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REVIEW OF RECENT GAO REPORTS ON ICEBREAKER ACQUISITION AND THE NEED FOR A NATIONAL MARITIME STRATEGY

(115–57)

HEARING

BEFORE THE

SUBCOMMITTEE ON
COAST GUARD AND MARITIME TRANSPORTATION

OF THE

COMMITTEE ON
TRANSPORTATION AND
INFRASTRUCTURE
HOUSE OF REPRESENTATIVES

ONE HUNDRED FIFTEENTH CONGRESS

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CONTENTS

Page

Summary of Subject Matter iv

WITNESSES

Rear Admiral Mark H. Buzby, U.S. Navy (Ret.), Administrator, Maritime Administration:
Oral statement 4
Prepared statement 6
Rear Admiral Michael J. Haycock, Assistant Commandant for Acquisition and Chief Acquisition Officer, U.S. Coast Guard:
Oral statement 7
Prepared statement 9
Marie A. Mak, Director of Contracting and National Security Acquisitions, U.S. Government Accountability Office:
Oral statement 10
Prepared statement 12
Andrew Von Ah, Director of Physical Infrastructure, U.S. Government Accountability Office:
Oral statement 20
Prepared statement 22
Ronald O'Rourke, Specialist in Naval Affairs, Congressional Research Service:
Oral statement 27
Prepared statement 29

PREPARED STATEMENTS SUBMITTED BY MEMBERS OF CONGRESS

Hon. John Garamendi of California 3

Committee on Transportation and Infrastructure
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November 21, 2018

SUMMARY OF SUBJECT MATTER

TO:	Members, Subcommittee on Coast Guard and Maritime Transportation
FROM:	Staff, Subcommittee on Coast Guard and Maritime Transportation
RE:	Hearing on "Review of Recent GAO Reports on Icebreaker Acquisition and the Need for a National Maritime Strategy"

PURPOSE

The Subcommittee on Coast Guard and Maritime Transportation will hold a hearing on Thursday, November 29, 2018, at 10:00 a.m. in 2253 Rayburn House Office Building to review recent Government Accountability Office reports on icebreaker acquisition and the need for a National Maritime Strategy. The Subcommittee will hear testimony from the United States Coast Guard (Coast Guard or Service), the Maritime Administration (MARAD), the Government Accountability Office (GAO), and the Congressional Research Service (CRS).

BACKGROUND

Government Accountability Office

The GAO is the audit, evaluation, and investigative arm of Congress which exists to support Congress in meeting its constitutional responsibilities and to improve the performance and accountability of the federal government for the American people.[1] The GAO examines the use of public funds, evaluates federal programs and policies, and provides analysis, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions.[2] Congress can mandate GAO action through legislation or request GAO action through a Member request letter.

[1] Page 74, Coast Guard Acquisitions – Polar Icebreaker Program Needs to Address Risk before Committing Resources (GAO-18-600), September 2018.
[2] Ibid

Reports

Coast Guard Acquisitions – Polar Icebreaker Program Needs to Address Risk before Committing Resources (GAO-18-600)

This report was released in September 2018 in response to section 122 of the National Defense Authorization Act for Fiscal Year 2018 (P.L. 115-91). The report directed GAO to assess issues related to the procurement of new icebreaker vessels.

Currently, the Coast Guard has two polar icebreaker vessels in operation, a heavy and a medium icebreaker. A heavy icebreaker can break through six feet of ice continuously at three knots. The Nation's only operational heavy polar icebreaker, Coast Guard Cutter (CGC) POLAR STAR, is 40 years old. The primary mission of CGC POLAR STAR is breaking a channel through the sea ice in the Ross Sea of the Southern Ocean off Antarctica to resupply the McMurdo Research Station. Its sister vessel, CGC POLAR SEA, has been inactive since 2010 due to major propulsion casualties. The Coast Guard operates a medium icebreaker, CGC HEALY, which can break through 4.5 feet of ice continuously at three knots. CGC HEALY, the Nation's only operational medium polar icebreaker, is 23 years old. CGC HEALY is primarily used to support scientific research in the Arctic and is also capable of performing search and rescue and other missions in the Arctic seasonally.

For much of the past decade, the Coast Guard has been talking about the need to recapitalize its icebreaker fleet, but did not show movement toward that goal until 2016.[3] The Department of Homeland Security (DHS) approved the Polar Icebreaker Operational Requirements Document in January 2016. In February 2017, the Service awarded industry studies to five U.S. shipyards with technical capabilities to build icebreakers[4]. The Coast Guard received industry technical proposals and pricing proposals in mid-July and early fall 2018, respectively. The Service plans to award a Detail Design and Construction contract in fiscal year (FY) 2019, with desired delivery of the first new icebreaker in the fourth quarter of FY 2023.

The recently released GAO report (GAO-18-600) notes that DHS did not have a sound business case in March 2018, when it established the cost, schedule, and performance baselines for its heavy polar icebreaker (HPIB) acquisition program. GAO found four risk areas:

[3] Ronald O'Rourke, "Coast Guard Polar Security Cutter (Polar Icebreaker) Program: Background and Issues for Congress", CRS Report RL 34391 (October 26, 2018).

[4] The contracts were awarded to: Bollinger Shipyards, LLC (Lockport, Louisiana); Fincantieri Marine Group, LLC (Washington, District of Columbia); General Dynamics/National Steel and Shipbuilding Company (San Diego, California); Huntington Ingalls, Inc. (Pascagoula, Mississippi); and VT Halter Marine, Inc. (Pascagoula, Mississippi). https://www.dcms.uscg.mil/Our-Organization/Assistant-Commandant-for-Acquisitions-CG-9/Newsroom/icebreaker022217/

- Program baselines were set before the Coast Guard conducted a preliminary design review, which puts the program at risk of having an unstable design and increasing program cost and schedule risks.
- A technology readiness assessment was not conducted by the Coast Guard to determine maturity of key technologies before setting baselines.
- The cost estimate did not quantify the range of possible costs over the entire life cycle of the program, compromising its reliability and potentially underestimating the total funding needed for the program.
- The planned delivery dates were driven by the potential gap in icebreaking capabilities instead of being informed by realistic assessment of shipbuilding activities.

GAO made six recommendations for executive action by the Commandant of the Coast Guard and one recommendation for DHS Under Secretary for Management. DHS concurred with all six GAO recommendations:

- GAO Recommendation 1: The Commandant should direct the polar icebreaker program to conduct a technology readiness assessment in accordance with best practices for evaluating technology readiness before detail design of the lead ship begins.
  - DHS Response: The Coast Guard Acquisition Directorate is conducting a tailored technical readiness assessment date with an estimated completion date of June 30, 2019.

- GAO Recommendation 2: The Commandant, in coordination with the Secretary of the Navy, should direct the polar icebreaker program to update the HPIB cost estimate in accordance with best practices for cost estimation before the option for construction of the lead ship is awarded.
  - DHS Response: The Coast Guard Acquisition Directorate is conducting a tailored technical readiness assessment to update the HPIB cost estimate with an estimated completion of June 30, 2019.

- GAO Recommendation 3: The Commandant should direct the polar icebreaker program to develop a program schedule in accordance with best practices for project schedules before the option for construction of the lead ship is awarded.
  - DHS Response: The Coast Guard Acquisition Directorate will update the program schedule within three months of the Detail Design and Construction contract award and before awarding construction, as appropriate, with an estimated completion date of September 30, 2019.

- GAO Recommendation 4: The Commandant should direct the polar icebreaker program office to analyze and determine appropriate schedule risks that could affect the program after construction of the lead ship begins to include in the risk management plan and develop appropriate risk management strategies.
  - DHS Response: The Coast Guard Acquisition Directorate is conducting a tailored technical readiness assessment to analyze and determine schedule risks with an estimated completion of June 30, 2019.

- GAO Recommendation 5: The Commandant, in coordination with the Secretary of the Navy, should update financial management and budget execution appendix of the memorandum of agreement between the Coast Guard and the Navy to detail how each organization will address any and all cost growth on the HPIB program.
  - DHS Response: Coast Guard and Navy officials are in the process of reviewing the July 2017 budget agreement to clarify the definition of cost overruns which should be completed by March 30, 2019.

- GAO Recommendation 6: The DHS Under Secretary should require the Coast Guard to update the HPIB acquisition program baselines prior to authorizing lead ship construction, after completion of the design review, and after information is updated on its technologies, cost, and schedule.
  - DHS Response: DHS Management Directorate Office of Program Accountability and Risk Management officials are in the process of updating acquisition policy to require key technical reviews prior to approving final acquisition program baselines.

