Cutter Production Delays as More Coasties Head to Sea," *USNI News*, February 23, 2022.

Philly Shipyard of Philadelphia and Fincantieri/Marinette Marine, of Marinette, WI.[21] The DD&C contract includes options for building the second and third PSCs. If both of these options are exercised, the total value of the contract would increase to $1,942.8 million (i.e., about $1.9 billion).[22]

On December 29, 2021, the Coast Guard exercised a $552.7 million fixed price incentive option to its contract with Halter Marine Inc. for the second PSC.[23]

As shown in **Table 1**, the figures of $745.9 million and $1,942.8 million cover only the shipbuilder's portion of the PSCs' total procurement cost; they do not include the cost of government-furnished equipment (or GFE, meaning equipment for the ships that the government purchases and then provides to the shipbuilder for incorporation into the ship), post-delivery costs, costs for Navy-specific equipment, or government program-management costs.

Ship Design

The PSC program is using the parent design approach, meaning that the design of the PSC is based on an existing icebreaker design. A key aim in using the parent design approach is to reduce cost, schedule, and technical risk in the PSC program.

Figure 1, **Figure 2**, **Figure 3**, and **Figure 4** show renderings of Halter Marine's design for the PSC. An April 25, 2019, press report states that "the Coast Guard and Navy said VT Halter Marine's winning design for the new Polar Security Cutter (PSC) 'meets or exceeds all threshold requirements' in the ship specification" for the PSC program.[24]

A May 7, 2019, press release from Halter Marine about its design for the PSC (which Halter Marine updated on May 29 to provide a corrected figure for the design's full load displacement) stated the following:

> VT Halter Marine is teamed with Technology Associates, Inc. [TAI] as the ship designer and, for over two years, has participated in the U.S. Coast Guard's Heavy Polar Icebreaker Industry Study. The ship design is an evolution from the mature "Polar Stern II" [German icebreaker] currently in design and construction; the team has worked rigorously to demonstrate its maturity and reliability. During the study, TAI incrementally adjusted the design and conducted a series of five ship model tank tests to optimize the design. The vessels are 460 feet in length with a beam of 88 feet overall, a full load displacement of approximately 22,900 long tons at delivery. The propulsion will be diesel electric at over 45,200 horse power and readily capable of breaking ice between six to eight feet thick. The vessel will accommodate 186 personnel comfortably for an extended endurance of 90 days.
>
> In addition to TAI, VT Halter Marine has teamed with ABB/Trident Marine for its Azipod propulsion system,[25] Raytheon for command and control systems integration, Caterpillar

[21] "Mississippi Shipyard Gets $746M Contract for Icebreaker," *Associated Press*, April 23, 2019.

[22] See Naval Sea Systems Command, "Polar Security Cutter Contract Awarded to Recapitalize Nation's Arctic Capabilities," April 23, 2019; Department of Defense, "Contracts for April 23, 2019" (Release No. CR-076-19); Sam LaGrone, "VT Halter Marine to Build New Coast Guard Icebreaker," *USNI News*, April 23, 2019; Maria Armental, "U.S. Orders First heavy Icebreaking Vessel in Decades, as Rivals Expand Arctic Presence," *Wall Street Journal*, April 23, 2019; "Mississippi Shipyard Gets $746M Contract for Icebreaker," Associated Press, April 23, 2019.

[23] U.S. Coast Guard, "Polar Security Cutter Integrated Program Office Exercises Option for Second Cutter," U.S. Coast Guard, December 30, 2021; Department of Defense, "Contracts for December 29, 2021."

[24] Rich Abott, "Polar Icebreaker Winner Meets Threshold Requirements, Has Incentives For Early Delivery," *Defense Daily*, April 25, 2019.

[25] ABB is ASEA Brown Boveri, a multinational corporation headquartered in Zurich, Switzerland, that is, among other things, a leading maker of electric-drive propulsion systems for ships. (ASEA is an acronym for Allmänna Svenska

for the main engines, Jamestown Metal Marine for joiner package, and Bronswerk for the HVAC system. The program is scheduled to bring an additional 900 skilled craftsman and staff to the Mississippi-based shipyard.[26]

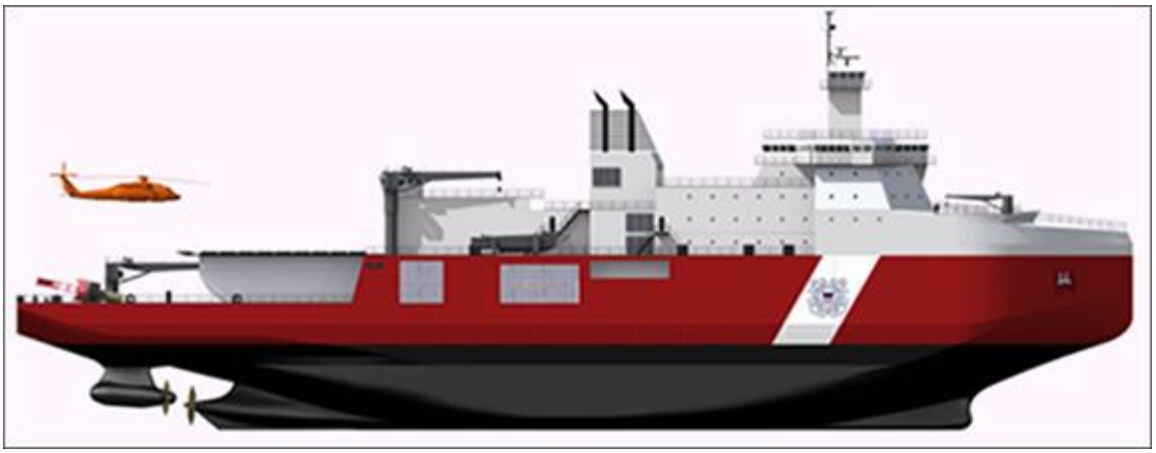
Figure 1. Rendering of Halter Marine Design for PSC

Source: Illustration accompanying Sam LaGrone, "UPDATED: VT Halter Marine to Build New Coast Guard Icebreaker," USNI News, April 23, 2019, updated April 24, 2019. The caption to the illustration states "An artist's rendering of VT Halter Marine's winning bid for the U.S. Coast Guard Polar Security Cutter. VT Halter Marine image used with permission."

Elektriska Aktiebolaget [i.e., General Swedish Electrical Limited Company], which merged with Brown, Boveri & Cie [BBC] in 1988 to create ABB.) Azipod is ABB's term for its azimuthing (i.e., swiveling) podded propulsors.

[26] Halter Marine press release, "VT Halter Marine Awarded the USCG Polar Security Cutter," May 7, 2019, updated May 29, accessed June 12, 2019, at http://vthm.com/wp-content/uploads/2019/05/Press-Release_USCG-PSC_Singapore-Exchange-FINAL_updatedMay29.pdf. The original (May 7) version of the press release stated that the design's full load displacement at delivery would be approximately 33,000 tons.

Figure 2. Rendering of Halter Marine Design for PSC



Source: Illustration posted by Robert A. Socha, Senior Vice President, Halter Marine, accessed May 6, 2019, at https://www.linkedin.com/feed/update/urn:li:activity:6526621529113976832.

Figure 3. Rendering of Halter Marine Design for PSC

Source: Technology Associates, Inc. (cropped version of rendering posted at http://www.navalarchitects.us/pictures.html, accessed June 10, 2020). A similar image was included in Halter Marine press release, "VT Halter Marine Awarded the USCG Polar Security Cutter," May 7, 2019, accessed May 8, 2019, at http://www.vthm.com/public/files/20190507.pdf.

Figure 4. Rendering of Halter Marine Design for PSC

Source: Photograph accompanying Connie Lee, "New Coast Guard Icebreaker Remains on Tight Schedule," *National Defense*, May 21, 2020. The article credits the photograph to Technology Associated, Inc.

The German icebreaker design referred to in Halter Marine's press release, *Polar Stern II* (also spelled *Polarstern II*) (**Figure 5**),[27] was to be built as the replacement for *Polarstern*, Germany's current polar research and supply icebreaker. On February 14, 2020, however, the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, announced that "the [German] Federal Ministry of Education and Research (BMBF) today cancelled the Europe-wide call for tenders for the procurement of a new polar research vessel, Polarstern II, for legal reasons."[28]

[27] *Polarstern* is the German word for Polar Star—coincidentally, the same name as the U.S. Coast Guard's operational heavy polar icebreaker.

[28] Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, "Call for tender procedure for the construction of a successor to the icebreaker Polarstern has been cancelled.," February 14, 2020, accessed March 12, 2020, at https://www.awi.de/en/about-us/service/press/press-release/call-for-tender-procedure-for-the-construction-of-a-successor-to-the-icebreaker-polarstern-has-been.html .

Figure 5. Rendering of SDC Concept Design for *Polarstern II*

Source: Cropped version of SDC Ship Design & Consult GmbH, design SDC2187, 133m Research Vessel, accessed May 9, 2019, at http://www.shipdesign.de/html/index.php?navi=3&navi2=80&navi3=115. The image is enlarged at http://www.shipdesign.de/html/detail.php?id=396.

A May 9, 2019, press report states that *Polarstern II* was designed by Germany's Ship Design & Consult (SDC), a firm based in Hamburg, Germany.[29] SDC states that its concept design for *Polarstern II* has a length of 133 meters (about 436.4 feet) long, a beam of 27 meters (about 88.6 feet), and a draft of 10.5 meters (about 34.4 feet), but does not provide the design's displacement.[30] A briefing on a preliminary version of the ship's design stated that the design at that point was somewhat larger, with a length of 145 meters (about 476 feet), a beam of 27.3 meters (about 89.6 feet), a draft of about 11 meters (about 36.1 feet), and a displacement (including payload) of about 26,000 tons.[31] These figures suggest that SDC's somewhat smaller concept design for *Polarstern II* might have a displacement (including payload) of something less than 26,000 tons, and perhaps closer to 23,000 tons.

The above-mentioned May 9, 2019, press report states that

> VT Halter's teammates on the PSC include ship designer Technology Associates, Inc. (TAI), which has been involved in the design for over two years and has made "a lot of modifications" in a number of areas to meet Coast Guard requirements, [Ronald Baczkowski, president and CEO of VT Halter Marine] said. The team went through six

[29] Calvin Biesecker, "Long-Lead Funding In FY '20 For Second Polar Security Cutter Would Help With Planning, Shipbuilder Says," *Defense Daily*, May 9, 2019.

[30] SDC Ship Design & Consult GmbH, design SDC2187, 133m Research Vessel, accessed May 9, 2019, at http://www.shipdesign.de/html/index.php?navi=3&navi2=80&navi3=115.

[31] Briefing entitled "Shipboard Polar Research, 32 Years Polarstern and the requirement for Polarstern II," accessed May 8, 2019, at http://www.ervo-group.eu/np4/np4/%7B$clientServletPath%7D/?newsId=43&fileName=Pr_sentation_Markterkundung_09.09.14_fin.pdf. The briefing is undated but includes a statement on one of its slides that refers in the past tense to an event that took place in January 2016.

