



Statement of

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Before

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Chairman Hunter, Ranking Member Garamendi, distinguished members of the subcommittee, thank you for the opportunity to appear before you today to discuss Coast Guard Arctic implementation capabilities. As requested, my testimony focuses on acquisition of polar icebreakers, and particularly on savings that could be realized in acquiring two polar icebreakers.

Portions of this statement are adapted from the CRS report on polar icebreaker modernization,¹ which was first published in February 2008 and has been updated periodically since then. For background information on the Coast Guard's polar icebreaker program, see **Appendix A** of this statement. For information on the idea of building Coast Guard polar icebreakers in a foreign shipyard, see **Appendix B**. For a general summary of acquisition lessons learned in Navy shipbuilding, see **Appendix C**.

Some Key Points Up Front

Some key points that can be made up front include the following:

- Given the potential need set forth in the June 2013 Department of Homeland Security (DHS) polar icebreaker Mission Need Statement (MNS) for a fleet of up to three heavy polar icebreakers and three medium polar icebreakers (i.e., “3+3”), the entry into service of the new polar icebreaker that the Administration wants to begin building in FY2020 would narrow but not necessarily close a potential gap in polar icebreaking capacity. Any remaining gap in capacity could be further narrowed by the entry into service of a second new polar icebreaker. The September 1, 2015, White House fact sheet stating that the Administration wants to begin building a new polar icebreaker in 2020 also states that the Administration will “begin planning for construction of additional icebreakers” beyond the one that the Administration wants to begin building in 2020.²
- There are various possible approaches for acquiring two or more new polar icebreakers. One approach, which might be viewed as a potential baseline or default approach, would be to build the ships several years apart from one another, contract for them separately, and purchase materials and components for them separately. A potential alternative approach would be to build the ships only a few (i.e., one or two or three) years apart from one another, contract for them together under a block buy contract, and carry out a combined purchase of materials and components for the two ships.
- Compared to the potential baseline or default approach outlined above, the potential alternative approach outlined above would compress the funding stream for the acquisition of two polar icebreakers into a smaller number of years, increasing average annual funding requirements, and reduce policymaker flexibility regarding whether and when to build the second ship, what design to build it to, and what shipyard to build it in. It would also likely get the second ship into service sooner, more quickly narrowing the potential gap in polar icebreaking capacity, and it could reduce the combined acquisition cost of the two ships by at least 5% (i.e., roughly \$100 million), and perhaps closer to 10% (i.e., closer to \$200 million).
- The Senate Appropriations Committee, in its report (S.Rept. 114-263 of May 26, 2016) on the FY2017 Department of Defense (DOD) Appropriations Act (S. 3000), recommends \$1 billion in the Navy's shipbuilding account for a new polar icebreaker.

¹ CRS Report RL34391, *Coast Guard Polar Icebreaker Modernization: Background and Issues for Congress*, by Ronald O'Rourke.

² The White House, “Fact Sheet: President Obama Announces New Investments to Enhance Safety and Security in the Changing Arctic,” September 1, 2015, accessed June 28, 2016, at <https://www.whitehouse.gov/the-press-office/2015/09/01/fact-sheet-president-obama-announces-new-investments-enhance-safety-and>.

This sum would more or less fully fund the acquisition of that ship. Alternatively, with congressional approval, an appropriation of \$1 billion could be used to partially fund a two-ship acquisition. Under this scenario, the \$1 billion would be used to develop the design, fund a combined purchase of materials and components for the two ships, and initiate shipyard construction activities on the first ship. The remainder of the funding for the two-ship acquisition would be provided in one or more fiscal years beyond FY2017.

- There are two options for temporarily narrowing a gap in polar icebreaking capability in the nearer term (i.e., prior to the entry into service of one or more new polar icebreakers). One would be to further extend the service life of *Polar Star* and/or repair and extend the service life of *Polar Sea*. The other would be to charter one or more foreign polar icebreakers, if such ships were available for charter. The United States has used both approaches in the past to mitigate polar icebreaking capacity gaps. Whether either of these approaches would be feasible and cost effective in coming years would need to be examined. The Coast Guard is currently examining the feasibility and potential cost effectiveness of either further extending the service life of *Polar Star* or repairing and extending the service life of *Polar Sea*.

DHS Polar Icebreaker Mission Need Statement

The June 2013 DHS polar icebreaker MNS states (emphasis added):

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

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

At a November 17, 2015, hearing before the Europe, Eurasia, and Emerging Threats subcommittee and the Western Hemisphere subcommittee of the House Foreign Affairs Committee, then-Vice Admiral Charles Michel, the Vice Commandant of the Coast Guard, stated in his prepared statement that “Polar icebreakers are critical to supporting key national priorities laid out in the National Security Presidential

³ Department of Homeland Security, *Polar Icebreaking Recapitalization Project Mission Need Statement, Version 1.0*, approved by DHS June 28, 2013, pp. 1, 9. As discussed in the CRS report on polar icebreaker modernization, although polar ice is diminishing due to climate change, observers generally expect that this development will not eliminate the need for U.S. polar icebreakers, and in some respects might increase mission demands for them. Even with the diminishment of polar ice, there are still significant ice-covered areas in the polar regions. Diminishment of polar ice could lead in coming years to increased commercial ship, cruise ship, and naval surface ship operations, as well as increased exploration for oil and other resources, in the Arctic—activities that could require increased levels of support from polar icebreakers. Changing ice conditions in Antarctic waters have made the McMurdo resupply mission more challenging since 2000. (See National Research Council, *Polar Icebreakers in a Changing World, An Assessment of U.S. Needs*, Washington, 2007, pp. 6-7, 14, 63.)