In November 2018, GAO released a study assessing a June 2018 Navy report on the Navy's capabilities in the Arctic.[5] The study found that the Navy and Department of Defense (DoD) align in the current assessment of low risk for conflict in the Arctic. Even though the Navy has significant limitations for operating surface ships in the Arctic, the Navy stated that there are currently no capability gaps that require them to ice-harden existing vessels or construct ice-capable vessels. The Navy's traditional surface combatant ships are not designed to operate in icy waters, although some of the Navy's T-class ships have capability to operate in light or broken first-year ice. In addition, the study notes that DoD officials that stated the U.S. right to operate in the Arctic can be demonstrated outside of Navy surface ships, such as through Coast Guard vessels, Navy submarines, or military aircraft.[6]

Maritime Security – DOT Needs to Expeditiously Finalize the Required National Maritime Strategy for Sustaining U.S.-Flag Fleet (GAO-18-478)

This report responded to a request by the Chairman of the House Committee on Rules, Congressman Pete Sessions (R-TX), and Congressman Mark Sanford (R-SC). In this report, released in August 2018, GAO reviewed:

- the effects of U.S. government support for the international trading U.S.-flag fleet on defense needs and other government programs;
- the sustainability challenges, if any, the international trading U.S.-flag fleet faces in meeting national defense needs;
- the status of the mandated national sealift and maritime strategies, and options the Department of Transportation considered to address any challenges related to sustaining the international trading U.S.-flag fleet.

[5] Arctic Planning – Navy Report to Congress Aligns with Current Assessments of Arctic Threat Levels and Capabilities Required to Execute DOD's Strategy (GAO-19-42), November 2018.
[6] Page 12, Ibid

There are over 41,000 U.S. flagged vessels. However, only 81 are currently employed in international commerce between U.S. and foreign ports (e.g., U.S. foreign trade).[7] Over the last 35 years, the number of U.S. flagged vessels sailing in the foreign trade dropped from 850 to 81 vessels. Within the international U.S. flag fleet, 60 vessels are enrolled in the Maritime Security Program (MSP).[8] Under this program, militarily useful oceangoing commercial vessels receive annual operating stipends of $5 million through FY 2020 to provide military sealift for the United States Transportation Command within the Department of Defense (DoD). The GAO report noted that, according to 2010 and 2013 mobility studies, 60 MSP vessels meet DoD's stated capacity needs. The National Defense Authorization Act for Fiscal Year 2018 (P.L. 115-91) requires DoD to complete a new mobility study by September 30, 2018. This study has not been released.

In addition to MSP, the U.S. government supports the international trading U.S.-flag fleet through cargo preference laws that require federal agencies to transport certain percentages of government-impelled cargo on U.S.-flag vessels. The GAO report noted that food aid advocates have questioned the economic efficiency of food aid shipments being used to support the U.S.-flag fleet for defense purposes. Officials with U.S. Agency for International Development (USAID) and U.S. Export-Import Bank (EXIM Bank) raised concerns that cargo preference requirements increase shipping costs and negatively affect their missions. Concerns were raised regarding the use of U.S.-flag vessels with limited military utility to transport 57 percent of food aid. In contrast, DoD and MARAD reiterate that a key aspect of supporting the U.S.-flag fleet, regardless of the military utility of the vessel, is to ensure a sufficient pool of mariners to operate vessels for defense sea lift purposes.

A MARAD report estimated the availability of approximately 11,768 qualified U.S. citizen mariners which is 1,839 less than the 13,607 mariners necessary for sustained operation (i.e., exceeding six months) of the reserve and commercial fleet.[9] The Subcommittee held a hearing on January 17, 2018, that reviewed the MARAD report and assessed the data limitations between the Coast Guard and MARAD that may be understating the extent of the potential mariner shortage.[10]

In 2014, Congress issued two mandates to the Secretary of Transportation. The first was to develop a national maritime strategy to support U.S.-flag vessel competitiveness (P.L. 113-281) no later than February 2015 and the second was for the Secretary to work with DoD to develop a national sealift strategy to ensure the long-term viability of the U.S. Merchant Marine (P.L. 113-76). A draft strategy that combined the two mandates was developed in 2016 by the Obama Administration. That draft has been under review by the Trump Administration but has not been released or submitted to Congress by the Secretary. The National Defense Authorization Act for Fiscal Year 2019 (P.L. 115-232) extended the deadline for the Administration to submit the maritime strategy to February, 2020.

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[7] U.S. Department of Transportation Maritime Administration United States Flag Privately-Owned Merchant Fleet Report November 2017

[8] This program is authorized under Chapter 531 of title 46, United States Code.

[9] U.S. Department of Transportation, Maritime Administration, Maritime Workforce Working Group Report (Washington, D.C., Sept. 29, 2017).

[10] https://transportation.house.gov/calendar/eventsingle.aspx?EventID=402105

The lack of a national maritime strategy has hindered MARAD and Department of Transportation (DOT) efforts to identify options to address the competitiveness of the U.S.-flag fleet and the long-term viability of the U.S. Merchant Marine. While the draft report has been under review, MARAD has identified some options to address those goals in other reports[11]:

- Reduce time and costs of bringing vessels under the U.S. flag;
- Implement tax reforms, including mariner income tax and liability insurance reform and eliminating the tax on U.S.-flag vessels receiving maintenance overseas;
- Increase the volume of government cargo carried on U.S.-flag vessels (e.g., energy export commodities such as oil or liquefied natural gas);
- Increase the MSP stipend; and
- Develop a broad-based reserve program.

Until a final national maritime strategy is released, MARAD and DOT officials are not yet ready to formally propose actions to address any of these issues. GAO recommends the Secretary of Transportation: (1) complete the national strategy; and (2) establish and provide to Congress a timeline by which the strategy document will be issued. DOT agreed with that recommendation.

WITNESS LIST

Rear Admiral Michael J. Haycock
Assistant Commandant for Acquisition & Chief Acquisition Officer
United States Coast Guard

Rear Admiral Mark H. Buzby, USN, Ret.
Administrator
Maritime Administration

Ms. Marie A. Mak
Director of Acquisition and Sourcing Management
Government Accountability Office

Mr. Andrew Von Ah
Director of Physical Infrastructure Issues
Government Accountability Office

Mr. Ronald O'Rourke
Specialist in Naval Affairs
Congressional Research Service

[11] Department of Transportation, Maritime Administration, Maritime Administration Strategic Plan Navigating the Future 2017-2021 and U.S. Department of Transportation, Maritime Administration, Maritime Workforce Working Group Report (Washington, D.C., Sept. 29, 2017).

REVIEW OF RECENT GAO REPORTS ON ICEBREAKER ACQUISITION AND THE NEED FOR A NATIONAL MARITIME STRATEGY

THURSDAY, NOVEMBER 29, 2018

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON COAST GUARD AND MARITIME TRANSPORTATION,
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE,
Washington, DC.

The subcommittee met, pursuant to call, at 10:02 a.m., in room 2253, Rayburn House Office Building, Hon. Brian J. Mast (Chairman of the subcommittee) presiding.

Mr. MAST. The subcommittee will come to order.

Without objection, the Chair is authorized to declare a recess at any time.

Sorry we had to squeeze you all in here like this. You all are severely outnumbering Mr. Garamendi and myself.

Mr. GARAMENDI. But think about the opportunities next year: a new, reconditioned room.

Mr. MAST. I think you are certainly finding the silver lining.

Mr. GARAMENDI. In the meantime we suffer.

Mr. MAST. Yeah.

All right. Today the subcommittee will hear testimony on two recent reports by the Government Accountability Office, GAO. The GAO conducts reviews and audits to provide information for Congress to perform its oversight functions in order to improve the performance and accountability of the Federal Government.

Today we review reports that discuss the Coast Guard's icebreaker acquisition program and the need for the Department of Transportation to release the National Maritime Strategy.

The Coast Guard is in the process of procuring the first new heavy icebreakers in over 40 years. Icebreakers are essential for Coast Guard operations in the Arctic and the Antarctic. They are critical to maintaining U.S. interests in these regions.

The three heavy polar icebreakers the Coast Guard says it needs are estimated to cost approximately $9.8 billion throughout their life cycle. In such an important and costly acquisition program, congressional oversight is absolutely needed to ensure the program is on time and on budget.

However, GAO found that the estimates for the cost, schedule, and performance baselines for the icebreaker acquisition program do not follow standard best practices. The National Academies of Sciences study expressed similar concerns last year.

The subcommittee is particularly interested to learn if the Coast Guard intends to wisely complete design of the first polar icebreaker before beginning construction or to imprudently start construction while design work is going on.

This subcommittee has been a strong supporter of the icebreaker acquisition program and we will continue to conduct oversight to ensure the program is a success.

The second GAO report focuses on the need for the Department of Transportation to release the National Maritime Strategy. Congress required this strategy to be completed by 2015, but 3 years after that deadline the Secretary still has not released it. The National Defense Authorization Act for fiscal year 2019 extended that deadline for the Secretary to submit the strategy to February of 2020.

This strategy is critical to addressing the challenges facing the U.S.-flag fleet, including the potential shortage of U.S. mariners and the decreasing number of U.S.-flag vessels.

As a maritime nation, the U.S. needs to address these challenges now. I can assure you that I do understand firsthand the importance of having sufficient maritime assets to get U.S. forces and their supplies to where they need to be.

I do thank the witnesses for being here today, and I look forward to hearing their testimony on all of these issues.

I will now yield to the ranking member, Mr. Garamendi, for 5 minutes to make any opening statement that he may have.