> design spirals to refine the design and the major modifications include changes in the hull form to enhance the ship's icebreaking capabilities and keep the ice clear from the propulsors and sensors, habitability improvements for comfort particularly in open water, easier access to different areas of the ship, and maintenance and endurance capabilities….
>
> Raytheon [RTN] is the integrator for C5I capabilities[32] on the ship and the main engines will be supplied by Caterpillar [CAT]. Switzerland-based ABB and Netherlands-based Trident are supplying the Azipod propulsion system, Florida-based Jamestown Metal Marine is supplying the joiner package, and Netherlands-based Bronswerk the heating, ventilation and cooling system.[33]

Halter Marine's 22,900-ton design for the PSC is considerably larger than the Coast Guard's current polar icebreakers. As shown in tons in **Table A-1**, the Coast Guard's largest polar icebreaker, *Healy*, is 420 feet long and has a full load displacement of 16,000 tons. Halter Marine's 460-foot design for the PSC is 40 feet longer than *Healy*, and its 22,900-ton displacement is about 43% greater than *Healy's*.

The horsepower generated by the propulsion plant in Halter Marine's design—more than 45,200, according to the earlier-quoted May 7, 2019 press release from Halter Marine—is roughly one-quarter less than the 60,000 shaft horsepower of the propulsion plant in the Coast Guard's heavy polar icebreaker, *Polar Star*. As shown in **Figure 1** and **Figure 2**, however, Halter Marine's design includes a centerline shafted propeller flanked by two azimuthing (i.e., swiveling) podded propulsors—an arrangement that, along with other modern icebreaker hull design features, is expected to give Halter Marine's design a capability for breaking ice comparable to that of *Polar Star*. A May 8, 2019, press report states the following:

> "We picked the most modern icebreaker that was on the market, soon to be production-level design that roughly met the Coast Guard's requirements, and we took it and modified it," Baczkowski said.
>
> "It has a contoured shape. The shape of the hull does the icebreaking. Instead of being a mass breaking ice, this actually slices the ice. The shape of the hull pushed the broken ice aside, so it doesn't interfere with your propulsion systems, with your instrumentation that's on the other side of the ship."
>
> The design of the cutter is optimized for seakeeping to support the long voyage from its homeport in Washington State to as far away as the Antarctic, he said.
>
> "It's an optimum design between icebreaking and seakeeping."
>
> "With the propulsors, with one fixed and two steerable, we were able to optimize the seakeeping capability so when you're going on long transits from Washington to Antarctica the crew is not beat to a pulp or heavily fatigued because of the stability characteristics in open water."[34]

Program Funding Through FY2021 and FY2022 Funding Request

The PSC program has received a total of $1,754.6 million (i.e., about $1.8 billion) in procurement funding through FY2021, including $300 million that was provided through the Navy's shipbuilding account in FY2017 and FY2018. With the funding the program has received through FY2021, the first two PSCs are now fully funded.

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[32] C5I stands for command, control, communications, computers, collaboration, and intelligence.

[33] Calvin Biesecker, "Long-Lead Funding In FY '20 For Second Polar Security Cutter Would Help With Planning, Shipbuilder Says," *Defense Daily*, May 9, 2019. Abbreviations for firm names in brackets as in original.

[34] Sam LaGrone, "VT Halter Marine Details Coast Guard Icebreaker Bid," *USNI News*, May 8, 2019.

The Coast Guard's proposed FY2022 budget requests $170.0 million in procurement funding for the PSC program, which would be used for, among other things, procuring long leadtime materials (LLTM) for the third PSC.

Service Life Extension for *Polar Star*

The Coast Guard plans to extend the service life of *Polar Star* until the delivery of at least the second PSC. In February 2020, for example, the Coast Guard testified that

> The Coast Guard also understands that we must maintain our existing heavy and medium icebreaking capability while proceeding with recapitalization.... Maintenance of POLAR STAR will be critical to sustaining this capability until the new PSCs are delivered. Robust planning efforts for a service life extension project on POLAR STAR are already underway and initial work for this project will begin in 2020, with phased industrial work occurring annually from 2021 through 2023. The end goal of this process will be to extend the vessel's service life until delivery of at least the second new PSC.[35]

The Coast Guard estimates the cost of *Polar Star's* service life extension work at $75 million. The work is being funded at a rate of $15 million per year; the $15 million requested in the FY2022 budget is the fourth of five planned annual funding increments. This funding is included in the vessels portion of the Coast Guard's PC&I account, in a line item called "Polar Sustainment" that is separate from the line item for the PSC program.

Issues for Congress

FY2022 Funding

One issue for Congress is whether to approve, reject, or modify the Coast Guard's $170 million FY2022 procurement funding request for the PSC. 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 the PSC program in FY2022.

Potential Impact of COVID-19 Situation

Another issue for Congress concerns the potential impact of the COVID-19 situation on the execution of U.S. military shipbuilding programs, including the PSC program. For additional discussion of this issue, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

Delay in Delivery Date of First PSC

Another potential issue for Congress concerns the delay in the delivery date of the first PSC. The Coast Guard had earlier said the ship would be delivered in the first half of 2024. As noted earlier, the Coast Guard now expects it to be delivered in the spring of 2025. A February 24, 2022, press report states

> The service had hoped the vessel, being built by Pascagoula, Mississippi-based VT Halter Marine Inc., would be finished by 2024.

[35] Testimony of Admiral Charles W. Ray, Coast Guard Vice Commandant, on "Arctic Security Issues," before the House Homeland Security Subcommittee on Transportation & Maritime Security, February 5, 2020, p. 9.

> But given the complexities of the design and delays related to the COVID-19 pandemic, [Coast Guard Commandant Admiral Karl] Schultz described that date as "aspirational."
>
> "It's a state-of-the art ship that requires exacting designs, complex steel work and systems integration," said Schultz, who will retire from the Coast Guard this spring.
>
> "There's international collaboration, the implications of COVID and international travel. There were some things that were delayed, and we made a couple of adjustments. Put it all together, and that pushes delivery to the spring of 2025," Schultz said.[36]

An October 19, 2021, press report stated

> Delivery of the first new Coast Guard heavy polar icebreaker has slipped a year to 2025 due to the fact that it's been 45 years since the last heavy icebreaker was built in the U.S. and impacts from the COVID-19 pandemic, Adm. Karl Schultz, the service's commandant, said on Tuesday [October 19].
>
> The first Polar Security Cutter (PSC) is expected to be delivered in the third quarter of fiscal year 2025, Schultz told a Senate Commerce Committee panel that oversees the Coast Guard. The PSC was originally expected to be delivered in March of 2024, which is in the second quarter of FY '24. That timeline was later revised to May 2024, which is the third quarter....
>
> Schultz said that COVID "complications" have hampered "international collaboration" on PSC ship construction, noting that the program is ambitious and "on a compressed timeline."
>
> A Coast Guard spokesman told Defense Daily in an email reply to questions that infection rates and travel restrictions due to COVID "significantly affected Halter Marine's ship design efforts and subcontractor integration, resulting in unavoidable delays. COVID-19 was particularly impactful to HMI's efforts to hire and maintain staffing levels across multiple occupation categories (labor, management, and engineering) and hindered collaboration with its ship design subcontractors, many of whom are based internationally and were significantly affected by early COVID-19 restrictions."
>
> The spokesman added that "The Coast Guard and Navy Integrated Program Office recently negotiated a consolidated contract action that definitizes COVID-19 delays and rebaselines the delivery schedule by 12 months." Still, the program remains on track to begin operations in 2027 with Operation Deep Freeze, he said.[37]

In a letter dated August 16, 2021, the House Transportation and Infrastructure Committee requested the Government Accountability Office (GAO) to review the management of the PSC acquisition program and the Coast Guard's efforts to address icebreaking capability gaps until the PSCs are fully operational. The letter stated

> The PSC's shipbuilder, VT Halter, [has] begun designing the [Polar Security] cutters but challenges, including impacts from the COVID-19 pandemic, have delayed these efforts as well as the start of lead ship construction. To mitigate the effect of these delays, DHS and the Coast Guard may authorize the start of construction before the design is

[36] Patricia Kime, "The Coast Guard's Next Icebreaker Has a Name," *Military.com*, February 24, 2022. See also Gidget Fuentes, "Coast Guard Weathering Cutter Production Delays as More Coasties Head to Sea," *USNI News*, February 23, 2022; Yasmin Tadjdeh, "Just In: No Room to Accelerate Icebreaker Program, Coast Guard Chief Says," *National Defense*, January 12, 2022.

[37] Cal Biesecker, "Coast Guard Commandant Confirms Delay In Polar Security Cutter; Talks Interim Purchase," *Defense Daily*, October 19, 2021. See also Melody Schreiber, "Delivery of the U.S. Coast Guard's New Icebreaker Is Delayed, Even as the Agency as [sic] Sharpens its Arctic Focus," *Arctic Today*, December 1, 2021; Joseph Trevithick, "Delivery Of The U.S. Coast Guard's New Heavy Icebreaker Has Been Delayed Yet Again," *The Drive*, December 3, 2021.

stabilized—a practice that has resulted in poor outcomes, including cost growth, for other shipbuilding programs. Further, with the delivery of the first cutter delayed, the Coast Guard must continue to rely on the aging *Polar Star*—the U.S.'s only operational heavy icebreaker—and explore other options to address the capability gaps, which could be costly.

Given the schedule delays and potential for cost growth, continued oversight of the PSC program is critical. As such, the Committee requests that the Government Accountability Office (GAO) review the management of the PSC acquisition program and the Coast Guard's efforts to address icebreaking capability gaps until the PSCs are fully operational, including but not limited to:

• The status of the PSC acquisition program and Coast Guard's efforts to manage schedule delays and cost growth;

• The status of efforts to maintain and extend the life of the Polar Star; and

• The status of the Coast Guard's efforts to explore other icebreaking alternatives.[38]

Technical, Schedule, and Cost Risk for PSC Program

Another potential issue for Congress concerns technical, schedule, and cost risk in the PSC program.

Parent Design and PSC Design

One potential aspect of the issue of technical, schedule, and cost risk in the PSC program relates to the parent design for the PSC design. As mentioned earlier, a key aim in using the parent design approach is to reduce cost, schedule, and technical risk in the PSC program. As also mentioned earlier, Halter Marine states that its winning design for the PSC "is an evolution from the mature 'Polar Stern II' [German icebreaker] currently in design and construction; the team has worked rigorously to demonstrate its maturity and reliability." As also mentioned earlier, Halter Marine and ship designer Technology Associates, Inc. reportedly made "a lot of modifications" and went through six design spirals to refine the PSC's design. Potential oversight questions for Congress include the following:

- To what degree was *Polarstern II's* design developed at the time it was used as the parent design for developing the PSC design? How much of *Polarstern II's* detail design and construction plan was completed at that time?
- How closely related is the PSC's design to *Polarstern II's* design? How many changes were made to *Polarstern II's* design to develop the PSC design? What were these changes, and what technical, schedule, and cost risks, if any, might arise from them?