Directive on Arctic Region policy and the National Strategy for the Arctic Region.”⁴ During the discussion portion of the hearing, Michel testified that the “Coast Guard needs at least two heavy icebreakers to provide year-round assured access and self-rescueability in the polar regions.”⁵

At a June 14, 2016, hearing before this subcommittee, Admiral Michel testified that “our commandant also testified that we need self-rescue capability for our heavy icebreaker and that includes the existing *Polar Star* that we have out there now. So that means at least two, the High Latitude study says three heavy polar icebreakers is what the Coast Guard's requirement is. So that's kind of where we're talking about for heavy icebreakers.”⁶

Block Buy Contracting

Block buy contracting is one form of multiyear contracting; multiyear procurement (MYP) is another. The Navy in recent years has made extensive use of MYP and block buy contracting in its shipbuilding programs, and as a result has reduced its ship acquisition costs by billions of dollars. In contrast, the Coast Guard to date has not used block buy contracting or MYP in its ship acquisition programs.

The polar icebreaker program would not qualify for MYP because MYP cannot be used to acquire the lead ship in a class.⁷ The polar icebreaker program could, however, be considered for block buy contracting. The Navy has used block buy contracts to procure the first four Virginia (SSN-774) class attack submarines as well as 22 ships (units 5 through 26) in the Littoral Combat Ship (LCS) program, and on June 30, 2016, awarded a block buy contract for the first six ships in the John Lewis (TAO-205) oiler shipbuilding program, previously known as the TAO(X) program.⁸

Congress needs to approve each use of block buy contracting. Block buy contracts can be awarded competitively and can be fixed price contracts. From a congressional perspective, tradeoffs in making greater use of multiyear 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 shipbuilding programs in response to unforeseen changes in strategic or budgetary circumstances (which can cause any needed funding reductions to fall more heavily on programs not covered by multiyear contracts);
- a potential need to shift funding from later fiscal years to earlier fiscal years to fund up-front batch purchases of materials and components;⁹

⁴ Testimony of Vice Admiral Charles D. Michel, Vice Commandant, U.S. Coast Guard, on “Arctic Operations” Before the House Foreign Affairs Committee—Western Hemisphere & Europe, Eurasia, and Emerging Threats Subcommittees, November 17, 2015, p. 3.

⁵ Transcript of hearing.

⁶ Transcript of hearing.

⁷ Block buy contracting, unlike MYP, can be used at the outset of a shipbuilding program, starting with the lead ship in the class. MYP, in contrast, cannot be used until the lead ship has completed construction. This difference is due to the requirement under the statute governing MYP (10 U.S.C. 2306b) that a program must demonstrate design stability to qualify for MYP. In a shipbuilding program, design stability is typically demonstrated by completing the construction of the lead ship in the class.

⁸ For more on these programs, including their actual or planned use of block buy contracting, see CRS Report RL32418, *Navy Virginia (SSN-774) Class Attack Submarine Procurement: Background and Issues for Congress*, by Ronald O'Rourke, CRS Report RL33741, *Navy Littoral Combat Ship (LCS)/Frigate 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.

⁹ In MYP contracts, these up-front batch purchases are called economic order quantity (EOQ) purchases.

- the risk of having to make penalty payments to shipbuilders if multiyear contracts need to be terminated due to unavailability of funds needed for the continuation of the contracts; and
- the risk that materials and components purchased for ships to be procured in future years might go to waste if those ships are not eventually procured.

For additional background information on block buy contracting and MYP, see Appendix A of my testimony to this subcommittee of February 3, 2016¹⁰ and the CRS report on MYP and block buy contracting.¹¹

Potential Alternative Approaches for Acquiring Two Polar Icebreakers

There are various possible approaches for acquiring two or more new polar icebreakers. One approach, which might be viewed as a potential baseline or default approach, would be to build the ships several years apart from one another, contract for them separately, and purchase materials and components for them separately. A potential alternative approach would be to build the ships only a few (i.e., one or two or three) years apart from one another, contract for them together under a block buy contract, and carry out a combined purchase of materials and components for the two ships. Spacing the construction of two polar icebreakers closely together would not be new to Coast Guard polar icebreaker acquisition: Construction of *Polar Sea* began less than two years after construction began on *Polar Star*.¹²

Compared to the potential baseline or default approach for acquiring two polar icebreakers outlined above, the potential alternative approach outlined above would compress the funding stream for the acquisition of two polar icebreakers into a smaller number of years, increasing average annual funding requirements, and reduce policymaker flexibility regarding whether and when to build the second ship, what design to build it to, and what shipyard to build it in. It would also likely get the second ship into service sooner, more quickly narrowing the potential gap in polar icebreaking capacity, and it could reduce the combined acquisition cost of the two ships by at least 5% (i.e., roughly \$100 million), and perhaps closer to 10% (i.e., closer to \$200 million).