Mr. GARAMENDI. I thank you, Mr. Chairman. I am looking forward to working with you, at least for some while, and then we will see where the world takes us.

By the way, we did a good piece of work 2 days ago.

Mr. MAST. Yeah.

Mr. GARAMENDI. For the third session in a row the Coast Guard reauthorization was done in a timely way. And so for the staff, John and David and for others that are involved in that, well done. We ought to make it four and five and six. Should we make that our goal? And under your ranking membership?

Mr. MAST. That is right.

Mr. GARAMENDI. And thank you for taking the chairmanship.

I am wandering, but I am really happy with what has been done around here. So let me just go through this.

For the Government Accountability Office, thank you.

Coast Guard, Maritime Administration, thank you for being here. Thank you for your work.

Bottom line, we are going to make these icebreakers—excuse me, Polar Security Cutters—happen. That is going to take place, and it is going to take place on time, on budget, and that is our goal.

Throughout this Congress this subcommittee has focused on oversight of what the Coast Guard has done, and we intend to continue to do so. The acquisition program, a lot of progress has been made on acquisition programs.

In this respect, significant acquisition programs have risen to the level of importance within the office of the Coast Guard to replace its aging fleet of polar icebreakers with a new generation of Polar Security Cutters. New acronym: PSCs. Are we ready for that? OK.

Generally, collaboration within the Coast Guard and Navy Integrated Program Office [IPO] appears to have enabled the successful development of solid requirements, produced a cost-conscious iterative design, and accelerated delivery time for the first of the six new PSCs.

Of course, the GAO has raised concerns—it is their job to do so—especially that the IPO may have underestimated the risks.

Moreover, the GAO contends that the IPO has been overly optimistic in its ability of the Congress to provide stable funding. Wrong. There is $7.2 billion in the defense budget.

The defense of the Arctic cannot take place without a PSC. All it takes is $1 billion out of that $7.12 billion to complete this project.

Am I clear about what at least this person intends to do?

In addition, CRS has noted that the PSC program could benefit from using different contracting methods, such as a block buy—I just told you how we can fund it—and a multiyear contract, which I just told you how we can fund it, to increase the affordability and efficiency across the program. We are going to have a robust discussion about getting this done.

Before Admiral Buzby thinks I have forgotten about him——

Admiral BUZBY. Never, sir.

Mr. GARAMENDI [continuing]. I want to learn from him where the Trump administration is.

I would suggest that the committee, beginning the next year, subpoena the Director of the Office of Management and Budget. Therein lies the problem. That is why we do not have Admiral Buzby's report. It is stuck right there.

And so, Mr. Mulvaney, the question is yours. Why we do not have this is in his hands. And we will see.

I have a written thing here. I am going to run out of time very quickly, Tom, and I don't want you to admonish me about being longwinded. But there are things that can be done and must be done. We need that report. And I am terribly impatient.

So we have the Ready Reserve Fleet. We have other opportunities. We need to get at it.

I will yield back at that point. Thank you.

[Mr. Garamendi's prepared statement follows:]

Prepared Statement of Hon. John Garamendi of California

Thank you, Mr. Chairman, I am looking forward to this morning's discussion of two recent reports released by the Government Accountability Office (GAO). Allow me to welcome our witnesses from the Coast Guard, the Maritime Administration, the GAO, and the Congressional Research Service (CRS).

Throughout this Congress this subcommittee has focused its oversight on what the Coast Guard has done, and intends to do, to improve its acquisition programs, principally to keep them on budget and to deliver new assets and equipment according to schedule.

In this respect, few acquisition programs rise to the level of importance of the Coast Guard's effort to replace its aged fleet of polar icebreakers with a new generation of Polar Security Cutters, or PSCs.

Generally, collaboration within the joint Coast Guard/Navy Integrated Program Office (IPO) appears to have enabled the successful development of solid requirements, produced a cost-conscious iterative design, and accelerated the delivery timetable for the first of six new PSCs.

Of course, GAO has raised concerns, especially that the IPO may have under-estimated risks. Moreover, GAO contends that the IPO has been overly optimistic in the ability of the Congress to provide stable funding over the life of the program, and raise questions about the ability of U.S. shipyards to construct these complex vessels under tight time constraints.

In addition, CRS has noted that the PSC program could benefit from using different contracting methods, such as block-buy and multiyear contracts, to increase affordability and efficiency across the program. I intend to have a robust discussion of all these points.

Before Admiral Buzby thinks that I have forgotten him, I will want to learn from him where the Trump administration stands on producing a National Maritime Strategy as required by law.

As Admiral Buzby well knows, you cannot steer a vessel without a rudder. Well, at present, we have no National Maritime Policy. As such, we are left rudderless and drifting without a clear course of action to steer by.

A whole host of issues, such as sustaining military sealift capacity, recapitalizing the Ready Reserve fleet, and replenishing the pool of licensed and unlicensed U.S. seafarers, to name just a few, must be addressed, and must be addressed now!

The development of a National Maritime Strategy, while four years overdue, remains imperative, and I look forward to hearing from Admiral Buzby regarding his views on the administration's progress in developing this seminal plan. Thank you.

Mr. MAST. Thank you, Mr. Garamendi.

Our witnesses today are Rear Admiral Mark H. Buzby, Administrator of Maritime Administration; Rear Admiral Michael J. Haycock, Assistant Commandant for Acquisition and Chief Acquisition Officer for the Coast Guard; Ms. Marie Mak, Director of Contracting and National Security Acquisitions at the Government Accountability Office; Mr. Andrew Von Ah, Director of Physical Infrastructure at the Government Accountability Office; Mr. Ronald O'Rourke, Specialist in Naval Affairs at the Congressional Research Service.

I ask unanimous consent that our witnesses' full statement be included in the record.

Without objection, so ordered.

Since your written testimony has been made a part of the record, the subcommittee would request that you limit your oral testimony for 5 minutes. Thank you all for taking the time to be here.

Admiral Buzby, you are recognized to give your statement.

TESTIMONY OF REAR ADMIRAL MARK H. BUZBY, U.S. NAVY (RET.), ADMINISTRATOR, MARITIME ADMINISTRATION; REAR ADMIRAL MICHAEL J. HAYCOCK, ASSISTANT COMMANDANT FOR ACQUISITION AND CHIEF ACQUISITION OFFICER, U.S. COAST GUARD; MARIE A. MAK, DIRECTOR OF CONTRACTING AND NATIONAL SECURITY ACQUISITIONS, U.S. GOVERNMENT ACCOUNTABILITY OFFICE; ANDREW VON AH, DIRECTOR OF PHYSICAL INFRASTRUCTURE, U.S. GOVERNMENT ACCOUNTABILITY OFFICE; AND RONALD O'ROURKE, SPECIALIST IN NAVAL AFFAIRS, CONGRESSIONAL RESEARCH SERVICE

Admiral BUZBY. Good morning. Thank you, Chairman Mast, Ranking Member Garamendi, members of the subcommittee. Thank you for this opportunity to testify about the need for a National Maritime Strategy.

In August of this year, the United States Government Accountability Office completed a report on maritime security examining the role of U.S.-flag commercial vessels in supporting Department of Defense sealift needs. The report recommended that the Depart-

ment of Transportation should complete a national strategy for sustaining the U.S.-flag fleet, a recommendation with which the Department of Transportation concurs.

The 2014 Coast Guard Act directed DOT to produce a strategy identifying which Federal regulations and policies reduce the competitiveness of U.S.-flag vessels in international trade. That strategy would also assess the impact of reduced cargo flow due to restrictions in the United States Armed Forces stationed overseas, as well as provide recommendations for making U.S.-flag vessels more competitive in international trade.

A comprehensive National Maritime Transportation Strategy will serve the Maritime Administration's mission to foster, promote, and develop the U.S. maritime industry to meet the Nation's economic and security needs. A critical part of this mission is ensuring the availability of U.S. ships, and qualified merchant mariners to crew those ships, to deploy military forces around the world to meet DoD sealift requirements.

When the United States goes to war, 90 percent of DoD cargo is moved with a strategic sealift fleet consisting of Government-owned ships and the commercial U.S.-flagged fleet.

The GAO report also reviewed the impact of the Government's support for a U.S.-flag fleet on national defense needs, the challenges of sustaining the U.S.-flag fleet for defense needs, as well as the status of the National Maritime Strategy. It concluded that while U.S. Government support for commercial sealift indeed helps meet national defense needs, the rise in operating costs and a decline in Government cargo volumes hamper the ability of U.S.-flag commercial ships to compete in international trade.

This has resulted in a decline in U.S.-flag ships trading internationally and in the number of available jobs for U.S. merchant mariners, all of which compromises our Nation's ability to crew Government-owned reserve ships in a large-scale war or crisis.

Finally, GAO concluded that the lack of a coherent, comprehensive National Maritime Transportation Strategy hinders effective policymaking on the complex issue of Government support for the U.S.-flag fleet.

Given that the 18 Federal agencies and numerous other stakeholders are involved, MARAD has taken profuse steps to ensure that all voices are heard. Since Congress directed MARAD to develop this comprehensive strategy, we have met extensively with the full spectrum of public and private stakeholders representing all maritime industry professions, sectors, and regions.