[38] Letter dated August 16, 2021, from Representative Peter A. DeFazio, Chairman, and Representative Sam Graves, Ranking Member, House Committee on Transportation and Infrastructure, to The Honorable Gene Dodaro, Comptroller General, Government Accountability Office, accessed August 17, 2021, at https://transportation.house.gov/imo/media/doc/2021-08-16%20GAO%20Request%20Letter%20for%20PSC%20Follow%20On%20Review%20-%20FINAL.pdf. See also House Transportation and Infrastructure Committee, "T&I Committee Leaders Ask GAO to Review Delays in Delivery of Critical Additions to Coast Guard Fleet," press release, August 16, 2021, and Cal Biesecker, "House Transportation Leaders Want GAO To Review Coast Guard OPC, PSC Programs," *Defense Daily*, August 16, 2021.

February 2020 GAO Testimony

February 2020 GAO testimony on Coast Guard Arctic capabilities states

> **The Coast Guard Has Taken Steps to Address Technology, Design, Cost, and Schedule Risks for the Polar Security Cutters**
>
> In September 2018, we found that the Coast Guard did not have a sound business case when it established the acquisition baselines for the Polar Security Cutter program in March 2018 due to risks in four key areas: technology, design, cost, and schedule. Our prior work has found that successful acquisition programs start with solid, executable business cases before setting program baselines and committing resources. A sound business case requires balance between the concept selected to satisfy operator requirements and the resources—design knowledge, technologies, funding, and time—needed to transform the concept into a product, which in this case is a ship with polar icebreaking capabilities. Without a sound business case, acquisition programs are at risk of breaching the cost, schedule, and performance baselines set when the program was initiated—in other words, experiencing cost growth, schedule delays, and reduced capabilities.
>
> To address the key risks we identified and help establish a sound business case for the Polar Security Cutter program, we made six recommendations to DHS, Coast Guard, and the Navy in our September 2018 report. The agencies concurred with all six recommendations and have taken steps to address some of the risks, as noted below.
>
> • **Technology.** The Coast Guard planned 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. As a result, the Coast Guard did not have full insight into whether these technologies were mature and was potentially underrepresenting the technical risk of the program. We recommended that the program conduct a technology readiness assessment, which DHS completed in June 2019. DHS determined that two of the three key technologies were mature and the remaining technology was approaching maturity. The Coast Guard now has plans in place to use testing results to increase the maturity and reduce risks for the remaining technology—the hull form.
>
> • **Design.** The Coast Guard set program baselines before conducting a preliminary design review. This review is a systems engineering event intended to verify that the contractor's design meets the requirement of the ship specifications and is producible. By not conducting this review before establishing program baselines, the program is at risk of having an unstable design, thereby increasing the program's cost and schedule risks. We recommended that the program update its baselines prior to authorizing lead ship construction and after completion of the preliminary design review. DHS and the Coast Guard agreed and plan to take these steps by fiscal year 2022.
>
> • **Cost.** The cost estimate that informed the program's $9.8 billion cost baseline—which includes life cycle costs for the acquisition, [and 30 years of] operations, and maintenance of three polar icebreakers—substantially met our best practices for being comprehensive, well-documented, and accurate. But the estimate 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, such as the period of operations and support. As a result, the cost estimate was not fully reliable and may underestimate the total funding needed for the program. We recommended that the program update its cost estimate to include risk and uncertainty analysis on all phases of the program life cycle, among other things. Subsequently, in December 2019, we found that while the Coast Guard updated the cost estimate in June 2019 to inform the budget process, the estimate did not reflect cost changes resulting from the contract award two months prior. Coast Guard officials acknowledged these cost risks and plan to address them as part of the next update to the program's cost estimate. Coast Guard officials told us that they plan to update the cost estimate by the end of February 2020.

> • **Schedule.** The Coast Guard's initial planned delivery dates of 2023, 2025, and 2026 for the three ships were not informed by a realistic assessment of shipbuilding activities. Rather, these dates were primarily 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. In addition, our analysis of selected lead ships for other Coast Guard and Navy shipbuilding programs found the icebreaker program's estimated construction time of 3 years to be optimistic. An unrealistic schedule puts the Coast Guard at risk of not delivering the icebreakers when promised. As a result, the potential gap in icebreaking capabilities could widen. We recommended that the program develop a realistic schedule, including delivery dates, and determine schedule risks during the construction phase of the program. In response, the Coast Guard is now tracking additional schedule risks for the program and is in the process of updating its program schedule. Further, in December 2019, we found that the contract delivery date for the lead ship, May 2024, is 2 months after the delivery date in the program's schedule baseline. Coast Guard officials said they plan to address this risk when they update the program's schedule by the end of March 2020.[39]

Medium-Speed Diesel Engines

Another potential issue for Congress concerns the medium-speed diesel engines for the PSCs, which are to be made by Caterpillar. A July 14, 2021, press report states

> American engine-builder Caterpillar has decided to phase out production of its medium-speed diesel engines, the company confirmed in a statement. The decision affects manufacturing plants in Kiel, Germany and in China, and employees have been notified. Existing MaK engine owners will still be able to obtain parts and service from Cat....
>
> The decision affects all of the Cat medium-speed engine facilities in Germany, as well as the company's JV manufacturing plant in China. Local managers will carry out the wind-down by the end of 2022, Cat said.[40]

Regarding this situation, the Coast Guard states

> Halter Marine, Inc. (HMI) established an agreement with Caterpillar to ensure availability of the combined engine-generator "gen sets" [generator sets] for the three ships in the PSC Program of Record. Caterpillar also provided extended warranties on the gen sets for PSC together with assurances that they are committed to life cycle support of the units. No other aspects of the [PSC] ship design or construction are expected to be impacted by Caterpillar's decision to cease production of medium-speed marine diesels."[41]

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 at least some of the PSCs. As noted earlier, the DD&C contract that the Coast Guard awarded to Halter Marine is a contract with options. Coast Guard and Navy officials, however, have expressed openness to the idea of using a block buy contract to acquire at least

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[39] Government Accountability Office, *Arctic Capabilities[:] Coast Guard Is Taking Steps to Address Key Challenges, but Additional Work Remains*, GAO-20-347T, Testimony Before the Subcommittee on Transportation and Maritime Security, Committee on Homeland Security, House of Representatives, Statement of Marie A. Mak, Director, Contracting and National Security Acquisitions, February 5, 2020, pp. 7-9. See also Craig Hooper, "Trouble Ahead As Builder Of USCG Heavy Icebreaker Abruptly Changes Leadership," *Forbes*, June 30, 2020.

[40] Paul Benecki, "Caterpillar Exits Production of Medium-Speed Engines," *Maritime Executive*, July 14, 2021. See also Mariska Buitendijk, "Caterpillar to End Production of MaK Medium-Speed Marine Engines," *SWZ Maritime (Netherlands)*, October 4, 2021.

[41] Email to CRS from Coast Guard liaison office, January 20, 2022.

some of the ships (particularly the second and third PSCs), and requested information on the possibility of using block buy contracting as part of the request for proposals (RFP) for the PSC program that the Coast Guard released on March 2, 2018. Section 311 of the Frank LoBiondo Coast Guard Authorization Act of 2018 (S. 140/P.L. 115-282 of December 4, 2018) provides permanent authority for the Coast Guard to use block buy contracting with economic order quantity (EOQ) purchases (i.e., up-front batch purchases) of components in its major acquisition programs. The authority is now codified at 14 U.S.C. 1137.

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 with 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 what design to build them to,[42] 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.[43] 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 could 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

[42] 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.

[43] See CRS Report R41909, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, by Ronald O'Rourke; 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.

> 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.[44]

Section 8111 of the Elijah E. Cummings Coast Guard Authorization Act of 2020 (Division H/Division G of FY2021 National Defense Authorization Act [H.R. 6395/P.L. 116-283]) states

> SEC. 8111. POLAR ICEBREAKERS.
>
> (a) IN GENERAL.—Section 561 of title 14, United States Code, is amended to read as follows:
>
> ''§ 561. Icebreaking in polar regions
>
> ''(a) PROCUREMENT AUTHORITY.—
>
> ''(1) IN GENERAL.—The Secretary may enter into one or more contracts for the procurement of—
>
> ''(A) the Polar Security Cutters approved as part of a major acquisition program as of November 1, 2019; and
>
> ''(B) 3 additional Polar Security Cutters.
>
> ''(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 during 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) PLANNING.—The Secretary shall facilitate planning for the design, procurement, maintenance, deployment, and operation of icebreakers as needed to support the statutory missions of the Coast Guard in the polar regions by allocating all funds to support icebreaking operations in such regions, except for recurring incremental costs associated with specific projects, to the Coast Guard.
>
> ''(c) REIMBURSEMENT.—Nothing in this section shall preclude the Secretary from seeking reimbursement for operation and maintenance costs of the Polar Star, Healy, or any other Polar Security Cutter from other Federal agencies and entities, including foreign countries, that benefit from the use of those vessels.
>
> ''(d) RESTRICTION.—
>
> ''(1) IN GENERAL.—The Commandant may not—
>
> ''(A) transfer, relinquish ownership of, dismantle, or recycle the Polar Sea or Polar Star;
>
> ''(B) change the current homeport of the Polar Sea or Polar Star; or
>
> ''(C) expend any funds—
>
> ''(i) for any expenses directly or indirectly associated with the decommissioning of the Polar Sea or Polar Star, including expenses for dock use or other goods and services;

[44] 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.

''(ii) for any personnel expenses directly or indirectly associated with the decommissioning of the Polar Sea or Polar Star, including expenses for a decommissioning officer;

''(iii) for any expenses associated with a decommissioning ceremony for the Polar Sea or Polar Star;

''(iv) to appoint a decommissioning officer to be affiliated with the Polar Sea or Polar Star; or

''(v) to place the Polar Sea or Polar Star in inactive status.

''(2) SUNSET.—This subsection shall cease to have effect on September 30, 2022.

''(e) LIMITATION.—

''(1) IN GENERAL.—The Secretary may not expend amounts appropriated for the Coast Guard for any of fiscal years 2015 through 2024, for—

''(A) design activities related to a capability of a Polar Security Cutter that is based solely on an operational requirement of a Federal department or agency other than the Coast Guard, except for amounts appropriated for design activities for a fiscal year before fiscal year 2016; or

''(B) long-lead-time materials, production, or postdelivery activities related to such a capability.

''(2) OTHER AMOUNTS.—Amounts made available to the Secretary under an agreement with a Federal department or agency other than the Coast Guard and expended on a capability of a Polar Security Cutter that is based solely on an operational requirement of such Federal department or agency shall not be treated as amounts expended by the Secretary for purposes of the limitation under paragraph (1).

''(f) ENHANCED MAINTENANCE PROGRAM FOR THE POLAR STAR.—

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

''(2) AUTHORIZATION OF APPROPRIATIONS.—The Commandant may use funds made available pursuant to section 4902(1)(A), to carry out this subsection.

''(g) DEFINITIONS.—In this section:

''(1) POLAR SEA.—The term 'Polar Sea' means Coast Guard Cutter Polar Sea (WAGB 11).

''(2) POLAR STAR.—The term 'Polar Star' means Coast Guard Cutter Polar Star (WAGB 10).

''(3) HEALY.—The term 'Healy' means Coast Guard Cutter Healy (WAGB 20).''.

(b) CONTRACTING FOR MAJOR ACQUISITIONS PROGRAMS.—Section 1137(a) of title 14, United States Code, is amended by inserting ''and 3 Polar Security Cutters in addition to those approved as part of a major acquisition program on November 1, 2019'' before the period at the end.