My testimony to this subcommittee on February 3, 2016, stated that “if using [block buy contracting] were to reduce the acquisition costs of a two-ship polar icebreaker program by about 5% (compared to costs under annual contracting), the combined savings on the two ships would amount to upwards of \$100 million.”¹³ The larger estimated savings cited in my testimony today—at least 5%, and perhaps closer to 10%—includes the savings of about 5% from using block buy contracting and a combined purchase of materials and components, plus additional savings from building the ships more closely together. **Table 1** summarizes the two acquisition approaches and the sources of savings.

¹⁰ Statement of Ronald O'Rourke, Specialist in Naval Affairs, Before House Transportation and Infrastructure Committee, Coast Guard and Maritime Transportation Subcommittee, Hearing on The Status of Coast Guard Cutter Acquisition Programs, February 3, 2016 (available as CRS Testimony TE10004, *The Status of Coast Guard Cutter Acquisition Programs*, by Ronald O'Rourke).

¹¹ CRS Report R41909, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, by Ronald O'Rourke and Moshe Schwartz

¹² *Polar Star's* keel was laid down on May 15, 1972; *Polar Sea's* keel was laid down on November 27, 1973. The ships were launched (i.e., put into the water for the final stages of construction) on November 17, 1973, and June 24, 1975, respectively, and commissioned into service on January 19, 1976, and February 23, 1978, respectively. Source: *Jane's Fighting Ships 1980-81*, p. 701.

¹³ CRS Testimony TE10004, *The Status of Coast Guard Cutter Acquisition Programs*, by Ronald O'Rourke, February 3, 2016, p. 6.

Table 1. Two Approaches for Acquiring Two New Polar Icebreakers

| | A potential baseline or default approach | A potential alternative approach | Sources of savings under potential alternative approach |
|---|--|--|--|
| Construction separation between ships | Construction of ships widely spaced—construction starts separated by several years | Construction of ships more closely spaced—construction starts separated by one or two or three years | Improved production learning curve (i.e., less loss of learning between first and second ship) |
| Contracting approach | Separate contracts | Single block buy contract | Shipyard optimizes work force and capital plant for a two-ship production run |
| Materials and components | Purchased separately for each ship | Combined purchase of at least some materials and components for both ships | Increased production economies of scale at material and component suppliers |
| Acquisition cost savings under potential alternative approach, compared to potential baseline or default approach | -- | At least 5%, and perhaps closer to 10% | |

Source: Table prepared by CRS.

If a shipyard that is awarded a contract to build one or more new polar icebreakers happens to be building other Coast Guard ships or Navy ships, the addition of the icebreaker work could marginally reduce the cost of those Coast Guard or Navy ships by absorbing some of the shipyard's fixed overhead costs. Any such savings could occur under either of the acquisition approaches shown in **Table 1**.

As an additional point relating to cost, it can be noted that while the Coast Guard's polar icebreaker industry data package¹⁴ includes a notional schedule for the program through FY2020, as well as a description of the ship's mission, top-level capability requirements, and design parameters, it does not include a target acquisition cost or a target annual operation and support (O&S) cost.

Funding Coast Guard Polar Icebreakers Through Navy's Shipbuilding Account

As noted in **Appendix A**, the Coast Guard's strategy for funding the acquisition of a new polar icebreaker appears to depend on having other federal agencies help pay for part of the ship's cost. There is some precedent for funding the acquisition of polar icebreakers through the Navy's shipbuilding account (i.e., the Shipbuilding and Conversion, Navy, or SCN, appropriation account within the DOD Budget): The acquisition of the Coast Guard's medium polar icebreaker, *Healy*, was funded largely through that account.¹⁵ It can also be noted that some new-construction oceanographic research ships operated by the

¹⁴ U.S. Coast Guard, Polar Icebreaker Industry Data Package, 24 pp., undated but released on January 13, 2016, accessed June 30, 2016, at: http://www.uscg.mil/ACQUISITION/icebreaker/pdf/PIBIndustryDataPackage_Feb2%20%28%29.pdf.

¹⁵ 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 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).

National Oceanic and Atmospheric Administration (NOAA—an agency within the Department of Commerce) have been funded through the Navy’s shipbuilding account.

The Senate Appropriations Committee, in its report (S.Rept. 114-263 of May 26, 2016) on the FY2017 DOD Appropriations Act (S. 3000), recommends \$1 billion in the Navy’s shipbuilding account for a new polar icebreaker. This sum would more or less fully fund the acquisition of that ship. Alternatively, with congressional approval, an appropriation of \$1 billion could be used to partially fund a two-ship acquisition. Under this scenario, the \$1 billion would be used to develop the design, fund a combined purchase of materials and components for the two ships, and initiate shipyard construction activities on the first ship. The remainder of the funding for the two-ship acquisition would be provided in one or more fiscal years beyond FY2017.