The draft strategy was placed into interagency review under the prior administration. It was subsequently withdrawn by the current administration so they could have the opportunity to review, revise, and align the strategy accordingly.

Congress recently passed the fiscal year 2019 National Defense Authorization Act, which extended the deadline of this strategy to February 2020. We appreciate this extension, which will allow us to better align the National Maritime Strategy with the administration's National Security Strategy and National Defense Strategy. MARAD is using the additional time afforded by Congress to further collaborate with stakeholders to refine the strategy's goals.

I appreciate this subcommittee's interest in seeing the National Maritime Strategy completed and for your continued support of the U.S. merchant marine. I am happy to respond to any questions you have, sir.

[Admiral Buzby's prepared statement follows:]

Prepared Statement of Rear Admiral Mark H. Buzby, U.S. Navy (Ret.), Administrator, Maritime Administration

Good morning, Chairman Mast, Ranking Member Garamendi, and members of the subcommittee. Thank you for this opportunity to testify about the need for a National Maritime Strategy.

In August of this year, the U.S. Government Accountability Office (GAO) completed a report on maritime security, which examined the role U.S.-flag commercial vessels play in supporting Department of Defense (DoD) sealift needs.[1] GAO recommended that the Department of Transportation (DOT) should complete the national maritime strategy and establish and provide to Congress a timeline by which the strategy document will be issued as required in the Howard Coble Coast Guard and Maritime Transportation Act of 2014 (2014 Coast Guard Act), P.L. 113–281. DOT concurred with GAO's recommendation. Subsequent to the publication of this report, Congress passed and the President signed the John S. McCain National Defense Authorization Act for Fiscal Year (FY) 2019 (P.L. 115–232), which extended the deadline of this strategy to February 2020. This extension affords the Administration the opportunity to align the National Maritime Strategy with other Administration strategy documents.

The 2014 Coast Guard Act directed DOT, in consultation with the U.S. Coast Guard (USCG), to produce a strategy that identifies Federal regulations and policies that reduce the competitiveness of U.S.-flag vessels in international trade and the impact of reduced cargo flow due to reductions in United States Armed Forces stationed overseas. In addition, the strategy must include recommendations to make U.S.-flag vessels more competitive in international trade.

Developing a National Maritime Strategy will help the Maritime Administration (MARAD) accomplish its mission to foster, promote, and develop the U.S. maritime industry to meet the Nation's economic and security needs. MARAD had embarked on a strategy development effort prior to passage of the 2014 Coast Guard Act. While the 2014 Coast Guard Act requirements are included in the scope of the statute, because of the evolving nature of the industry, it is important to develop a strategy that can serve the government and industry over the long term. A critical part of this mission is ensuring the availability of U.S. ships, and qualified merchant mariners to crew those ships, to meet DoD sealift requirements. DoD relies on these strategic sealift capabilities to efficiently and effectively deploy military forces around the world. When the United States goes to war, DoD's U.S. Transportation Command moves 90 percent of its cargo requirements with the strategic sealift fleet, which consists of government-owned ships augmented by the commercial U.S.-flagged fleet.[2] A key issue MARAD faces in carrying out its mission includes simultaneously coordinating access to shipping services to meet commercial demands, with potentially overlapping DoD sealift requirements, and other national emergency needs that involve this limited fleet of U.S.-flag vessels. In addition to this important work, the people of MARAD must work with the interagency and direct focus on improving the Nation's lagging competitiveness in port and intermodal freight infrastructure. The National Maritime Strategy is aimed at addressing all of these challenges.[3]

In its report, GAO reviewed: (1) The effect the U.S. government's support for the U.S.-flag fleet has had on national defense needs and other government programs; (2), the challenges identified by stakeholders in sustaining the U.S.-flag fleet for defense needs; and, (3) the status of the National Maritime Strategy. GAO concluded

[1] Maritime Security, DOT Needs to Expeditiously Finalize the Required National Maritime Strategy for Sustaining U.S.-Flag Fleet, GAO–18–478, August 2018.

[2] General Darren W. McDew, United States Air Force Commander, U.S. Transportation Command, Statement before the Senate Armed Services Committee on the State of Command, April 10, 2018, page 8.

[3] The National Maritime Strategy will address requirements from the 2014 Coast Guard Authorization Act, as well as fulfill a directive from the fiscal year Consolidated Appropriations Act, P.L. 113–76, requiring DOT, in collaboration with DoD, to develop a national sealift strategy that ensures the long-term viability of the U.S. Merchant Marine.

that although U.S. Government support for commercial sealift helps meet national defense requirements, operating cost increases unique to the U.S. flag and a decline in government impelled cargo volumes have challenged the ability of U.S.-flag commercial ships to remain economically viable in international trade. As demand for U.S.-flag ships in international trade has declined in recent years in response to these pressures, the number of ships and associated jobs available to U.S. citizen merchant mariners continues to decline. In turn, MARAD's ability to identify qualified volunteer mariners to crew Government-owned reserve ships in the event of a large-scale war or emergency is more challenging. GAO concluded that the continued lack of a National Maritime Strategy limits decisionmakers' ability to make policy choices related to these challenges in a comprehensive way that considers the complex issues related to the government support that is currently required to retain the U.S.-flag fleet. To reverse the continued long-term decline of the American fleet, the National Maritime Strategy must also seek to enhance U.S. maritime competitiveness to a degree sufficient enough to generate and sustain growth in commercial demand for U.S.-flag shipping.

MARAD is conscious of the time it has taken to develop the strategy since Congress directed that it be done in 2014. In this time, MARAD has conducted extensive engagement with public and private stakeholders representing the full spectrum of maritime industry professions, sectors, and regions. As the U.S. Committee on the Marine Transportation System (CMTS) notes, there are 18 Federal Agencies and numerous public stakeholders with a role in maritime transportation issues. Each of these Agencies is an important stakeholder and their input is critical to address both the challenge involved in developing a strategy for the U.S. merchant marine that can garner wide-spread support and the importance of developing a long-term strategy to address future needs. As you may be aware, the draft strategy was placed into review under the prior Administration. It was subsequently withdrawn by the current Administration so that they could have an opportunity to review, revise, and align the strategy accordingly. We appreciate that Congress provided an extension on this requirement to allow us to best align this strategy with the Administration's National Security Strategy and National Defense Strategy. MARAD has not stood idle during this interim period. We are using the extension afforded by Congress as an opportunity to further collaborate with stakeholders to refine goals of the strategy and produce an effective National Maritime Strategy.

I appreciate this subcommittee's continued support for the U.S. merchant marine and look forward to working with you to address the challenges facing the U.S. maritime industry and take advantage of opportunities to enhance and improve the U.S. maritime transportation system.

I am happy to respond to any questions you may have.

Mr. MAST. Thank you, Admiral Buzby.

Admiral Haycock, you are recognized for your statement.

Admiral HAYCOCK. Good morning, Mr. Chairman, Ranking Member Garamendi, and distinguished members of the subcommittee. On behalf of the Commandant and the U.S. Coast Guard, I would like to thank you for this opportunity to highlight our efforts to recapitalize a key component of the national fleet and acquire a new class of Polar Security Cutters that will meet our mission requirements in the polar regions.

I would also like to extend our thanks and our appreciation for the hard work that you put in earlier this week when you passed the Coast Guard Authorization Act of 2018. There are some provisions in there that will benefit us in our major acquisition programs.

I would like to respectfully request that my written testimony be entered into the record.

Mr. MAST. Without objection, so ordered.

Admiral HAYCOCK. The Coast Guard's current icebreaking fleet provides minimal capacity to carry out current icebreaking missions in the polar regions and does not facilitate uninhibited access or self-rescue. To ensure access and project sovereign presence in the high latitudes, the Nation must take swift action to rebuild and enhance this national capability.

The United States is an Arctic nation and an Antarctic principal with substantial political, national security, natural resource, environment, and other interests in the polar regions. The Coast Guard and the Nation need a fleet of Polar Security Cutters that can not only break through the barriers that stand in the way of our access to the polar regions in our areas of responsibility, but can also execute the full range of maritime security, safety, and stewardship missions once they arrive on site.

As outlined by the Commandant, the Coast Guard is focused on a 6–3-1 approach to recapitalize the polar icebreaking fleet. That is six icebreakers, three of them with heavy-duty icebreaking capability and one being needed immediately. The Service plans to build these six icebreakers to provide multimission capability in high latitudes.

We are moving out on an accelerated program to provide these national assets quickly and as affordably as we can. And to that end, we established an Integrated Program Office with the Navy to leverage each Service's experience and lessons learned across similar shipbuilding programs. Over the past 2 years we have pursued a number of strategies to reduce program risk, including a comprehensive review and validation of operational requirements and an extensive industry study strategy with five U.S. shipyards to inform development of the system specification.

This past March we released a solicitation for detailed design and production of up to three Polar Security Cutters. Source selection is ongoing, and we are on track to award a design to one U.S. shipyard this fiscal year.