(c) REPEALS.—

(1) COAST GUARD AND MARITIME TRANSPORTATION ACT OF 2006.—Section 210 of the Coast Guard and Maritime Transportation Act of 2006 (14 U.S.C. 504 note) is repealed.

> (2) COAST GUARD AND MARITIME TRANSPORTATION ACT OF 2012.—Section 222 of the Coast Guard and Maritime Transportation Act of 2012 (Public Law 112–213) is repealed.
>
> (3) HOWARD COBLE COAST GUARD AND MARITIME TRANSPORTATION ACT OF 2014.—Section 505 of the Howard Coble Coast Guard and Maritime Transportation Act of 2014 (Public Law 113–281) is repealed.
>
> (4) FRANK LOBIONDO COAST GUARD AUTHORIZATION ACT OF 2018.—Section 821 of the Frank LoBiondo Coast Guard Authorization Act of 2018 (Public Law 115–282) is repealed.

Common Design for Heavy and Medium Polar Icebreakers

Another potential issue for Congress is whether to procure the Coast Guard's envisioned fleet of PSCs (i.e., heavy polar icebreakers) and ASCs (i.e., medium polar icebreakers) to a common basic design. 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 A-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 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.[45]

If policymakers decide to procure a second new ASC or a third new ASC, the same general approach recommended by the NASEM report could be followed—a second ASC and third ASC could be built to the same common design used for the three new PSCs and the first new ASC.

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

[45] 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.

> 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.[46]

Section 8108 of the Elijah E. Cummings Coast Guard Authorization Act of 2020 (Division H/Division G of FY2021 National Defense Authorization Act [H.R. 6395/P.L. 116-283]) states

> SEC. 8108. POLAR SECURITY CUTTER ACQUISITION REPORT.
>
> Not later than 1 year after the date of the enactment of this Act, the Commandant shall submit to the Committees on Transportation and Infrastructure and Armed Services of the House of Representatives, and the Committees on Commerce, Science, and Transportation and Armed Services of the Senate a report on—
>
> (1) the extent to which specifications, key drawings, and detail design for the Polar Security Cutter are complete before the start of construction;
>
> (2) the extent to which Polar Security Cutter hulls numbers one, two, and three are science ready; and
>
> (3) what actions will be taken to ensure that Polar Security Cutter hull number four is science capable, as described in the National Academies of Sciences, Engineering, and Medicine's Committee on Polar Icebreaker Cost Assessment letter report entitled ''Acquisition and Operation of Polar Ice breakers: Fulfilling the Nation's Needs'' and dated July 11, 2017.

Funding Coast Guard Polar Icebreakers through Navy's Shipbuilding Account

Another potential issue for Congress is whether to provide any additional procurement funding for the PSC program through the Navy's shipbuilding account, known formally as the Shipbuilding and Conversion Navy (SCN) appropriation account. As noted earlier, $300 million of the funding that the PSC program has received through FY2021 was provided through the SCN account in FY2017 and FY2018 ($150 million each year). 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

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

the program's contracting actions could be funded by either USCG or Navy appropriations, and the source of the appropriations will award the contract."[47]

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.[48]
- 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.[49]

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.—
>
> (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

[47] 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.

[48] 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 procurement 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 procurement funding. (Source: Undated Coast Guard information paper provided to CRS by Coast Guard legislative liaison office, March 3, 2016.)

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

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.[50]

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 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.

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

> 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)

Building Polar Icebreakers in Foreign Shipyards

Overview

Another potential issue for Congress concerns the possibility of building polar icebreakers for the U.S. Coast guard in foreign shipyards. Shipyards in Finland, for example, reportedly are interested in building polar icebreakers for the U.S. Coast Guard.[51] Some observers believe the acquisition cost of Coast Guard polar security cutters could be reduced, perhaps substantially, by building them in a foreign shipyard, such as a shipyard in Finland or in one of the other Nordic countries that is experienced in building icebreakers. Other observers question whether icebreaker designs offered by foreign shipbuilders would meet (or be a cost-effective way of providing) the Coast Guard's desired capabilities for polar security cutters, which include capabilities for performing Coast Guard missions other than icebreaking.

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.[52] Two other laws, however, are of note in connection with the idea of building a U.S. Coast Guard polar icebreaker in a foreign shipyard. One is 14 U.S.C. 1151, which states the following:

> §1151. 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.

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[51] 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.

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

The federal agency in charge of deciding what kind of maritime activity must comply with the Jones Act, U.S. Customs and Border Protection (CBP), has confirmed that icebreaking is not one of those activities. In a 2006 ruling, which appears to be its most recent ruling on the subject, 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.

> 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. 8679, which states the following:

> §8679. 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,[53] 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 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."[54]

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 polar security cutters, which include

[53] 14 U.S.C. 101, 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."

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

capabilities for performing Coast Guard missions other than icebreaking. Of the six Russian heavy polar icebreakers shown in **Table B-1** (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 B-1** (whether operated by Finland or other countries) could be considered, based on their brake horsepower (BHP), to be medium or light polar icebreakers.

Legislative Activity for FY2022

Summary of Appropriation Action on FY2022 Funding Request

The Coast Guard's proposed FY2022 budget requests $170.0 million in procurement funding for the PSC program. **Table 2** summarizes congressional appropriation action on the program's FY2022 funding request.

Table 2. Summary of Congressional Appropriations Action on FY2022 Procurement Funding Request

(In millions of dollars)

	Request	HAC	House-passed	SAC	Conf.
FY2022 DHS Appropriations Act (H.R. 4431/S. XXXX)[a]					
PSC procurement funding	170.0	170.0		50.0	
Great Lakes icebreaker procurement funding	0	0		0[b]	
Build Back Better Act (H.R. 5376)					
PSC procurement funding			788.0		
Great Lakes icebreaker procurement funding			350.0		

Source: Table prepared by CRS, based on Coast Guard's FY2022 budget submission, HAC and SAC committee reports, and conference report on FY2022 DHS Appropriations Act.

Notes: HAC is House Appropriations Committee; **SAC** is Senate Appropriations Committee; **Conf.** is conference agreement.

a. Funding shown for H.R. 4431/S. XXXX is procurement funding for a Great Lakes icebreaker in the Coast Guard's Procurement, Construction, and Improvements (PC&I account).

b. See the discussion in the narrative below about funding for pre-acquisition activities for a Great Lakes icebreaker that is recommended in the SAC report for S. XXXX for the Coast Guard's Operations and Support (O&S) account.

FY2022 DHS Appropriations Act (H.R. 4431/S. XXXX)

House

The House Appropriations Committee, in its report (H.Rept. 117-87 of July 15, 2021) on H.R. 4431, recommends the funding level shown in the HAC column of **Table 2**. H.Rept. 117-87 states

> *Polar Security Cutter (PSC).*—The recommendation includes the requested $170,000,000 for a portion of the long lead time materials for a third PSC, which will keep the acquisition program on schedule. The Committee is committed to the importance of an expanded U.S. presence in the polar regions, especially the Arctic. (Page 57)

H.Rept. 117-87 also states

> *Great Lakes Icebreaker Program.*—The Coast Guard is tasked by Executive Order to carry out icebreaking efforts in support of commerce. The Committee is concerned that in recent years, performance metrics for icebreaking on the Great Lakes has been redefined by the availability of assets, rather than mission requirements, often with severe economic impacts. As the Coast Guard begins to define its requirements for the recapitalization of ice breaking assets in the Great Lakes, the Committee directs the Coast Guard to incorporate historical measures of performance. Not later than 180 days after the date of enactment of this Act, the Coast Guard is directed to brief the Committee on such performance measures and other considerations for planning the recapitalization of assets in the Great Lakes. (Page 55)

Senate

The Senate Appropriations Committee, in the explanatory statement it released on October 18, 2021, for the FY2022 DHS Appropriations Act (S. XXXX), recommends the funding level shown in the SAC column of **Table 2**. The explanatory statement states

> *Polar Ice Breaking Vessel*.—The Committee recognizes the value of heavy polar icebreakers in promoting the national security and economic interests of the United States in the Arctic and Antarctic regions. Due to delays that are consistent with complex, first-in-class surface acquisition programs as well as management delays exacerbated by the global pandemic, the schedule projects that the amount requested for LLTM for the third heavy polar icebreaker is not necessary in fiscal year 2022. Therefore, the recommendation does not include $120,000,000 from the request. (PDF page 69 of 160; see also PDF page 145 of 160)

Regarding the Coast Guard's Operations and Support (O&S) account, funding for which is not shown in **Table 2**, the explanatory statement states

> *Great Lakes Icebreaking [GLIB] Program Management Office*.—The recommendation includes $5,500,000, $3,500,000 above the request for pre-acquisition activities, for a new Great Lakes icebreaker that is as capable as USCGC MACKINAW. (PDF page 65 of 160)

FY2022 DOD Appropriations Act (H.R 4432)

House

The House Appropriations Committee, in its report (H.Rept. 117-88 of July 15, 2021) on H.R. 4432, states

> ICEBREAKERS
>
> The Committee understands that the Coast Guard is expanding its fleet of polar icebreakers but is disappointed that the Navy has not also considered purchasing either new or used icebreakers. The Committee directs the Secretary of the Navy to submit a report to the congressional defense committees not later than 60 days after the enactment of this Act which details the Navy's plan to address this capability requirement in fiscal year 2022 and the future years defense program. (Page 186)

Build Back Better Act (H.R. 5376)

House

Section 110023 of H.R. 5376 as passed by the House on November 19, 2021, states

SEC. 110023. GREAT LAKES ICEBREAKER ACQUISITION.

In addition to amounts otherwise available, there is appropriated for fiscal year 2022, out of funds in the Treasury not otherwise appropriated, $350,000,000, to remain available until September, 30, 2031, to the Coast Guard, for acquisition, design, and construction of a Great Lakes heavy icebreaker, as authorized under section 8107 of the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 (P.L. 116-283).[55] The Coast Guard shall return to the Treasury any funds appropriated under this section that have not been expended by September 30, 2031.

Section 10024 of H.R. 5376 as passed by the House states

SEC. 110024. POLAR SECURITY CUTTERS AND CLIMATE SCIENCE.

In addition to amounts otherwise available, there is appropriated for fiscal year 2022, out of any money in the Treasury not otherwise appropriated, $788,000,000, to remain available until September 30, 2031, to the Coast Guard, for the acquisition of the fourth heavy Polar Security Cutter, including scientific laboratory and berthing facilities, to expand access for scientists to the polar regions, to improve climate and weather research, for other polar missions, and for other purposes, as authorized under section 561 of title 14, United States Code.

FY2022 National Defense Authorization Act (H.R. 4350/S. 1605/P.L. 117-81)

House

Section 5301 of H.R. 4350 as reported by the House Armed Services Committee (H.Rept. 117-118 of September 10, 2021) states

SEC. 5301. GREAT LAKES WINTER SHIPPING.

(a) SHORT TITLE.—This section may be cited as the ‘‘Great Lakes Winter Shipping Act of 2021’’.