Options for Temporarily Narrowing a Polar Icebreaking Capacity Gap in Nearer Term

A polar icebreaker that begins construction in FY2020 might enter service in 2024 or 2025. Following refurbishment intended to extend its service life, *Polar Star* reentered service in December 2012 for a period of 7 to 10 years—a period that will end between December 2019 and December 2022. There are two options for temporarily narrowing a gap in polar icebreaking capability in the nearer term (i.e., prior to the entry into service of one or more new polar icebreakers). One would be to further extend the service life of *Polar Star* and/or repair and extend the service life of *Polar Sea*. The other would be to charter one or more foreign polar icebreakers, if such ships were available for charter. The United States has used both of these approaches in the past to mitigate polar icebreaking capacity gaps:

- In addition to the work done to extend the service life of *Polar Star* by an additional 7 to 10 years, the Coast Guard in the 1970s mitigated a polar icebreaking capacity gap by putting two of its older *Wind*-class icebreakers through a vessel rehabilitation and modernization (VRAM) program.¹⁶
- Since 2005, the National Science Foundation (NSF) has occasionally chartered foreign polar icebreakers—specifically, the Russian icebreakers *Krasin* and *Vladimir Ignatyuk*, and the Swedish icebreaker *Oden*—to help perform icebreaking missions in polar waters.¹⁷

Another \$50 million was rescinded by the Dire Emergency Supplemental Appropriations for Disaster Assistance, Food Stamps, Unemployment Compensation Administration, and Other Urgent Needs, and Transfers, and Reducing Funds Budgeted for Military Spending Act of 1990 (H.R. 4404/P.L. 101-302 of May 25, 1990). An additional \$59 million for the ship was then appropriated in the FY1992 DOD Appropriations Act (H.R. 2521/P.L. 102-172 of November 26, 1991). Also, an additional \$40.4 million in acquisition funding for the ship was provided through a series of annual appropriations in the Coast Guard’s AC&I account from FY1988 through FY2001. The resulting net funding for the ship was thus \$374.2 million, of which \$333.8 million, or 89.2%, was DOD funding, and \$40.4 million, or 10.8%, was Coast Guard acquisition funding. (Source: Undated Coast Guard information paper provided to CRS by Coast Guard legislative liaison office, March 3, 2016.)

¹⁶ See National Research Council, *Polar Icebreakers in a Changing World: An Assessment of U.S. Needs*, Washington, 2007, p. 55. See also Donald L. Canney, “Icebreakers and the U.S. Coast Guard,” accessed June 28, 2016, at: <http://www.uscg.mil/history/webcutters/Icebreakers.asp>.

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

Whether either of these approaches—extending the service life of *Polar Star* and/or *Polar Sea*, or chartering a foreign polar icebreaker—would be feasible and cost effective in coming years would need to be examined.

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

The Coast Guard states that it is studying the option of extending the service life of *Polar Sea* or *Polar Star*:

One of Coast Guard's two polar-class icebreakers (POLAR STAR) is operational following a reactivation in 2013 that provided an estimated 7-10 years of useful life. The second (POLAR SEA) is out of service and undergoing a Material Condition Assessment and an Alternatives Analysis to evaluate the feasibility of reactivation. To ensure the Nation is able to maintain heavy icebreaking capability until replacement assets are delivered, the Coast Guard is evaluating extending the service life of one of these icebreakers. Results from the Materiel Condition Assessment and Alternatives Analysis, planned for 2016, will inform selection of the candidate icebreaker. Funds requested [for FY2017] (\$3 million) [in the Survey and Design—Vessel and Boats line of the Coast Guard's AC&I account] will support the specification development for the reactivation/sustainment of the selected icebreaker.¹⁸

At a June 26, 2013, hearing before this subcommittee, Vice Admiral John P. Currier, the Vice Commandant of the Coast Guard, testified that repairing and reactivating *Polar Sea* for an additional 7 to 10 years of service would require about three years of repair work at a cost of about \$100 million.¹⁹

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

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

Arctic seasonal icebreaking demands through 2022 can be met with existing and planned Coast Guard assets, as current requirements do not justify the need for heavy icebreaking capability in the Arctic. Heavy icebreaker capability is needed to perform Operation Deep Freeze in Antarctica, but Coast Guard assets may not be the only option available to the National Science Foundation to support this activity. Although a second heavy icebreaker would provide redundancy, the cost of this redundant capability would come at the expense of more pressing and immediate operational demands. POLAR STAR, when fully reactivated, will provide heavy icebreaker capability until a new icebreaker can be delivered to meet both current and emerging requirements.²⁰

¹⁸ Department of Homeland Security, United States Coast Guard, *Fiscal Year 2017 Congressional Justification*, pp. CG-AC&I-29 and CG-AC&I-30 (pdf pages 171 and 172 of 407).

¹⁹ Transcript of hearing.