With the continued support of the administration and Congress, we are as close as we have ever been in the last 40 years to recapitalizing our old polar icebreaking fleet.

I am pleased to testify alongside with Ms. Mak from GAO. The Coast Guard continues to benefit from our collaborative relationship with GAO, and the recent GAO report on the polar icebreaking program highlights the work by the Coast Guard and the Navy Integrated Program Office to mature the designs and technologies while setting realistic cost and schedule estimates.

As noted in the report, the Integrated Program Office has complied with the Department of Homeland Security's acquisition directives and policies, and we have leveraged the Navy's expertise to develop an independent cost estimate to guide the acquisition decisions. DHS, the Coast Guard, and the Navy have concurred with each of the recommendations in the GAO report, and we are collectively moving forward to address each item with the timeline noted in the Department's response letter.

We understand the urgency expressed by the administration and Congress, and there is no doubt that we are operating on a challenging schedule to replace the Nation's aging polar icebreaking fleet. However, we are confident that our acquisition approach and our risk reduction efforts will position the Integrated Program Office to deliver the first Polar Security Cutter as soon as possible. And prudence demands that we continue investing in a modernized Coast Guard, and your support has helped us make the tremendous progress that we have achieved.

I thank you for the opportunity to testify before you today. I look forward to your continued support of the men and women in the Coast Guard. And I look forward to your questions. Thank you, sir.

[Admiral Haycock's prepared statement follows:]

Prepared Statement of Rear Admiral Michael J. Haycock, Assistant Commandant for Acquisition and Chief Acquisition Officer, U.S. Coast Guard

Good morning Chairman Mast, Ranking Member Garamendi, and distinguished members of the subcommittee. I appreciate the opportunity to testify today and thank you for your enduring support of the United States Coast Guard.

The Coast Guard offers unique and enduring value to the Nation. A branch of the Armed Forces at all times, our combination of broad authorities and complementary capabilities squarely align with the President's national security and economic prosperity priorities. The Coast Guard is also a Federal law enforcement agency, a regulatory body, a first responder, and a member of the U.S. Intelligence Community, which uniquely position the Service to help secure the maritime border, combat transnational criminal organizations (TCOs), facilitate and safeguard commerce on America's waterways, and protect our national interests in the Polar Regions.

RECAPITALIZATION OF THE NATION'S POLAR FLEET

The United States is an Arctic nation and Antarctic principal with substantial political, national security, natural resource, environmental, and other interests in both Polar Regions. The Coast Guard has been the lead Federal agency in assuring surface access to the Polar Regions since 1965, meeting the Nation's most critical mission needs in the Arctic and Antarctic. The Coast Guard's current polar icebreaking fleet provides minimal capacity to carry out current icebreaking missions and does not provide uninhibited access, continuous presence, or self-rescue. To ensure access and sovereign presence in the high latitudes, the Nation must take swift action to rebuild and enhance this critical national capability.

We have established an Integrated Program Office (IPO) with the Navy to leverage each service's experience and lessons learned across similar shipbuilding programs. Program roles and responsibilities for each service are well defined, and the acquisition is following established processes and procedures under the Department of Homeland Security's (DHS) acquisition framework while incorporating Navy best practices.

The IPO leveraged extensive industry studies with five U.S. shipyards to identify and reduce potential acquisition, technology and production risks and to inform development of the system specification. This effort significantly enhanced our understanding of the state of the market and the capabilities of the industrial base. In conjunction with the DHS Science and Technology Directorate, the Naval Surface Warfare Center Carderock and the Canadian National Research Council, the IPO conducted extensive modeling and simulation (M&S) of Polar Security Cutter hulls and propulsion systems, which validated our "Indicative Design". The combined industry studies and M&S efforts identified cost and resource savings and provided the framework to minimize the negative effects of potential risks.

With the support of the Administration and Congress, we are making significant progress toward building new Polar Security Cutters. This past March, we released a request for proposal (RFP) as a full and open competition, and we are on track to award a Detail Design and Construction (DD&C) contract in fiscal year for the construction of up to three heavy Polar Security Cutters. We are as close as we have been in over 40 years to recapitalizing our polar icebreaking fleet; continued investment **now** is vital to solidifying our standing as an Arctic nation and affirms the Coast Guard's role in providing assured access to the Polar Regions for decades to come.

Given the state of our heavy icebreaker fleet, recapitalization cannot be delayed and must be carried out expeditiously. As highlighted in the 2017 National Security Strategy, China and Russia challenge American power, influence, and interests, attempting to erode American security and prosperity. This is increasingly the case in the Polar Regions. The ongoing rapid expansion of China's icebreaker fleet is a bellweather to its ambition as a Polar power. In order to maintain American leadership in this vital arena, acquisition of the Polar Security Cutter must also account for the pace at which China is surging past the United States.

GAO REVIEW OF THE POLAR ICEBREAKER PROGRAM

The Coast Guard continues to benefit from our collaborative relationship with the Government Accountability Office (GAO). The recent GAO report on the Polar Icebreaker, renamed the "Polar Security Cutter," acquisition program highlights the work by the IPO to develop mature designs and technologies and set realistic cost and schedule estimates. As noted in the report, the IPO has complied with DHS acquisition directives and policies and leveraged the Navy's expertise to develop an independent cost estimate to guide acquisition decisions.

The IPO has adopted an acquisition strategy designed to maximize competition by inviting industry to propose a design that meets the government's operational requirements and to constrain the government's cost risk through the use of a fixed price contract. This approach leverages lessons learned from recent Coast Guard acquisition programs, including the Offshore Patrol Cutter program, as well as similar Navy shipbuilding programs.

The Polar Security Cutter solicitation directs offerors to use proven, state of the market technologies and components in their proposals to minimize design risk. Under the Polar Security Cutter contract, the selected shipyard will mature the proposed design further during the detail design process, and a stable design will be achieved and approved prior to the start of construction of the first Polar Security Cutter. To guide development of industry technical and price proposals for DD&C, the IPO provided an estimated cost for the government's indicative design—a representative design that meets key performance parameters—at an average price of $615 million per ship for design and construction of a three-ship acquisition.

As part of the study, GAO made six recommendations for action by DHS, the Coast Guard and the Navy. We concurred with each of the recommendations, and we are collectively moving forward on addressing each item along the timeline noted in the Department's response letter.

CONCLUSION

Coast Guard mission readiness requires an ability to execute our full suite of missions in the present while simultaneously making the investments necessary to meet mission demands in the future. There is no doubt that we are operating on a challenging schedule to replace the Nation's aging polar icebreaker fleet; however we are confident that our acquisition approach and the risk reduction measures that we have already taken position the IPO to deliver the first PSC on the current schedule. Prudence demands we continue investing in a modernized Coast Guard, and your support has helped us make tremendous progress.

Thank you for the opportunity to testify before you today and for all that you do for the men and women of the Coast Guard. I look forward to your questions.

Mr. MAST. Thank you, Admiral Haycock.

Ms. Mak, you are recognized for your statement.

Ms. MAK. Good morning, Chairman Mast, Ranking Member Garamendi, and members of the subcommittee. Thank you for inviting me here today to discuss the Coast Guard's acquisition of the Polar Security Cutter.

In our report that we issued in September, we found that the Coast Guard has not yet established a sound business case for the program. A solid business case is achieved when there is a balance between the concept you are trying to build and the available resources you have to build it.

The resources and the associated risks we covered in our report include design, technology maturity, cost, and schedule. We made several recommendations to address each of these key risk areas, all of which DHS and the Coast Guard agreed with and have already initiated efforts to address.

With that said, two risk areas that I would like to highlight today are, first, the need to develop a realistic schedule that takes into account risks that are inherent to shipbuilding programs, particularly unique shipbuilding programs like the Polar Security Cutter; and second, the importance of understanding the maturity of

key technologies before awarding the contract for detailed design of the cutter.

Specifically with regards to schedule, in our review this summer we noted that the Coast Guard's planned delivery dates were optimistic because it was not informed by a realistic assessment of shipbuilding activities. Instead, the schedule was 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.

Having visited the *Polar Star* this summer, I give much credit to the Coast Guard crew for doing everything possible to keep that cutter operational to resupply the McMurdo Station in Antarctica. While we all agree with the Coast Guard that it is critical to proceed as quickly as possible, to replace the *Polar Star*, it has to be done with a realistic schedule.

An overly optimistic schedule does not provide decisionmakers with reasonable timeframes of when the replacement cutters will be operational. This puts pressure on the Coast Guard to potentially take short cuts, which in the long run can end up costing more time and money than taking the time to do things right the first time upfront.

Second, our work found that while the Coast Guard completed design studies, ice trials, and spoke to industry on key technologies, they did not systematically assess the maturity and risk associated with these technologies.

Given that this type of icebreaker has not been built in the U.S. for over four decades and that it has unique requirements to operate in extreme conditions, such as being able to traverse both poles year round, we believe it is important to not underestimate the effort required to develop the cutter's technologies.

The best way to address this is for an independent objective group to assess the maturity of each technology, which then lays out the potential risks and allows the Coast Guard to put in place appropriate mitigation strategies.