(b) GREAT LAKES ICEBREAKING OPERATIONS.—

(1) GAO REPORT.—

(A) IN GENERAL.—Not later than 1 year after the date of the enactment of this Act, the Comptroller General of the United States 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 report on Coast Guard icebreaking in the Great Lakes.

(B) ELEMENTS.—The report required under subparagraph (A) shall—

[55] Section 8107 of H.R. 6395/P.L. 116-283 of January 1, 2021, states

SEC. 8107. PROCUREMENT AUTHORITY FOR GREAT LAKES ICEBREAKER.

(a) IN GENERAL.—Of the amounts authorized to be appropriated by section 4902(2)(A)(ii) of title 14, United States Code, as amended by section 8101 of this division, $160,000,000 for fiscal year 2021 is authorized for the acquisition of a Great Lakes icebreaker at least as capable as Coast Guard Cutter Mackinaw (WLBB–30).

(b) REPORT.—Not later than 30 days after the date of the enactment of this Act, the Commandant 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 for acquiring an icebreaker as required by section 820(b) of the Frank LoBiondo Coast Guard Authorization Act of 2018 (Public Law 115–282).

(i) evaluate—

(I) the economic impact related to vessel delays or cancellations associated with ice coverage on the Great Lakes;

(II) the impact the standards proposed in paragraph (2) would have on Coast Guard operations in the Great Lakes if such standards were adopted;

(III) the fleet mix of medium ice breakers and icebreaking tugs necessary to meet the standards proposed in paragraph (2); and

(IV) the resources necessary to support the fleet described in subclause (III), including billets for crew and operating costs; and

(ii) make recommendations to the Commandant for improvements to the Great Lakes icebreaking program, including with respect to facilitating shipping and meeting all Coast Guard mission needs.

(2) PROPOSED STANDARDS FOR ICEBREAKING OPERATIONS.—The proposed standards, the impact of the adoption of which is evaluated in subclauses (II) and (III) of paragraph (1)(B)(i), are the following:

(A) Except as provided in subparagraph (B), that ice-covered waterways in the Great Lakes shall be open to navigation not less than 90 percent of the hours that vessels engaged in commercial service and ferries attempt to transit such ice-covered waterways.

(B) In a year in which the Great Lakes are not open to navigation as described in subparagraph (A) because of ice of a thickness that occurs on average only once every 10 years, ice-covered waterways in the Great Lakes shall be open to navigation at least 70 percent of the hours that vessels engaged in commercial service and ferries attempt to transit such ice-covered waterways.

(3) REPORT BY COMMANDANT.—Not later than 90 days after the date on which the Comptroller General submits the report under paragraph (1), the Commandant 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 report that includes the following:

(A) A plan for Coast Guard implementation of any recommendation made by the Comptroller General under paragraph (1)(B)(ii) with which the Commandant concurs.

(B) With respect to any recommendation made under paragraph (1)(B)(ii) with which the Commandant does not concur, an explanation of the reasons why the Commandant does not concur.

(C) A review of, and a proposed implementation plan for, the results of the fleet mix analysis under paragraph (1)(B)(i)(III).

(D) Any proposed modifications to current Coast Guard Standards for icebreaking operations in the Great Lakes.

(4) PILOT PROGRAM.—During the 5 ice seasons following the date of enactment of this Act, the Coast Guard shall conduct a pilot program to determine the extent to which the current Coast Guard Great Lakes icebreaking cutter fleet can meet the proposed standards described in paragraph (2).

(c) DATA ON ICEBREAKING OPERATIONS IN THE GREAT LAKES.—

(1) IN GENERAL.—The Commandant shall collect, during ice season, archive, and disseminate data on icebreaking operations and transits on ice-covered waterways in the Great Lakes of vessels engaged in commercial service and ferries.

(2) ELEMENTS.—Data collected, archived, and disseminated under paragraph (1) shall include the following:

(A) Voyages by vessels engaged in commercial service and ferries to transit ice-covered waterways in the Great Lakes that are delayed or cancelled because of the nonavailability of a suitable icebreaking vessel.

(B) Voyages attempted by vessels engaged in commercial service and ferries to transit ice covered waterways in the Great Lakes that do not reach their intended destination because of the nonavailability of a suitable icebreaking vessel.

(C) The period of time that each vessel engaged in commercial service or ferry was delayed in getting underway or during a transit of ice-covered waterways in the Great Lakes due to the nonavailability of a suitable icebreaking vessel.

(D) The period of time elapsed between each request for icebreaking assistance by a vessel engaged in commercial service or ferry and the arrival of a suitable icebreaking vessel and whether such icebreaking vessel was a Coast Guard or commercial asset.

(E) The percentage of hours that Great Lakes ice-covered waterways were open to navigation, as defined by this section, while vessels engaged in commercial service and ferries at tempted to transit such waterways for each ice season after the date of enactment of this section.

(F) Relevant communications of each vessel engaged in commercial service or ferry with the Coast Guard or commercial icebreaking service providers with respect to subparagraphs (A) through (D).

(G) A description of any mitigating circumstance, such as Coast Guard Great Lakes icebreaker diversions to higher priority missions, that may have contributed to the amount of time described in subparagraphs (C) and (D) or the percentage of time described in subparagraph (E).

(3) VOLUNTARY REPORTING.—Any reporting by operators of commercial vessels engaged in commercial service or ferries under this Act shall be voluntary.

(4) PUBLIC AVAILABILITY.—The Commandant shall make the data collected, archived and disseminated under this subsection available to the public on a publicly accessible internet website of the Coast Guard.

(5) CONSULTATION WITH INDUSTRY.—With respect to the Great Lakes icebreaking operations of the Coast Guard and the development of the data collected, archived, and disseminated under this subsection, the Commandant shall consult operators of vessel engaged in commercial service and ferries.

(6) DEFINITIONS.—In this subsection:

(A) VESSEL.—The term ‘‘vessel’’ has the meaning given such term in section 3 of title 1, United States Code.

(B) COMMERCIAL SERVICE.—The term ‘‘commercial service’’ has the meaning given such term in section 2101(4) of title 46, United States Code.

(C) GREAT LAKES.—The term ‘‘Great Lakes’’—

(i) has the meaning given such term in section 118 of the Federal Water Pollution Control Act (33 U.S.C. 1268); and

(ii) includes harbors adjacent to such waters.

(D) ICE-COVERED WATERWAY.—The term ‘ice-covered waterway’’ means any portion of the Great Lakes, as defined by subparagraph

(C), in which vessels engaged in commercial service or ferries operate that is 70 percent or greater covered by ice, but does not include any waters adjacent to piers or docks for which commercial icebreaking services are available and adequate for the ice conditions.

(E) OPEN TO NAVIGATION.—The term ''open to navigation'' means navigable to the extent necessary to meet the reasonable demands of shipping, minimize delays to passenger ferries, extricate vessels and persons from danger, prevent damage due to flooding, and conduct other Coast Guard missions as required.

(F) REASONABLE DEMANDS OF SHIPPING.—The term ''reasonable demands of shipping'' means the safe movement of vessels engaged in commercial service and ferries transiting ice-covered waterways in the Great Lakes to their intended destination, regardless of type of cargo.

(d) GREAT LAKES ICEBREAKER ACQUISITION.—Of the amounts authorized to be appropriated under section 4902(2)(A)(ii) of title 14, United States Code—

(1) for fiscal year 2022, $350,000,000 shall be made available to the Commandant for the acquisition of a Great Lakes icebreaker at least as capable as Coast Guard Cutter Mackinaw (WLBB–30); and

(2) for fiscal year 2023, $20,000,000 shall be made available to the Commandant for the design and selection of icebreaking cutters for operation in the Great Lakes, the Northeastern United States, and the Arctic, as appropriate, that are at least as capable as the Coast Guard 140-foot icebreaking tugs.

(e) PROHIBITION ON CONTRACT OR USE OF FUNDS FOR DEVELOPMENT OF COMMON HULL DESIGN.—Section 8105 of the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 (P.L. 117-116–283) is amended by striking subsection (b) and inserting the following:

''(b) REPORT.—Not later than 90 days after the date of the enactment of this subsection, the Commandant shall submit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Transportation and Infrastructure of the House of Representative a report on the operational benefits and limitations of a common hull design for icebreaking cutters for operation in the Great Lakes, the Northeastern United States, and the Arctic, as appropriate, that are at least as capable as the Coast Guard 140-foot icebreaking tugs.''.

H.Rept. 117-118 states

Report on Need for Additional Ice Breakers in the Great Lakes Region

The committee directs the Secretary of Defense to submit a report to the congressional defense committees by March 1, 2022 on whether additional ice breaking vessels are necessary in the Great Lakes region. The report must include an analysis on the necessity for ice breaking vessels in the St. Clair River. (Page 223)

Enacted

The joint explanatory statement for S. 1605/ P.L. 117-81 of December 27, 2021, states

Great Lakes winter shipping

The House bill contained a provision (sec. 5301) that would require certain reports, pilot programs, and information collection, as well as authorizing appropriations for icebreakers, to improve the safety and commercial utility of the Great Lakes region during the ice season.

The Senate amendment contained no similar provision.

The agreement does not include this provision. (PDF page 645 of 670)

Arctic Focus Act (S. 3272)

Senate

S. 3272 was introduced in the Senate on November 29, 2021. The text of bill states

> To prioritize icebreaker deployments to the Arctic, and for other purposes.
>
> Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,
>
> SECTION 1. SHORT TITLE.
>
> This Act may be cited as the "Arctic Focus Act".
>
> SEC. 2. DEFINITIONS.
>
> In this Act:
>
> (1) APPROPRIATE CONGRESSIONAL COMMITTEES.—The term "appropriate congressional committees" means—
>
> (A) the Committee on Commerce, Science, and Transportation of the Senate;
>
> (B) the Committee on Armed Services of the Senate;
>
> (C) the Committee on Appropriations of the Senate;
>
> (D) the Committee on Transportation and Infrastructure of the House of Representatives;
>
> (E) the Committee on Armed Services of the House of Representatives; and
>
> (F) the Committee on Appropriations of the House of Representatives.
>
> (2) ARCTIC.—The term "Arctic" has the meaning given such term in section 112 of the Arctic Research and Policy Act of 1984 (15 U.S.C. 4111).
>
> SEC. 3. STATEMENT OF POLICY REGARDING ARCTIC ACTIVITIES.
>
> In recognition of the Arctic's strategic importance to the national security interests of the United States, and the need to exert influence through persistent presence in the Arctic, the Coast Guard shall—
>
> (1) prioritize icebreaker deployments to the Arctic so that Antarctic deployments do not occur at the expense of sufficient Arctic presence or operations;
>
> (2) provide sufficient icebreaking activity to keep the Northwest Passage sea lanes open for commerce, national defense, rescue and recovery operations, and scientific exploration by 2030;
>
> (3) permanently station at least 1 icebreaking vessel within the Arctic not later than the earlier of—
>
> (A) the date that is 1 year after the delivery of the first Polar Security Cutter; or
>
> (B) 2030; and
>
> (4) continuously patrol the Arctic with at least 1 major Coast Guard cutter that is able to execute search and rescue operations, fisheries enforcement, pollution response, and support for national defense operations.
>
> SEC. 4. ARCTIC OPERATIONAL IMPLEMENTATION REPORT.
>
> Not later than 1 year after the date of the enactment of this Act, the Secretary of the department in which the Coast Guard is operating shall submit a report to the appropriate congressional committees that—

(1) describes the ability and timeline to conduct a transit of the Northern Sea Route and periodic transits of the Northwest Passage; and

(2) includes a plan to implement the activities described in section 3.