²⁰ U.S. Coast Guard, *USCGC POLAR SEA Business Case Analysis, 2103 Report to Congress*, November 7, 2013, p. 4. The report was accessed April 9, 2014, at http://assets.fiercemarkets.net/public/sites/govit/polarsea_businesscaseanalysis_nov2013.pdf. See also "Second Heavy Icebreaker Not Necessary Through 2022, Says Coast Guard," Fierce Homeland Security (<http://www.fiercehomelandsecurity.com>), January 19, 2014, which includes a link to the assets.fiercemarkets.net site at which

At a July 23, 2014, hearing before this subcommittee, Vice Admiral Peter Neffenger, the Vice Commandant of the Coast Guard, testified that “as I understand it, that \$100 million [estimate for reactivating *Polar Sea*] was a snapshot in time if we were to have begun at that point to reactivate the vessel. We believe that there’s been some additional deterioration [in the ship’s condition] in the 2.5 years it’s been sitting [at pier].... But I suspect that it will be something more than \$100 million once we do the assessment [of the ship’s condition].”²¹

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

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

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

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

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

That's why we're doing this full assessment, but we should know probably within a year from now, and what that will provide us is a floor. It will cost not less than, and I would never give an exact amount because it's not until you tear into this with an old ship in trying to find new parts and the like, those costs in all likelihood will grow over time.²²

At the June 14, 2016, hearing before this subcommittee, Admiral Michel testified that

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

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

And that's what I'd like to do is bridge out to that new construction icebreaker that I request the Congress' support and—and assistance in the president's budget request.²³

the report was posted.

²¹ Transcript of hearing.

²² Jacqueline Klimas, “Interview: Adm. Paul Zukunft, Coast Guard Commandant,” *Washington Examiner*, September 26, 2015. Material in brackets as in original.

²³ Transcript of hearing.

Chartering a Foreign Polar Icebreaker

The feasibility of the option of chartering a foreign polar icebreaker would depend on whether a polar icebreaker were available for charter at the time of the year when the United States would need it to perform desired missions in the Arctic or Antarctic. Foreign polar icebreakers like *Krasin*, *Vladimir Ignatyuk*, and *Oden*, mentioned above, are used by their own countries for polar icebreaking operations, and may not always be available for charter when the United States might want to use them.

If a foreign polar icebreaker were available for charter, the potential cost effectiveness of this option would then depend on the cost of the charter, the ability of the ship to perform U.S. polar icebreaker missions, and how these costs and capabilities compare to the option of extending the service life of *Polar Star* and/or *Polar Sea*.

The Coast Guard states that

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

This process came with risks, as there was no way to gauge icebreaker availability until NSF received responses to their RFP. Additionally, a foreign-flagged commercial or state vessel can become unavailable for a variety of environmental and political reasons. For example, the Swedish government abruptly terminated their contract during the spring/summer of 2011, and NSF was left without a platform to conduct its mission. NSF requested support from CGC HEALY, but it was employed in the Arctic. NSF ultimately leased the Russian icebreaker VLADIMIR IGNATYUK. After that incident, NSF decided to utilize CGC POLAR STAR to support the McMurdo mission, which it has been doing since 2013.²⁴

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

REPRESENTATIVE HUNTER (Chairman):

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

ADMIRAL MICHEL:

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

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

HUNTER:

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

(UNKNOWN)

²⁴ Source: Email from Guard Office of Congressional Affairs to CRS, July 8, 2016.

Mm-hmm.

HUNTER:

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

MICHEL:

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

HUNTER:

Yeah.

MICHEL:

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

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

When I talked to the shipbuilders over there, they said there is not a vessel like that that currently exists that will meet those requirements in the—in the FedBizOpps technical package. So you'd have to build a vessel like that. And that's the type of vessel that we're looking for.²⁵

Mr. Chairman, this concludes my statement. Thank you again for the opportunity to testify, and I will be pleased to respond to any questions the subcommittee may have.

²⁵ Transcript of hearing.

Appendix A. Coast Guard Polar Icebreaker Program

This appendix presents background information on the Coast Guard's program for acquiring a new polar icebreaker. It is adapted from the CRS report on polar icebreaker modernization.

Overview

The Coast Guard's proposed FY2017 budget requests \$150 million in acquisition funding for a new polar icebreaker that the Coast Guard wants to begin building in FY2020. The Coast Guard's FY2017-FY2021 five-year Capital Investment Plan (CIP) includes a total of \$780 million in acquisition funding for a new polar icebreaker, including the \$150 million requested for FY2017, \$200 million projected for FY2019 and FY2020, and \$430 million projected for FY2021. The total acquisition cost of the ship has not been officially estimated but might be roughly \$1 billion, including design costs.

The project to acquire a new polar icebreaker was initiated in the Coast Guard's FY2013 budget submission. The project has received about \$15.6 million in acquisition funding through FY2016, including \$7.609 million in FY2013, \$2.0 million in FY2014, zero in FY2015, and \$6.0 million in FY2016. The \$150 million requested for FY2017 is the first major increment of acquisition funding requested for the ship and would fund planning design activities required to begin production of the ship in FY2020.