It is encouraging that DHS and the Coast Guard have already initiated efforts to address our concern in this area, especially since we have found that technologies often have a ripple effect on the overall design, cost, and schedule of an acquisition.

Much of our prior acquisition shipbuilding work has found that lead ships routinely exceed cost and schedule targets and do not meet planned performance goals. This is because shipbuilding programs typically start with a weak business case. Specifically, these programs do not fully assess risks and have unrealistic cost, schedule, and performance goals.

In line with our recommendations from the icebreaker report, the Coast Guard needs to ensure that it has developed all the elements of a sound business case before making future investments. This is important for ensuring continuity between the aging legacy asset, the *Polar Star*, and the new Polar Security Cutter so any additional capability gaps are minimized.

Chairman Mast, Ranking Member Garamendi, members of the subcommittee, this completes my prepared statement. I would be pleased to respond to any questions that you may have. Thank you.

[Ms. Mak's prepared statement follows:]

Prepared Statement of Marie A. Mak, Director of Contracting and National Security Acquisitions, U.S. Government Accountability Office

COAST GUARD ACQUISITIONS: ADDRESSING KEY RISKS IS IMPORTANT TO SUCCESS OF POLAR ICEBREAKER PROGRAM

Chairman Mast, Ranking Member Garamendi, and members of the subcommittee: I am pleased to be here today to discuss key challenges the Coast Guard faces with its heavy polar icebreaker acquisition program. The Coast Guard, a component within the Department of Homeland Security (DHS), is developing the first heavy polar icebreakers it has bought in over 40 years. The Coast Guard, in collaboration with the Navy, plans to invest up to $9.827 billion for the acquisition, operation, and maintenance of three heavy polar icebreakers over their entire 30-year lifecycle. In March 2018, the Navy released a solicitation that included options for the detail design and construction of three polar icebreakers. The Navy anticipates awarding the contract to a single shipbuilder in the third quarter of fiscal year 2019. As the *Polar Star*—the Coast Guard's only operating heavy polar icebreaker—nears the end of its service life, the new icebreakers will play a critical role in the Coast Guard's ability to ensure year-round access to the Arctic and Antarctic, which affects U.S. economic, maritime, and national security interests in these regions.

My statement today will address (1) key acquisition risks facing the polar icebreaker program and (2) funding uncertainties for the program. This statement is based primarily on our April and September 2018 reports examining the Coast Guard's polar icebreaker acquisition, as well as drawing from our extensive body of work examining the Coast Guard's and the Navy's shipbuilding efforts.[1] For the reports cited in this statement, among other methodologies, we analyzed Coast Guard and Navy guidance, data, and documentation, and interviewed Coast Guard and Navy officials. Detailed information on our scope and methodology can be found in the reports cited in this statement.

We conducted the work on which this statement is based in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

THE COAST GUARD DID NOT ESTABLISH A SOUND BUSINESS CASE FOR THE POLAR ICEBREAKER PROGRAM

In September 2018, we found the Coast Guard did not have a sound business case when it established the acquisition baselines for its polar icebreaker program in March 2018 due to risks in four main areas—design, technology, cost, and schedule.[2] Our prior work has found that successful acquisition programs start with solid, executable business cases before setting program baselines and committing resources.[3] 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.

At the heart of a business case is a knowledge-based approach. We have found that successful shipbuilding programs build on attaining critical levels of knowledge at key points in the shipbuilding process before significant investments are made (see figure 1).

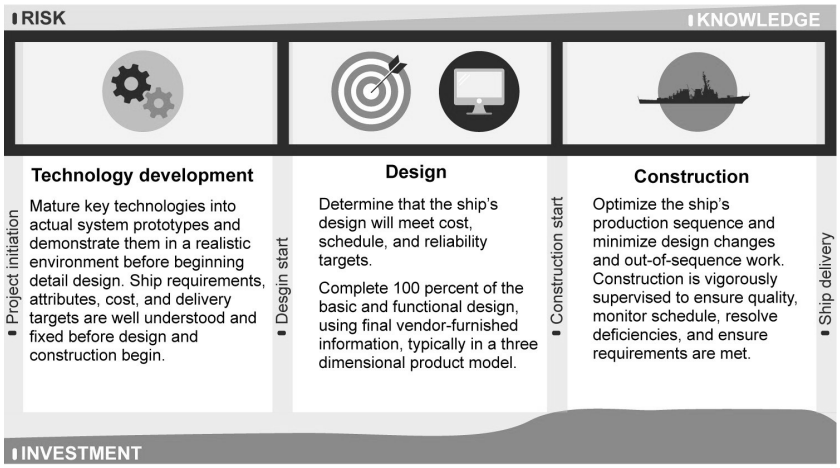
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[1] GAO, *Coast Guard Acquisitions: Polar Icebreaker Program Needs to Address Risks before Committing Resources*, GAO–18–600 (Washington, DC.: Sept. 4, 2018); and *Coast Guard Acquisitions: Status of Coast Guard's Heavy Polar Icebreaker Acquisition*, GAO–18–385R (Washington, DC.: Apr. 13, 2018).

[2] GAO–18–600.

[3] GAO, *Navy Shipbuilding: Past Performance Provides Valuable Lessons for Future Investments*, GAO–18–238SP (Washington, DC.: June 6, 2018); *Weapon System Requirements: Detailed Systems Engineering Prior to Product Development Positions Programs for Success*, GAO–17–77 (Washington, DC.: Nov. 17, 2016); *Best Practices: High Levels of Knowledge at Key Points Differentiate Commercial Shipbuilding from Navy Shipbuilding*, GAO–09–322 (Washington, DC.: May 13, 2009); and *Defense Acquisitions: Realistic Business Cases Needed to Execute Navy Shipbuilding Programs*, GAO–07–943T (Washington, DC.: July 24, 2007).

Figure 1: Executing a Strong Shipbuilding Case



Source: GAO depiction of notional shipbuilding process. | GAO-19-255T

We provide additional information below on each of the four main risks that affect the soundness of the polar icebreaker program's business case.

The Coast Guard Plans to Have a Stable Design before Starting Construction but Did Not Assess Design Maturity Prior to Setting Program Baselines

The Coast Guard expressed a commitment to having a stable design for the polar icebreaker program prior to the start of lead ship construction, but it set the program's baselines before conducting a preliminary design review—a systems engineering event that is intended to verify that the contractor's design meets the requirement of the ship specifications and is producible.

Shipbuilding best practices we identified in 2009 found that design stability on a ship is achieved upon completion of the basic and functional designs.[4] The basic design includes fixing the ship steel structure; routing all major distributive systems, including electricity, water, and other utilities; and ensuring the ship will meet the performance specifications. The functional design includes further iteration of the basic design, such as providing information on the exact position of piping and other outfitting in each block, and completing a 3D product model. At this point of design stability, the shipbuilder has a clear understanding of the ship structure as well as how every system is set up and routed throughout the ship. Consistent with our best practices, prior to the start of construction on the lead ship, the Coast Guard plans to require the shipbuilder to complete basic and functional designs, develop a 3D model output, and provide at least 6 months of production information to support the start of construction.

Although the Coast Guard plans to have a stable design prior to ship construction, it set the program's acquisition program baselines prior to gaining knowledge on the feasibility of the selected shipbuilder's design. Program baselines inform DHS's and the Coast Guard's decisions to commit resources. Our best practices for knowledge-based acquisitions state that before program baselines are set, programs should hold key systems engineering events, such as a preliminary design review, to help ensure that requirements are defined and feasible and that the proposed design can be met within cost, schedule, and other system constraints.[5]

The Coast Guard has yet to conduct a preliminary design review for the program because DHS's current acquisition policy does not require programs to do so until after setting program baselines. However, in April 2017, we found that DHS's sequencing of the preliminary design review is not consistent with our acquisition best practices, which state that programs should pursue a knowledge-based acquisition approach that ensures program needs are matched with available resources—such

[4] GAO–09–322.

[5] GAO, *Best Practices: Using A Knowledge-Based Approach To Improve Weapon Acquisition*, GAO–04–386SP (Washington, DC.: Jan. 1, 2004).

as technical and engineering knowledge, time, and funding—prior to setting baselines.[6] As a result, we recommended that DHS update its acquisition policy to require key technical reviews, including the preliminary design review, to be conducted prior to approving programs' baselines. DHS concurred with this recommendation and stated that it planned to initiate a study to assess how to better align its processes for technical reviews and acquisition decisions. Upon completion of the study, DHS plans to update its acquisition policies, as appropriate. As of June 2018, DHS indicated that it had completed its study and was in the process of updating its acquisition policies. GAO will review the policies once complete to determine if the updates meet the intent of this recommendation.

By setting the polar icebreaker program's baselines prior to gaining knowledge on the shipbuilder's design, the Coast Guard has established cost, schedule, and performance baselines without a stable or mature design. Although completing the preliminary design review after setting program baselines is consistent with DHS policy, this puts the Coast Guard at risk of breaching its established baselines and having to revise them later in the acquisition process, after a contract has been signed and significant resources have been committed to the program. At that point, the program will be well underway and it will be too late for decisionmakers to make appropriate tradeoff decisions between requirements and resources without causing disruptions to the program.