Appendix A. Current U.S. Polar Icebreakers and Polar Research Ships

This appendix provides background information on current U.S. polar icebreakers and polar research ships.

Three Coast Guard Polar Icebreakers

Two Heavy Polar Icebreakers—*Polar Star* and *Polar Sea*

Polar Star (WAGB-10) and *Polar Sea* (WAGB-11),[56] sister ships built to the same general design (**Figure A-1** and **Figure A-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 A-1. *Polar Star* and *Polar Sea*

(Side by side in McMurdo Sound, Antarctica)

Source: Coast Guard photograph that was accessed on April 21, 2011, at http://www.uscg.mil/pacarea/cgcpolarsea/history.asp (link no longer active). The photograph accompanies Kyung M. Song, "Senate Passes Cantwell Measure to Postpone Scrapping of Polar Sea Icebreaker," *Seattle Times*, September 22, 2012, posted at http://blogs.seattletimes.com/politicsnorthwest/2012/09/22/senate-passes-cantwell-measure-to-postpone-scrapping-of-polar-sea-icebreaker/.

[56] 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.

Figure A-2. *Polar Sea*

Source: Coast Guard photograph that was accessed April 21, 2011, at http://www.uscg.mil/pacarea/cgcpolarsea/img/PSEApics/FullShip2.jpg (link no longer active). The photograph accompanies Associated Press, "Reprieve for Seattle-Based Icebreaker Polar Sea," KOMO News, June 15, 2012, posted at https://komonews.com/news/local/reprieve-for-seattle-based-icebreaker-polar-sea.

The ships are 399 feet long and displace about 13,200 tons.[57] 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 (in U.S. parlance) 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 more than 10 years beyond its originally 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.[58] 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.[59]

Polar Sea was commissioned into service on February 23, 1978, and consequently is also more than 10 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.[60] The Coast Guard placed *Polar Sea* in

[57] 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.

[58] 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."

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

[60] "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.

commissioned, inactive status on October 14, 2011. The Coast Guard transferred certain major equipment from *Polar Sea* to *Polar Star* to facilitate *Polar Star*'s return to service.[61]

Although the Coast Guard in recent years has invested millions of dollars to overhaul, repair, and extend the service life of *Polar Star*, the ship's material condition, as a result of its advancing age, has nevertheless become increasingly fragile, if not precarious. During its annual deployments to McMurdo Station in Antarctica, shipboard equipment frequently breaks, and shipboard fires sometimes occur.[62] Replacements for many of the ship's components are no longer commercially available. To help keep *Polar Star* operational, the Coast Guard continues to use *Polar Sea* as a source of replacement parts.

One Medium Polar Icebreaker—*Healy*

Healy (WAGB-20) (**Figure A-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.

Figure A-3. *Healy*

Source: Coast Guard photograph accessed August 12, 2019, at https://www.history.uscg.mil/US-Coast-Guard-Photo-Gallery/igphoto/2002136680/.

[61] 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 B**.

[62] See, for example, Richard Read, "Meet the Neglected 43-Year-Old Stepchild of the U.S. Military-Industrial Complex," *Los Angeles Times*, August 2, 2019; Melody Schreiber, "The Only Working US Heavy Icebreaker Catches Fire Returning from Antarctica," *Arctic Today*, March 2, 2019; Calvin Biesecker, "Fire Breaks Out On Coast Guard's Aging, and Only, Heavy Icebreaker," *Defense Daily*, March 1, 2019.

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). (HII subsequently wound down shipbuilding activities at Avondale, and the facility is no longer building ships.)

Although it is referred to (in U.S. parlance) as a medium polar icebreaker, *Healy* is actually larger than *Polar Star* and *Polar Sea*—it is 420 feet long and displaces about 16,000 tons. Compared to *Polar Star* and *Polar Sea*, *Healy* has less icebreaking capability (which is why it is referred to as a medium polar icebreaker rather than a heavy 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 and conducting other operations in the Arctic.

Three National Science Foundation (NSF) Polar Research Ships

Nathaniel B. Palmer

Nathaniel B. Palmer (**Figure A-4**) was built for the NSF in 1992 by North American Shipbuilding, of Larose, LA.

Figure A-4. *Nathaniel B. Palmer*

Source: Photograph accompanying Peter Rejcek, "System Study, LARISSA Takes Unique Approach for Research on Ice Shelf Ecosystem," *Antarctic Sun* (Untied States Antarctic Program), September 18, 2009. A caption to the photograph states "Photo Courtesy: Adam Jenkins."

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.[63] *Palmer* is 308 feet long and has a displacement of about 6,500 tons. It has a crew of 22 and can embark a

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

scientific staff of 27 to 37.[64] 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* (**Figure A-5**) 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.

Figure A-5. *Laurence M. Gould*

Source: Photograph accompanying Alchetron, "RV Laurence M. Gould," updated August 25, 2018, accessed August 7, 2019, at https://alchetron.com/RV-Laurence-M.-Gould#-.

[64] 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.

Sikuliaq

Sikuliaq (see-KOO-lee-auk; **Figure A-6**), 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.

Figure A-6. *Sikuliaq*

Source: Photograph accompanying Lauren Frisch, "UAF Joins International Consortium of Icebreaker Operators," *UAF [University of Alaska Fairbanks] News and Information*, February 6, 2018. A caption to the photograph states in part: "Photo by Mark Teckenbrock. The research vessel Sikuliaq navigates through Arctic ice in summer 2016."

Summary

Table A-1 summarizes the above six ships. In addition to the ships shown in **Table A-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 A-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.

Appendix B. Required Numbers of U.S. Polar Icebreakers

This appendix provides additional background information on required numbers of U.S. polar icebreakers.

June 9, 2020, Presidential Memorandum

On June 9, 2020, President Trump issued a memorandum, "Memorandum on Safeguarding U.S. National Interests in the Arctic and Antarctic Regions," which states

> Memorandum for the Secretary of State, the Secretary of Defense, the Secretary of Commerce, the Secretary of Energy, the Secretary of Homeland Security, the Director of the Office of Management and Budget, [and] the Assistant to the President for National Security Affairs
>
> Subject: Safeguarding U.S. National Interests in the Arctic and Antarctic Regions
>
> To help protect our national interests in the Arctic and Antarctic regions, and to retain a strong Arctic security presence alongside our allies and partners, the United States requires a ready, capable, and available fleet of polar security icebreakers that is operationally tested and fully deployable by Fiscal Year 2029. Accordingly, by the authority vested in me as President by the Constitution and the laws of the United States of America, I hereby direct the following:
>
> Section 1. Fleet Acquisition Program. The United States will develop and execute a polar security icebreaking fleet acquisition program that supports our national interests in the Arctic and Antarctic regions.
>
> (a) The Secretary of Homeland Security, in coordination with the Secretary of State, the Secretary of Defense, the Secretary of Commerce, and the Director of the Office of Management and Budget (OMB), shall lead a review of requirements for a polar security icebreaking fleet acquisition program to acquire and employ a suitable fleet of polar security icebreakers, and associated assets and resources, capable of ensuring a persistent United States presence in the Arctic and Antarctic regions in support of national interests and in furtherance of the National Security Strategy and the National Defense Strategy, as appropriate. Separately, the review shall include the ability to provide a persistent United States presence in the Antarctic region, as appropriate, in accordance with the Antarctic Treaty System. The Secretary of Homeland Security and the Director of OMB, in executing this direction, shall ensure that the United States Coast Guard's (USCG) Offshore Patrol Cutter acquisition program is not adversely impacted.
>
> (b) The Secretary of Homeland Security, acting through the Commandant of the Coast Guard, in coordination with the Secretary of Defense, acting through the Secretary of the Navy, and the Secretary of Energy, as appropriate, shall conduct a study of the comparative operational and fiscal benefits and risks of a polar security icebreaking fleet mix that consists of at least three heavy polar-class security cutters (PSC) that are appropriately outfitted to meet the objectives of this memorandum. This study shall be submitted to the President, through the Director of OMB and the Assistant to the President for National Security Affairs, within 60 days from the date of this memorandum and at a minimum shall include:
>
> (i) Use cases in the Arctic that span the full range of national and economic security missions (including the facilitation of resource exploration and exploitation and undersea cable laying and maintenance) that may be executed by a class of medium PSCs, as well as analysis of how these use cases differ with respect to the anticipated use of heavy PSCs

for these same activities. These use cases shall identify the optimal number and type of polar security icebreakers for ensuring a persistent presence in both the Arctic and, as appropriate, the Antarctic regions;

(ii) An assessment of expanded operational capabilities, with estimated associated costs, for both heavy and medium PSCs not yet contracted for, specifically including the maximum use of any such PSC with respect to its ability to support national security objectives through the use of the following: unmanned aviation, surface, and undersea systems; space systems; sensors and other systems to achieve and maintain maritime domain awareness; command and control systems; secure communications and data transfer systems; and intelligence-collection systems. This assessment shall also evaluate defensive armament adequate to defend against threats by near-peer competitors and the potential for nuclear-powered propulsion;

(iii) Based on the determined fleet size and composition, an identification and assessment of at least two optimal United States basing locations and at least two international basing locations. The basing location assessment shall include the costs, benefits, risks, and challenges related to infrastructure, crewing, and logistics and maintenance support for PSCs at these locations. In addition, this assessment shall account for potential burden-sharing opportunities for basing with the Department of Defense and allies and partners, as appropriate; and

(iv) In anticipation of the USCGC POLAR STAR's operational degradation from Fiscal Years 2022-2029, an analysis to identify executable options, with associated costs, to bridge the gap of available vessels as early as Fiscal Year 2022 until the new PSCs required to meet the objectives of this memorandum are operational, including identifying executable, priced leasing options, both foreign and domestic. This analysis shall specifically include operational risk associated with using a leased vessel as compared to a purchased vessel to conduct specified missions set forth in this memorandum.

(c) In the interest of securing a fully capable polar security icebreaking fleet that is capable of providing a persistent presence in the Arctic and Antarctic regions at the lowest possible cost, the Secretary of State shall coordinate with the Secretary of Homeland Security in identifying viable polar security icebreaker leasing options, provided by partner nations, as a near- to mid-term (Fiscal Years 2022-2029) bridging strategy to mitigate future operational degradation of the USCGC POLAR STAR. Leasing options shall contemplate capabilities that allow for access to the Arctic and Antarctic regions to, as appropriate, conduct national and economic security missions, in addition to marine scientific research in the Arctic, and conduct research in Antarctica in accordance with the Antarctic Treaty System. Further, and in advance of any bid solicitation for future polar security icebreaker acquisitions, the Secretary of State shall coordinate with the Secretary of Homeland Security to identify partner nations with proven foreign shipbuilding capability and expertise in icebreaker construction.

(d) The Secretary of Defense shall coordinate with the Secretary of State and the Secretary of Homeland Security to continue to provide technical and programmatic support to the USCG integrated program office for the acquisition, outfitting, and operations of all classes of PSCs.