Desired Capabilities for New Polar Icebreaker

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

- an ability to break through 6 feet of ice at 3 knots (threshold) or 8 feet of ice at three knots (objective);²⁶
- an ability to break through ridged ice of 21 feet;
- an ability to operate without replenishment (i.e., resupply) for 80 days (threshold) or 90 days (objective); and
- an ability to exchange voice and data with DHS, Coast Guard, Defense Department units, and other stakeholders.²⁷

Additional desired capabilities include the following:

- an ability to operate for a total of 3,300 hours (the equivalent of 137.5 days) per year (threshold) or a total of 4,050 hours (the equivalent of 168.75 days) per year (objective);
- an operational availability (i.e., percentage of time available for operation) of 85% (threshold) or 92% (objective); and
- a space and weight allowance for accommodating a communication workspace (objective) or an installed communication workspace (threshold).²⁸

²⁶ The terms *threshold* and *objective* are acquisition terms. Threshold can be translated roughly as minimum required capability. Objective can be translated roughly as maximum or preferred capability (if feasible and affordable).

²⁷ Coast Guard polar icebreaker program industry day briefing entitled "Polar Icebreaker (PIB) Acquisition Program Industry Engagement," slide 23, accessed April 4, 2016, at <http://www.uscg.mil/ACQUISITION/icebreaker/pdf/Industry%20Day%2018%20March%202016.pdf>.

²⁸ Coast Guard polar icebreaker program industry day briefing entitled "Polar Icebreaker (PIB) Acquisition Program Industry Engagement," slide 32, accessed April 4, 2016, at <http://www.uscg.mil/ACQUISITION/icebreaker/pdf/Industry%20Day%2018%20March%202016.pdf>.

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

- the ability to conduct long-range, high-endurance, independent operations with heavy icebreaking capability;
- flexibility in personnel support spaces and systems;
- interoperability to support interagency and interservice mission execution.²⁹

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

- features for improved reliability, maintainability, supportability, operational availability, and system redundancy;
- features for meeting modern environmental standards;
- features for improved ship control;
- features for modern human habitability and human systems integration; and
- space, weight, and power margins (i.e., growth margin) for accepting specialized capabilities.³⁰

Notional Program Schedule

The Coast Guard's notional schedule for the program, which could change, shows a draft Request for Proposals (RFP) being released in the first quarter of FY2017, a final RFP being released in the fourth quarter of FY2017 or the first quarter of FY2018, Coast Guard evaluation of received proposals taking place from the third or fourth quarter of FY2018 through the third or fourth quarter of FY2019, a contract award being made in the third or fourth quarter of FY2019, and construction of the ship beginning in the third or fourth quarter of FY2019.³¹

Strategy of Using Funding Contributions from Other Agencies

The Coast Guard's strategy for funding the acquisition of a new polar icebreaker appears to depend on having other federal agencies help pay for part of the ship's cost. The Coast Guard's website for the polar icebreaker acquisition project states:

A new, heavy polar icebreaker will be designed to meet the requirements of multiple government stakeholders that require access to and presence within the polar regions. In order to appropriately fund the acquisition of a new polar icebreaker, a "whole-of-government" funding approach is necessary to acquire this national asset.³²

²⁹ Coast Guard polar icebreaker program industry day briefing entitled "Polar Icebreaker (PIB) Acquisition Program Industry Engagement," slide 24, accessed April 4, 2016, at <http://www.uscg.mil/ACQUISITION/icebreaker/pdf/Industry%20Day%2018%20March%202016.pdf>.

³⁰ Coast Guard polar icebreaker program industry day briefing entitled "Polar Icebreaker (PIB) Acquisition Program Industry Engagement," slide 26, accessed April 4, 2016, at <http://www.uscg.mil/ACQUISITION/icebreaker/pdf/Industry%20Day%2018%20March%202016.pdf>.

³¹ Coast Guard polar icebreaker program industry day briefing entitled "Polar Icebreaker (PIB) Acquisition Program Industry Engagement," slide 14, accessed April 4, 2016, at <http://www.uscg.mil/ACQUISITION/icebreaker/pdf/Industry%20Day%2018%20March%202016.pdf>.

³² U.S. Coast Guard, "Polar Icebreaker," accessed April 4, 2016, at <http://www.uscg.mil/acquisition/icebreaker/default.asp>.

Funding Requested in FY2013-FY2017 Submissions

FY2013 Submission

The Administration's FY2013 budget submission initiated a new project for the design and construction of a new polar icebreaker, and included \$860 million over five years for the acquisition of the ship (**Table 2**)—enough or almost enough to fully fund the acquisition of a new polar icebreaker. (Any remaining needed funding might have been projected for FY2018 and perhaps also FY2019, which were beyond the five-year window of the FY2013 budget submission.) The submission stated that DHS anticipated awarding a construction contract for the ship “within the next five years” (i.e., by FY2018) and taking delivery on the ship “within a decade” (i.e., by 2023).³³

FY2014 Submission

The Administration's FY2014 budget submission reduced the five-year funding for a new polar icebreaker to \$230 million (**Table 2**)—a 73% reduction from the figure in the FY2013 budget submission—but still stated that DHS anticipated awarding a construction contract for the ship “within the next four years” (i.e., by FY2018).³⁴

FY2015 Submission

The Administration's FY2015 budget submission maintained five-year funding for a new polar icebreaker at \$230 million (**Table 2**), but did not state when a construction contract for the ship might be awarded, creating uncertainty about the timing of the project.³⁵