Coast Guard Intends to Use Proven Technologies for the Polar Icebreaker Program but Has Not Assessed Their Maturity

The Coast Guard intends to use what it refers to as "state-of-the-market" or "proven" technologies for the polar icebreaker program, but it has not yet conducted a technology readiness assessment to determine the maturity of key technologies prior to setting program baselines. This approach is inconsistent with our best practices for technology readiness.[7] A technology readiness assessment is a systematic, evidence-based process that evaluates the maturity of critical technologies—hardware and software technologies critical to the fulfillment of the key objectives of an acquisition program. According to our best practices, a technology readiness assessment should be conducted prior to program initiation.

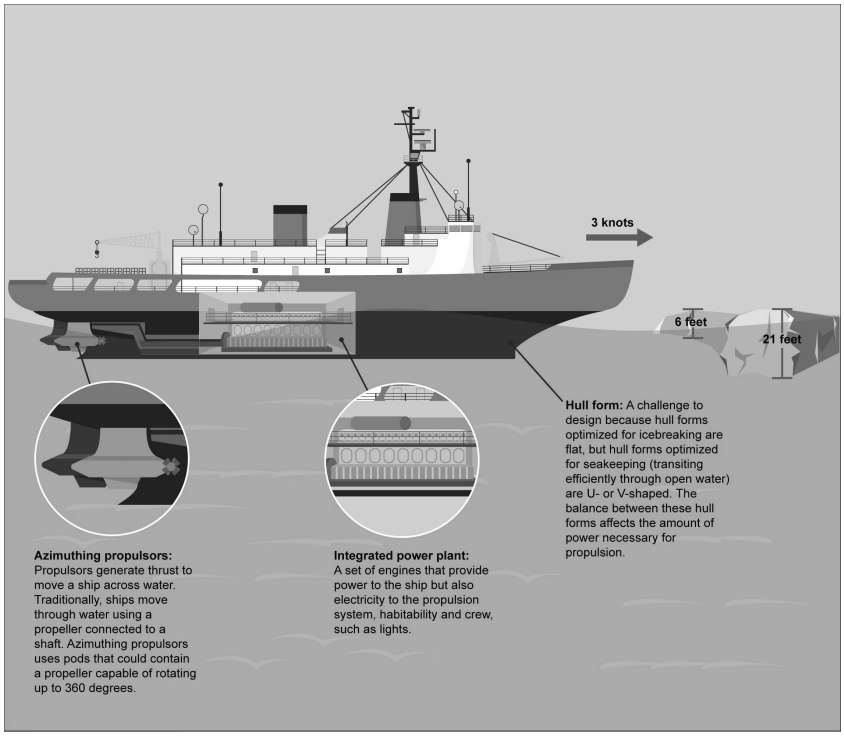
At the time of our earlier review, Coast Guard officials told us the polar icebreaker program does not have any critical technologies and thus, does not need to conduct a technology readiness assessment. From design studies and industry engagement, Coast Guard officials determined that the key technologies required for the polar icebreakers, such as the integrated power plant and azimuthing propulsors, are available commercially and do not need to be developed. Figure 2 provides additional information on the risks for these key technologies, as well as design risks for an icebreaker's hull form.

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[6] GAO, *Homeland Security Acquisitions: Earlier Requirements Definition and Clear Documentation of Key Decisions Could Facilitate Ongoing Progress*, GAO–17–346SP (Washington, DC.: Apr. 6, 2017).

[7] GAO, *GAO Technology Readiness Assessment Guide: Best Practices for Evaluating the Readiness of Technology for Use in Acquisition Programs and Projects*, GAO–16–410G (Washington, DC.: Aug. 11, 2016).

Figure 2: Key Technology and Design Risks for Notional Heavy Polar Icebreaker



Source: GAO notional depiction based upon analysis of U.S. Coast Guard and Navy information. | GAO-19-255T

Note: This ship design is notional and does not represent a design solution from the Coast Guard or industry.

Coast Guard officials stated that the integrated power plant is the standard power plant used on domestic and foreign icebreakers. Coast Guard officials told us that similarly, market survey data on azimuthing propulsors show that ice-qualified azimuthing propulsors in the power range required have been used on foreign icebreakers.

However, according to our best practices, critical technologies are not just technologies that are new or novel.[8] Technologies used on prior systems can also become critical if they are being used in a different form, fit, or function. Based on our analysis of available Coast Guard information, we believe the polar icebreaker program's planned integrated power plant and azimuthing propulsors should be considered critical technologies given their criticality in meeting key performance parameters, how the technologies are being reapplied to a different operational environment from prior uses of the technologies, and the extent to which they pose major cost risks. By not conducting a technology readiness assessment and identifying, assessing, and maturing its critical technologies prior to setting the program's program baselines, the Coast Guard is potentially underrepresenting technical risk and understating its cost, schedule, and performance risks.

Polar Icebreaker Program's Cost Estimate Substantially Met Best Practices but Is Not Fully Reliable

We found that the Navy's lifecycle cost estimate used to inform the polar icebreaker program's $9.827 billion cost baseline substantially adheres to most of our

[8] GAO–16–410G.

cost estimating best practices; however, the estimate is not fully reliable.[9] The cost estimate is not fully reliable because it only partially met best practices for being credible.[10] Highlights from our assessment of the polar icebreaker program's lifecycle cost estimate are detailed below:

- *Comprehensive: substantially met*. The estimate includes government and contractor costs over the full lifecycle of all three ships and documents detailed ground rules and assumptions, such as the learning curve used to capture expected labor efficiencies for follow-on ships. However, the costs for disposal of the three ships were not at a level of detail to ensure that all costs were considered and not all assumptions, particularly regarding operating and support costs, were varied to reflect the impact on cost should these assumptions change.
- *Well-documented: substantially met*. The estimate's documentation mostly captured the source data used as well as the primary methods, calculations, results, rationales, and assumptions used to generate each cost element. However, the documentation alone did not provide enough information for someone unfamiliar with the cost estimate to replicate what was done and arrive at the same results.
- *Accurate: substantially met*. The estimate was properly adjusted for inflation, and we did not find any mathematical errors in the estimate calculations we inspected. Officials stated that labor and material cost data from recent, analogous programs were used in the estimate. While the documentation does not discuss the reliability, age, or relevance of the cost data, Navy officials provided us with additional information regarding those data characteristics.
- *Credible: partially met*. The Navy only modeled cost variation in the detail design and construction portion of the program and excluded from its analyses any risk impacts related to the remainder of the acquisition, operating and support, and disposal phases, which altogether comprise about 75 percent of the lifecycle cost. Without performing a sensitivity analysis on the entire life cycle cost of the three ships, it is not possible for the Navy to identify key elements affecting the overall cost estimate. Further, without performing a risk and uncertainty analysis on the entire life cycle cost of the three ships, it is not possible for the Navy to determine a level of confidence associated with the overall cost estimate.

By not quantifying important risks, the Navy may have underestimated the range of possible costs for about three-quarters of the entire program. The estimate provides an overly optimistic assessment of the program's vulnerability to cost growth should risks be realized or current assumptions change. This, in turn, may underestimate the lifecycle cost of the program.

Polar Icebreaker Program's Optimistic Schedule Is Driven by Capability Gap and Does Not Reflect Robust Analysis

The Coast Guard's planned delivery dates of 2023, 2025, and 2026 for the three ships were not informed by a realistic assessment of shipbuilding activities, but rather were primarily driven by the potential gap in icebreaking capabilities once the *Polar Star* reaches the end of its service life (see figure 3).

[9] The GAO Cost Estimating and Assessment Guide was used as criteria in this analysis. For more information, see *GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs*, GAO–09–3SP (Washington, DC.: Mar. 2, 2009). A cost estimate is considered reliable if the overall assessments for each of the four characteristics of a reliable cost estimate—comprehensive, well documented, accurate, and credible—are substantially or fully met.

[10] A credible cost estimate should analyze the sensitivity of the program's expected cost to changes among key cost-driving assumptions and risks. It should also quantify the cost impact of risks related to assumptions changing and variability in the underlying data used to create the cost estimate.

Figure 3: The Coast Guard's Heavy Polar Icebreaker, Polar Star

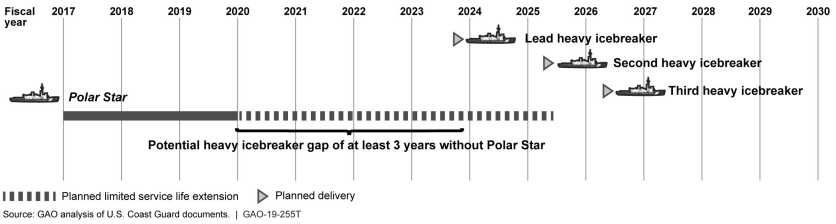


U.S. Coast Guard Cutter Polar Star

Source: U.S. Coast Guard. | GAO-19-255T

The *Polar Star*'s service life is estimated to end between fiscal years 2020 and 2023. This creates a potential heavy polar icebreaker capability gap of about 3 years, if the *Polar Star*'s service life were to end in 2020 and the lead polar icebreaker were to be delivered by the end of fiscal year 2023 as planned. If the lead ship is delivered later than planned in this scenario, the potential gap could be more than 3 years. The Coast Guard is planning to recapitalize the *Polar Star*'s key systems starting in 2020 to extend the service life of the ship until the planned delivery of the second polar icebreaker (see figure 4).