Sec. 2. General Provisions. (a) Nothing in this memorandum shall be construed to impair or otherwise affect:

(i) the authority granted by law to an executive department or agency, or the head thereof; or

(ii) the functions of the Director of OMB relating to budgetary, administrative, or legislative proposals.

> (b) This memorandum shall be implemented consistent with applicable law and subject to the availability of appropriations.
>
> (c) This memorandum is not intended to, and does not, create any right or benefit, substantive or procedural, enforceable at law or in equity by any party against the United States, its departments, agencies, or entities, its officers, employees, or agents, or any other person.[65]

A September 10, 2020, press report states

> The White House dropped a surprise directive in June calling for a new strategy in the High North, a move applauded by Arctic watchers who've been waiting for an administration to make the issue a priority….
>
> Yet a month after the report was due to the White House, it's not clear when, or if, anyone will see it.
>
> The report, which was to include new designs for a fleet of possibly nuclear-powered icebreakers, has been submitted to the National Security Council. Yet an NSC spokesperson did not respond to a query on the timing of a release, and would only say the report is "under review."[66]

A December 3, 2020, press report states

> The Coast Guard and its partners are assessing options for additional polar icebreaking capacity in the next decade beyond current plans pursuant to a directive from the Trump administration, Coast Guard Commandant Adm. Karl Schultz said on Thursday [December 3].
>
> The Coast Guard's current polar strategy calls for six new icebreakers, at least three of them heavy, and one immediately, and now "The good news is there's been a conversation beyond the 6-3-1 strategy," Schultz said during a virtual address hosted by the Navy League. "The president and his team have pressed us here since this past summer pulling together the energy of five cabinet level officials and OMB [Office of management and Budget] about saying, 'Hey, what does more capacity for high-latitude work between now and 2029 look like?'"…
>
> The Coast Guard hasn't looked favorably in the past on leasing options for ice breakers, at least not as a permanent solution to its polar requirements. But Schultz said leasing could fill near-term gaps.
>
> "We clearly don't want to be looking at leasing options as a replacement for the procurement of ships that are going to serve us for decades to come, but there might be some bridging strategies and some leasing options," he said. "So, we're working really hard on that, answering some deliverables over to the White House and hope we can keep some momentum."
>
> A Coast Guard spokesman told Defense Daily following Schultz's speech that the service and the Navy "have formed a joint working group to assess available foreign and domestic vessels that would meet short-term mission needs in the Arctic. The Coast Guard is

[65] White House, "Memorandum on Safeguarding U.S. National Interests in the Arctic and Antarctic Regions," June 9, 2020, accessed June 10, 2020, at https://www.whitehouse.gov/presidential-actions/memorandum-safeguarding-u-s-national-interests-arctic-antarctic-regions/. For press reports about the memorandum, see, for example, David B. Larter, Joe Gould, and Aaron Mehta, "Trump Memo Demands New Fleet of Arctic Icebreakers Be Ready by 2029," *Defense News*, June 9, 2020; Paul McLeary, "White House Orders New Icebreaker Strategy For Coast Guard," *Breaking Defense*, June 9, 2020; Cal Biesecker, "Trump Wants Review Of Polar Security Cutter Needs In Arctic, Antarctic," *Defense Daily*, June 9, 2020.

[66] Sarah Cammarata, "Trump's Arctic Plan Stuck in the Ice," *Politico Pro*, September 10, 2020.

> continuing to evaluate all options and provide detailed analysis of icebreaker capacity, lease options, and long-term strategies to protect vital economic and national security interests in the Polar Regions."[67]

A December 16, 2020, press report stated

> The White House National Security Adviser and the Navy may be on the verge of agreeing to move forward shortly with a plan to lease medium polar icebreakers to fill a near-term gap in the Coast Guard's icebreaking needs, Alaska Sen. Dan Sullivan (R) said last week.
>
> Sullivan, during a Dec. 8 hearing that he chaired that morning on the Coast Guard's capabilities in the Arctic, said he spoke earlier that day with White House National Security Adviser Robert O'Brien, who told him that the U.S. is looking at leasing polar icebreakers from Finland.
>
> "My understanding is the White House National Security Adviser [and] possibly the Navy with regard to some of their funding, are looking at moving forward on leases soon, hopefully as early as the end of this month," Sullivan told Adm. Charles Ray, vice commandant of the Coast Guard.
>
> Ray replied that discussions on leasing are part of a presidential directive issued in June, noting that a joint Coast Guard and Navy group are looking into this.
>
> Later during the hearing, in response to a question from Sen. Mike Lee (R-Utah) about potentially buying polar icebreakers from NATO allies or friendly Arctic nations, Ray said the "The bridging strategy that makes the most sense to the Coast Guard at this point is this potential to lease one of these icebreakers."
>
> Ray pointed out to Sullivan that the potential leasing strategy is not in place of the Coast Guard eventually acquiring new polar icebreakers.
>
> A Coast Guard spokesman on Wednesday told Defense Daily that the exact number if icebreakers that would be leased hasn't been determined and "depends on individual vessel availability and capabilities, crew availability, funding, and other factors." He also said the options only included medium icebreakers because no heavy icebreakers are currently available that meet the service's minimum requirements.…
>
> The Coast Guard spokesman said a bridging strategy is being examined because the first PSC won't begin operations until 2027. Any leased vessels, which potentially could be domestic or foreign flagged, would operate in the Arctic "to project U.S. sovereignty; protect vital economic and national security interests; and conduct maritime domain awareness, search and rescue, and other Coast Guard missions," he wrote in an email response to questions.…
>
> Ray said that a key shortfall of leasing commercial polar icebreakers is they aren't built to military specifications, highlighting communications, damage control and compartmentalization in case of an incident.
>
> "They're a different cat," Ray said. "We would have to do some work to them. It's not just, take one off the shelf. If it was, we probably would have done that a long time ago. So, there will be some work required to make these for the Coast Guard. But with that said, it is the commandant's position and our position we will certainly consider this and work to see what makes sense to bridge this gap."[68]

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[67] Cal Biesecker, "Coast Guard, Partners Assessing Options For More Polar Icebreaking Capacity," *Defense Daily*, December 3, 2020.

[68] Cal Biesecker, "Senator Says Decision Could Come Soon to Lease Icebreakers for Coast Guard," *Defense Daily*, December 16, 2020. See also Liz Ruskin, "Trump Administration May Hire Private Ship to Fill Arctic 'Icebreaker Gap' by Year's End," *Alaska Public Radio*, December 14, 2020.

June 2013 DHS Polar Icebreaker Mission Need Statement

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.[69]

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 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.[70]

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[69] 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.

[70] 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.

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

In recent years, Coast Guard officials have tended to refer simply to a total Coast Guard requirement for three heavy and three medium polar icebreakers. For example, in the October 25, 2016, summary of a request for information (RFI) that the Coast Guard released the next day to receive industry feedback on its notional polar icebreaker acquisition approach and schedule, the Coast Guard 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."[71] A requirement for three heavy and three medium polar icebreakers is often abbreviated as 3+3.

Short of a 3+3 requirement, Coast Guard officials in the past have sometimes stated that, as a bare minimum number of heavy polar icebreakers, the Coast Guard needs two such ships. For example, 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 during the discussion portion of the hearing that the "Coast Guard needs at least two heavy icebreakers to provide year-round assured access and self-rescueability in the polar regions."[72] Similarly, 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 [ships], [and] 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."[73]

A September 25, 2017, 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 Guard officials cited various factors affecting the Coast Guard's ability to meet all requests, particularly the unavailability of its heavy polar icebreakers.[74]

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

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(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).)

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

[72] Transcript of hearing.

[73] Transcript of hearing.

[74] 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.

> 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.[75]

In addition to the 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.

Polar Icebreakers Operated by Other Countries

In discussions of U.S. polar icebreakers, observers sometimes note the sizes of polar icebreaking fleets operated by other countries. **Table B-1** 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.

Some observers highlight the difference between the number of U.S. polar icebreakers and the much larger number of Russian polar icebreakers, and characterize the situation as an "icebreaker gap."[76] Other observers question the relevance of that comparison and characterization.[77] In considering the number of Russian polar icebreakers, factors that may be considered include the length of Russia's Arctic coastline and Russia's use of maritime transportation along its Arctic coastline to support numerous Russian Arctic communities. (Russia's Arctic population is roughly 2 million.)[78] 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. (The term *icebreaker gap* is also sometimes used to refer to a potential gap in time between the end of *Polar Star's* service life and the entry into service of the first PSC, or to discuss options, such as leasing existing icebreakers, for bolstering U.S. polar icebreaking capability prior to the entry into service of the first PSC.)[79]

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

[76] See, for example, Mike Glenn, "U.S. Icebreaker Gap with Russia a Growing Concern as Arctic 'Cold War' Heats Up," *Washington Times*, September 23, 2021; Lin A. Mortensgaard and Kristian Søby Kristensen, "The 'Icebreaker-Gap'—How US Icebreakers Are Assigned New, Symbolic Roles as Part of an Escalating Military Competition in the Arctic," Safe Seas, January 5, 2021; Christopher Woody, "As US Tries to Close 'Icebreaker Gap' with Russia, Its Only Working Icebreaker Is Making a Rare Trip North," *Business Insider*, November 9, 2020; Peter Kikkert, *Gaps and Bridges: The Case for American Polar Icebreakers*, North American Arctic Defence and Security Network, August 12, 2020, 5 pp.; Marc Lanteigne, "So What Is the 'Icebreaker Gap' Anyway?" *Over the Circle*, March 3, 2019; Charlie Gao, "The 'Icebreaker Gap': How Russia is Planning to Build more Icebreakers to Project Power in the Arctic," *National Interest*, August 19, 2018; Dermot Cole, "The US Is Finally Picking Up the Pace to Build a Modern Heavy Icebreaker," *ArcticToday*, April 21, 2018; Craig H. Allen Sr., "Addressing the US Icebreaker Shortage," *Pacific Maritime*, December 2017: 30-33; Adam Lemon and Brian Slattery, "Standoff in The Arctic: Closing the Icebreaker Gap," *Newsweek*, August 14, 2016; Franz-Stefan Gady, "Will the US Coast Guard Close the 'Icebreaker Gap'?" *Diplomat*, January 14, 2016; Jen Judson, "The Icebreaker Gap," *Politico*, September 1, 2015.

[77] See, for example, Robert D. English, "Why an Arctic Arms Race Would Be a Mistake," *ArcticToday*, June 18, 2020; Paul C. Avey, "The Icebreaker Gap Doesn't Mean America Is Losing in the Arctic," *War on the Rocks*, November 28, 2019; Chuck Hill, "Horrors, It's the Icebreaker Gap (cringe)," *Chuck Hill's CG Blog*, December 21, 2017; Jeremy Hsu, "U.S. Icebreaker Fleet Is Overdue for an Upgrade," *Scientific American*, June 1, 2017; Andreas Kuersten, "Icebreakers and U.S. Power: Separating Fact From Fiction," *War on the Rocks*, October 11, 2016; Andreas Kuersten, "The Dangerous Myth of an 'Icebreaker Gap,'" *Defense One*, September 6, 2016; Andrew C. Revkin, "The U.S. Icebreaker Gap is About Arctic Needs, Not About Chasing Russia," *New York Times (Dot Earth New York Times Blog)*, September 1, 2015.