FY2016 Submission

The Administration's FY2016 budget submission, submitted to Congress in February 2015, reduced five-year funding for a new polar icebreaker further, to \$166 million (**Table 2**)—an 81% reduction from the figure in the FY2013 budget submission—and again did not state when a construction contract for the ship might be awarded, maintaining the uncertainty about the timing of the project.³⁶

On September 1, 2015, the White House issued a fact sheet in conjunction with a visit to Alaska by President Obama indicating that the Administration, in its own internal planning, had at some point over the past two years deferred acquisition of a new polar icebreaker to FY2022, but that this has now been changed to FY2020.³⁷ The newly announced construction start date of FY2020 is a two-year acceleration

³³ U.S. Department of Homeland Security, *Annual Performance Report, Fiscal Years 2011-2013*, p. CG-AC&I-40 (pdf page 1,777 of 3,134).

³⁴ Department of Homeland Security, United States Coast Guard, *Fiscal Year 2014 Congressional Justification*, p. CG-AC&I-32 (pdf page 204 of 403).

³⁵ Department of Homeland Security, United States Coast Guard, *Fiscal Year 2015, Congressional Justification*, p. CG-AC&I-42 (pdf page 196 of 474).

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

³⁷ The White House, “Fact Sheet: President Obama Announces New Investments to Enhance Safety and Security in the Changing Arctic,” September 1, 2015, accessed September 2, 2015, at <https://www.whitehouse.gov/the-press-office/2015/09/01/fact-sheet-president-obama-announces-new-investments-enhance-safety-and>. Regarding icebreakers, the fact sheet states:

Accelerating the acquisition of new Coast Guard icebreakers. After World War II, the United States Coast Guard had seven icebreakers in its fleet—four under the U.S. Navy and three under the U.S. Coast Guard. Today, the United States technically has three icebreakers in its fleet—all under the command of the U.S. Coast Guard. However, when age and reliability are taken into account, the fleet is down to the

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

On January 13, 2016, the Coast Guard announced that it intended to hold an industry day for the polar icebreaker program, followed by one-on-one meetings between the Coast Guard and prospective shipbuilders and ship designers, as a part of the Coast Guard’s ongoing market research for the program.³⁸ The industry day was held on March 18, 2016, and the one-on-one meetings between the Coast Guard and industry officials were scheduled for March 28-31, with industry feedback to be submitted to the Coast Guard by April 5, 2016.³⁹

FY2017 Submission

The Coast Guard’s proposed FY2017 budget requests \$150 million in acquisition funding for a new polar icebreaker that the Coast Guard wants to begin building in FY2020. The figure of \$150 million includes \$147.6 million in the polar icebreaker line of the Coast Guard’s Acquisition, Construction, and Improvements (AC&I) account, and \$2.4 million that is embedded in the personnel and management line in the AC&I account.⁴⁰ The Coast Guard’s FY2017-FY2021 five-year Capital Investment Plan (CIP) includes a total of \$780 million in acquisition funding for a new polar icebreaker, including the \$150 million requested for FY2017, \$200 million projected for FY2019 and FY2020, and \$430 million projected for FY2021.

As shown in **Table 2**, the \$150 million requested for FY2017 is the first major increment of acquisition funding requested (not just projected for a future fiscal year) for a new polar icebreaker. The Coast Guard states that the requested \$150 million

Funds completion of programmatic planning documents and award of a contract for Detail Design and all other design activities leading to commencement of production activities for a heavy polar-class icebreaker by 2020. To maintain an accelerated acquisition schedule, the 2017 request forward funds acquisition activities to occur through 2019. The availability of these funds will give Coast Guard maximum flexibility to implement an optimal acquisition approach....

equivalent of two fully functional icebreakers and only one heavy-duty icebreaker. Russia, on the other hand, has forty icebreakers and another eleven planned or under construction.

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

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

³⁸ “USCG Polar Class Icebreaker Replacement Program,” accessed January 15, 2016, at <https://www.fbo.gov/index?s=opportunity&mode=form&id=a778c49349c443d2658666e19cc100e9&tab=core&tabmode=list&=>.

³⁹ “Heavy Polar Icebreaker Industry Engagement Activities,” accessed April 4, 2016, at http://www.uscg.mil/ACQUISITION/icebreaker/Industry_Day_031816.asp.

⁴⁰ Department of Homeland Security, United States Coast Guard, *Fiscal Year 2017 Congressional Justification*, pp. CG-AC&I-28 and CG-AC&I-47 (pdf pages 170 and 189 of 407).

Activities in FY 2017 will focus on completion of programmatic planning documents and issue of the Request for Proposal (RFP) for Detail Design.⁴¹

Table 2. Funding for Acquisition of New Polar Icebreaker Under FY2013-FY2017 Budget Submissions

(millions of then-year dollars)

| | FY13 | FY14 | FY15 | FY16 | FY17 | FY18 | FY19 | FY20 | FY21 | 5-year total |
|---------------|------|------|------|------|------|------|------|------|------|--------------|
| FY2013 budget | 8 | 120 | 380 | 270 | 82 | | | | | 860 |
| FY2014 budget | | 2 | 8 | 100 | 20 | 100 | | | | 230 |
| FY2015 budget | | | 6 | 4 | 100 | 20 | 100 | | | 230 |
| FY2016 budget | | | | 4 | 10 | 2 | 100 | 50 | | 166 |
| FY2017 budget | | | | | 150 | 0 | 50 | 150 | 430 | 780 |

Source: Table prepared by CRS based on Coast Guard FY2013-FY2017 budget submissions.