[78] For additional discussion, see the "Background" section of CRS Report R41153, *Changes in the Arctic: Background and Issues for Congress*, coordinated by Ronald O'Rourke.

[79] See, for example, Liz Ruskin, "Trump Administration May Hire Private Ship to Fill Arctic 'Icebreaker Gap' by

Table B-1. 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)						

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

Year's End," *Alaska Public Media*, December 14, 2020; Government Accountability Office, *Coast Guard Acquisitions[:] Polar Icebreaker Program Needs to Address Risks before Committing Resources*, GAO-18-600, September 2018, summary page; Norton A. Schwartz and James G. Stavridis, "A Quick Fix for the U.S. 'Icebreaker Gap,'" *Wall Street Journal*, February 3, 2016.

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 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 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.

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.[80]

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 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

[80] 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.

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 nonmaterial 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.[81]

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.[82]

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:

> 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

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

[82] Source: Transcript of hearing.

> 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.[83]

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[84]

The report also states the following:

> 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

[83] 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.

[84] 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.

> 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.[85]

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[86]

The report's conclusion and recommendations were as follows:

> **Conclusion**
>
> With an aging fleet of three icebreakers, one operational and two beyond their intended 30-year service life, the Coast Guard is at a critical crossroads in its Polar Icebreaker Maintenance, Upgrade, and Acquisition Program. It must clarify its mission requirements, and if the current mission requirements remain, the Coast Guard must determine the best method for meeting these requirements in the short and long term.
>
> **Recommendations**
>
> We recommend that the Assistant Commandant for Marine Safety, Security, and Stewardship:
>
> **Recommendation #1:** Request budgetary authority for the operation, maintenance, and upgrade of its icebreakers.

[85] 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.

[86] 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.

> **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.[87]

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.[88]

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.[89]

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.[90] The study was required by report language accompanying the FY2005 DHS appropriations act (H.R. 4567/P.L. 108-334).[91] The study was completed in 2006 and published in 2007. Some

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[87] 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.

[88] 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.

[89] 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.

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

[91] 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:

> 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

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 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

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> 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.")

> 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.[92]

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 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."[93]

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

[93] 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 C. Great Lakes Icebreakers

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

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 (**Figure C-1**);
- 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.[94]

Figure C-1. Great Lakes Icebreaker *Mackinaw*

Source: U.S. Coast Guard, "USCGC Mackinaw," accessed September 11, 2019, at https://www.atlanticarea.uscg.mil/Our-Organization/District-9/Ninth-District-Staff/Prevention-Division/Cutters/MACKINAW/.

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.[95] *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.[96]

[94] 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.

[95] 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.

[96] As discussed earlier in this report, the Coast Guard's two heavy polar icebreakers—the operational *Polar Star* and the nonoperational *Polar Sea*, are 399 feet long and displace about 13,200 tons each. *Polar Star* can break ice up to six

Some Members of Congress in recent years have expressed interest in 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.[97] A new Great Lakes icebreaker with capabilities generally similar to those of *Mackinaw* might have a total acquisition cost of about $350 million. Supporters of procuring an additional Great Lakes icebreaker with capabilities generally similar to those of *Mackinaw* argue the following:

- The 2014 and 2015 ice seasons were a 20-year anomaly, but the Coast Guard should have a capability for supporting maritime commerce in above-average ice seasons. About 24% of recent years (11 out of 46 years) featured 75% or higher ice coverage. The economic consequences of ice-related restrictions on navigation can be significant.
- The Coast Guard's Great Lakes icebreaking capability is less sufficient for meeting winter needs than the size of Coast Guard's current Great Lakes icebreaker fleet might suggest because some of the icebreakers are sometimes not available for duty, because the Coast Guard reports ice-related navigation restrictions for only some of the area's commercial waterways and not others, and because the Coast Guard defines a waterway as restricted or closed when two commercial ships get stuck in the ice in certain waterways, overlooking instances where commercial ship operators decline to operate their ships on those waters because they assess a high risk of the ships getting stuck.
- While the Canadian Coast Guard usually assigns one or more additional icebreakers to the St. Lawrence River and the Great Lakes in severe ice seasons, Canadian Coast Guard ships operating there provide icebreaking assistance to U.S. commercial ships only under certain circumstances, resulting in only a small amount of icebreaking assistance being provided to U.S. commercial ships.

In the past, the Coast Guard stated that it did not view the procurement of additional Great Lakes icebreakers as an urgent near-term acquisition need, given 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, and Canada's own Great Lakes icebreaking capabilities.[98] In October 2021,

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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.)

[97] 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.

[98] A 2016 Coast Guard report to Congress on the Great Lakes icebreaking mission, for example, 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

however, the Commandant of the Coast Guard, Admiral Karl Schultz, expressed support for procuring an additional heavy Great Lakes icebreaker as part of a budget reconciliation bill. At an October 19, 2021, hearing on Coast Guard oversight before the Oceans, Fisheries, Climate Change, and Manufacturing subcommittee of the Senate Commerce, Science, and Transportation Committee, the following exchange occurred:

> SENATOR TAMMY BALDWIN:
>
> Thank you. I want to start this round of questions by talking about the Great Lakes icebreaker. Climate change does not mean the end of cold winters in the Great Lakes. In fact, three of the worst Great Lakes ice seasons of the past several decades have occurred during the last seven years. By one estimate, these three winters cost our region's economic—economy approximately $2 billion with 10,000 jobs lost due to reductions in maritime commerce and the resulting impacts on manufacturers in the region.
>
> Climate change is also contributing to more extreme weather events, larger quantities of precipitation, and higher lake levels. During the winter, this results in greater risk of flooding because ice collects in rivers to form ice dams, our communities rely on Coast Guard icebreakers to break up these ice dams and prevent flooding in our communities.
>
> From transportation to saving lives and property from flooding, we need more icebreakers, and that's why I'm fighting for a new Great Lakes icebreaker to be funded in our current budget reconciliation bill. Admiral Schultz, yes or no, do you support funding for a new Great Lakes icebreaker in the reconciliation package?
>
> COAST GUARD COMMANDANT ADMIRAL KARL SCHULTZ:
>
> Madam Chair, funding in the reconciliation packs [sic: package], absolutely, yeah, in support of that.
>
> BALDWIN:
>
> Great. I appreciate your support, Admiral. During the time—during the Lake Michigan ice jam caused flooding last winter, the Coast Guard's only Great Lakes heavy icebreaker was not available, and smaller icebreaking cutters struggled to break through that ice jam. While the Coast Guard eventually accomplished their mission with the current assets, if a second heavy icebreaker had been available last winter, the Coast Guard could have provided more flood relief, more quickly, would you agree?
>
> SCHULTZ:
>
> Senator, I don't have all the specifics around that. I would say, clearly, more capacity and a bigger breaker versus a small breaker, that's sort of common sense, I would say. You know, depending on what's going on at the time, we could find one breaker, you know, in one part of the Great Lakes, having sailed up there is quite a great distances [sic].

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other year since 2005.

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.

(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).)

> But I think, additional capacity—additional heavy capacity and capability is probably a positive there that could have lend to better outcomes there. Yes.[99]

A February 2, 2022, press report states

> A lack of U.S. Coast Guard icebreaking assets has delayed cargoes this season on the Great Lakes despite a relatively mild and delayed onset of winter in the region, the Great Lakes Maritime Task Force said Wednesday [February 2].
>
> U.S.-flag "lakers" on 20 voyages, with a total of 750,000 tons of carrying capacity for iron ore, coal and cement, were delayed for a total of 325 hours, the group said.
>
> The Great Lakes Maritime Task Force, with 74 members, is the largest coalition to speak for the Great Lakes Navigation System.
>
> In one case involving the MV American Century, the ship became beset in the St. Mary's River even after it cleared a regulatory check-in point in time to meet the scheduled closing of the Soo Locks in Sault Ste. Marie, Michigan. Coast Guard icebreakers were unable to free the vessel in time for its planned transit through the locks, which connect Lake Superior to Lake Huron. This delayed the downbound lockage's of the last vessels leaving Lake Superior, including the Coast Guard Cutter Biscayne Bay, which left no icebreakers on Lake Superior during the lock closure.
>
> The U.S. Coast Guard Cutter Alder, which is normally stationed in Duluth, Minnesota, is on the East Coast for an overhaul.
>
> The ice-induced vessel delays also forced the Army Corps of Engineers to begin lock dewatering operations a day later than planned.
>
> "The inefficiency introduced into the Great Lakes Navigation System by inadequate Coast Guard icebreaking resources impacts the carriers, their customers and the entire North American Manufacturing supply chain," said Jim Weakley, President of Great Lakes Maritime Task Force, and the Lake Carriers' Association. "The men and women of the U.S. Coast Guard do the best they can with the resources they are provided. Unfortunately, they do not have enough icebreakers to keep the system operating efficiently."
>
> Coast Guard icebreaking operations on the Great Lakes, known as Operation Taconite, typically begin on December 15, giving icebreaking assets one month before the scheduled closure of the Soo Locks on January 15. But this year the icebreaking operation was delayed until December 29, and the U.S. Coast Guard had four of its nine Great Lakes icebreakers in scheduled overhaul, scheduled maintenance, or unscheduled maintenance periods, according to the task force, and at one point in January, five of its eight icebreakers operating on the Great Lakes were simultaneously unavailable due to mechanical failures. A total of 68 icebreaking cutter days were lost due to equipment fires or engine breakdowns, the task force said.
>
> "The lives of the professional women and men sailing aboard lakers, the safety of the vessels and the protection of the environment depend on adequate Coast Guard icebreakers," said John Clemons, Great Lakes Maritime Task Force's Vice President and with American Maritime Officers, AFL-CI). "In recent years, vessels have been sliced open, forced aground or collided with each other because of inadequate icebreaking resources."
>
> "The Port of Duluth-Superior is the Great Lakes' top port by tonnage and one of the nation's top twenty, but the Coast Guard doesn't consider its waterways as 'Tier I' for icebreaking purposes," says Deb DeLuca, executive director, Duluth Seaway Port

[99] Transcript of hearing as posted at CQ.com.

Authority. "This is troubling given that Minnesota's docks along the western edge of Lake Superior provide the iron ore to produce 80 percent of the nation's first-pour steel. The

Head of the Lakes is a vital link in North America's domestic steel production supply chain."

"Adequate icebreaking not only supports the Great Lakes Navigation System, but it also prevents flooding," said Eric Peace, the Lake Carriers' Associations' Vice President and an experienced sailor. "Last February, we saw extensive flooding because of an ice dam in the St. Clair River. At the time the lone 'heavy' icebreaker operated by the Coast Guard was not available because it was undergoing repairs."[100]

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[100] Mike Schuler, "Lack of Coast Guard Icebreakers Disrupts Shipping on Great Lakes, Says Task Force," *gCaptain*, February 2, 2022. See also Julie Riddle, "Icebreaker Shortage Slows Deliveries to Alpena, Other Ports," *Alpena [MI] News*, February 3, 2022.