Notes: For each line in the table, the first figure shown (e.g., \$8 million in the case of the FY2013 budget) is the amount of funding that was requested for that fiscal year. Actual funding figures for FY2013-FY2016 are as follows: \$7.609 million in FY2013; \$2.0 million in FY2014; zero in FY2015; and \$6.0 million in FY2016, for a total of \$15.609 million for the period FY2013-FY2016.

The FY2017 requested figure of \$150 million includes \$147.6 million in the polar icebreaker line of the Coast Guard's Acquisition, Construction, and Improvements (AC&I) account, and \$2.4 million that is embedded in the personnel and management line in the AC&I account. The projected figures for FY2018-FY2021 include only funding in the polar icebreaker line.

Actual Prior-Year Funding in FY2013-FY2016

In each line of **Table 2**, the first figure shown (e.g., \$8 million in the case of the FY2013 budget) is the amount of funding that was requested for that fiscal year. Actual funding figures for FY2013-FY2016 are as follows: \$7.609 million in FY2013; \$2.0 million in FY2014; zero in FY2015; and \$6.0 million in FY2016, for a total of \$15.609 million for the period FY2013-FY2016.

⁴¹ Department of Homeland Security, U.S. Coast Guard, *Fiscal Year 2017 Congressional Justification*, p. CG-AC&I-47 (pdf page 189 of 407).

Appendix B. Building U.S. Coast Guard Polar Icebreakers in a Foreign Shipyard

This appendix presents background information on the idea of building U.S. Coast Guard polar icebreakers in a foreign shipyard. Some observers believe the acquisition cost of U.S. Coast Guard polar icebreakers could be reduced, perhaps substantially, by building them in a foreign shipyard, such as a yard in one of the Nordic countries that is experienced in building icebreakers. Shipyards in Finland reportedly are interested in building polar icebreakers for the U.S. Coast Guard.⁴²

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.⁴³ Two other laws, however, are of note in connection with the idea of building a U.S. Coast Guard polar icebreaker in a foreign shipyard. One is 14 U.S.C. 665, which states:

§665. Restriction on construction of vessels in foreign shipyards

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

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

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

§7309. Construction of vessels in foreign shipyards: prohibition

(a) Prohibition.-Except as provided in subsection (b), no vessel to be constructed for any of the armed forces,⁴⁴ and no major component of the hull or superstructure of any such vessel, may be constructed in a foreign shipyard.

⁴² See, for example, Jim Paulin, “Finland Wants In On US Icebreaker Investment,” *Alaska Dispatch News*, September 8, 2015.

⁴³ 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.

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

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

(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).

Appendix C. A Summary of Some Acquisition Lessons Learned for Navy Shipbuilding

A general summary of lessons learned in Navy shipbuilding, reflecting comments made repeatedly by various sources over the years, includes the following:⁴⁵

- **At the outset, get the operational requirements for the program right.** Properly identify the program's operational requirements at the outset. Manage risk by not trying to do too much in terms of the program's operational requirements, and perhaps seek a so-called 70%-to-80% solution (i.e., a design that is intended to provide 70%-80% of desired or ideal capabilities). Achieve a realistic balance up front between operational requirements, risks, and estimated costs.
- **Impose cost discipline up front.** Use realistic price estimates, and consider not only development and procurement costs, but life-cycle operation and support (O&S) costs.
- **Employ competition** where possible in the awarding of design and construction contracts.
- **Use a contract type that is appropriate for the amount of risk involved,** and structure its terms to align incentives with desired outcomes.
- **Minimize design/construction concurrency** by developing the design to a high level of completion before starting construction and by resisting changes in requirements (and consequent design changes) during construction.
- **Properly supervise construction work.** Maintain an adequate number of properly trained Supervisor of Shipbuilding (SUPSHIP) personnel.
- **Provide stability for industry,** in part by using, where possible, MYP or block buy contracting.
- **Maintain a capable government acquisition workforce** that understands what it is buying, as well as the above points.

Identifying these lessons is not the hard part—most if not all these points have been cited for years. The hard part is living up to them without letting circumstances lead program-execution efforts away from these guidelines.

⁴⁵ Material in this appendix is adapted from Statement of Ronald O'Rourke, Specialist in Naval Affairs, Congressional Research Service, Before the House Armed Services Committee on Case Studies in DOD Acquisition: Finding What Works, June 24, 2014, pp. 8-9. A version also appeared in Statement of Ronald O'Rourke, Specialist in Naval Affairs, Before House Armed Services Committee, Seapower and Projection Forces Subcommittee, Hearing on Acquisition Efficiency and the Future Navy Force, December 1, 2015, p. 25 (available as CRS Testimony TE10001, *Acquisition Efficiency and the Future Navy Force*, by Ronald O'Rourke).

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