Figure 4: The Coast Guard's Potential Heavy Polar Icebreaker Capability Gap and Planned Delivery of New Heavy Polar Icebreakers



Source: GAO analysis of U.S. Coast Guard documents. | GAO-19-255T

Further, we compared the program's planned construction schedule to the construction schedules of delivered lead ships for major Coast Guard and Navy shipbuilding programs active in the last 10 years as well as the *Healy*, the Coast Guard's only medium polar icebreaker. We found that the polar icebreaker's lead ship construction cycle time of 2.5 to 3 years is optimistic, as only 3 of the 10 ships in our analysis were constructed in 3 years or less.[11] Further, as another point of comparison, the *Healy* was constructed in just under 4.5 years.

An unrealistic schedule puts the Coast Guard at risk of not delivering the icebreakers when promised and the potential gap in icebreaking capabilities could widen. Just as importantly, our prior work on shipbuilding programs has shown that establishing optimistic program schedules based on insufficient knowledge can

[11] The three ships in our analysis that were constructed in 3 years or less were largely based on commercial designs or built to mostly commercial standards.

create pressure for programs to make sacrifices elsewhere, which can lead to work being performed concurrently, costly rework, and further delays.[12]

To address the risks we identified and establish a sound business case, we made a number of recommendations in our September 2018 report to DHS, Coast Guard, and the Navy, including:

- Conducting a technology readiness assessment in accordance with best practices, identifying critical technologies, and developing a plan to mature any technologies not designated to be mature before detail design of the lead ship begins;
- Updating the program's cost estimate in accordance with best practices before the contract option for construction of the lead ship is awarded;
- Developing a program schedule in accordance with best practices to set realistic schedule goals for all three ships before the contract option for construction of the lead ship is awarded; and
- Updating the program's acquisition program baselines prior to authorizing lead ship construction, after completion of the preliminary design review, and after it has gained the requisite knowledge on its technologies, cost, and schedule.[13]

DHS concurred with all of our recommendations and identified actions it planned to take to address them. For example, earlier this month, the Coast Guard indicated that it has identified a preliminary list of potential critical technologies and is in the process of developing a technology readiness assessment plan. The Coast Guard also plans to update the program's cost estimate within 8 months of the contract award and update the program schedule within 3 months of the contract award.

HOW THE POLAR ICEBREAKER PROGRAM WILL BE FUNDED MOVING FORWARD IS UNCLEAR

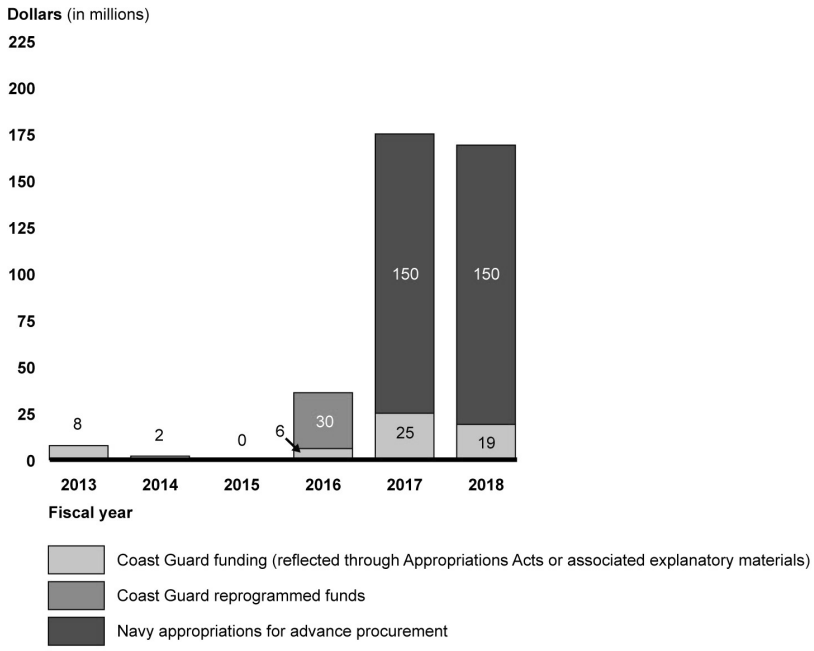
Of the $9.827 billion estimated for the lifecycle costs of the polar icebreaker program, about $3 billion is for acquisition costs. From 2013 through 2018, the polar icebreaker program has received $360 million in funding—$60 million in Coast Guard appropriations and $300 million in Navy appropriations. In addition, according to Coast Guard officials, in fiscal year 2017, Coast Guard reprogrammed $30 million in fiscal year 2016 appropriations for the polar icebreaker program from another program (see figure 5).

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[12] GAO, *Columbia Class Submarine: Immature Technologies Present Risks to Achieving Cost, Schedule, and Performance Goals*, GAO–18–158 (Washington, DC.: Dec. 21, 2017); *Navy Shipbuilding: Past Performance Provides Valuable Lessons for Future Investments*, GAO–18–238SP (Washington, DC.: June 6, 2018); *Ford-Class Aircraft Carrier: Follow-On Ships Need More Frequent and Accurate Cost Estimates to Avoid Pitfalls of Lead Ship*, GAO–17–575 (Washington, DC.: June 13, 2017); and GAO–07–943T.

[13] GAO–18–600.

Figure 5: Polar Icebreaker Program Funding, Fiscal Years 2013–2018



Source: GAO analysis of U.S. Coast Guard and Navy information. | GAO-19-255T

According to Coast Guard and Navy officials, the Navy plans to use the $300 million in Navy appropriations in fiscal year 2019 to fund the advanced planning, design, engineering, and long lead time materials for the first polar icebreaker. As part of the polar icebreaker program's acquisition strategy and reflected in the March 2018 request for proposals, the Navy plans to establish options for the subsequent detail design and construction of each of the three ships. The request for proposals specified that the options will be priced as fixed-price incentive type (see table 1).

TABLE 1: POLAR ICEBREAKER PROPOSED DETAIL DESIGN AND CONSTRUCTION CONTRACT STRUCTURE AS OF MAY 2018

Line item number	Initial award or option	Scope of work
1	Initial award	Advanced planning, design, engineering, long lead time materials
2	Option 1	Detail design and construction of ship 1
3	Option 2	Detail design and construction of ship 2
4	Option 3	Detail design and construction of ship 3

Source: GAO analysis of Navy information. GAO–19–255T.

The Navy did not request any funding in fiscal year 2019 for the polar icebreaker program, while Coast Guard requested $30 million. Subsequently, after discretionary budget caps were relaxed by Congress, the administration's fiscal year 2019 budget addendum requested an additional $720 million in fiscal year 2019 Coast Guard appropriations for the program.[14] As the program prepares to award a contract in fiscal year 2019 worth billions of dollars if all the options are exercised, it

[14] See Bipartisan Budget Act of 2018, Pub. L. No. 115–123, § 30101(a) (Feb. 9, 2018).

is unclear to what extent the program will be funded using Coast Guard or Navy appropriations or how much total funding will be provided.

In conclusion, as the Coast Guard embarks on the acquisition of its new polar icebreakers to address capability gaps in the Arctic and Antarctic regions, it faces a number of key acquisition and funding risks. DHS, the Coast Guard, and the Navy must gain key acquisition knowledge before committing significant resources to the program while Congress faces key funding and tradeoff considerations. To put the polar icebreaker program in a position to succeed, Congress and the agencies must remain committed to establishing and executing a sound business case for the program.

Chairman Mast, Ranking Member Garamendi, and members of the subcommittee, this concludes my prepared statement. I would be pleased to respond to any questions.

Mr. MAST. Thank you, Ms. Mak.

Mr. Von Ah, you are recognized to give your statement.

Mr. VON AH. Good morning, Chairman Mast, Ranking Member Garamendi, and members of the subcommittee. Thank you for the opportunity to discuss our recent report on costs and challenges to sustaining the U.S.-flag fleet for military needs.

DoD relies on oceangoing U.S.-flag vessels, mostly those involved in international trade, for its sealift needs. However, it has long been recognized that the operating costs of U.S.-flag vessels are higher than those of foreign-flag vessels, and Government support is therefore necessary to maintain the fleet.

To help ensure the fleet is adequate for defense needs, the Government supports selected vessels through the Maritime Security Program, which provides operators a stipend in exchange for agreeing to provide sealift support, and through cargo preference requirements that specify that Federal agencies must transport certain percentages of international Government cargo on U.S.-flag vessels.

Despite this support, the U.S.-flag fleet in international trade has been in decline for many years, going from 199 vessels at the end of 1990 to just 82 vessels by the end of 2017. Recognizing this, Congress mandated in 2014 that DOT develop strategies related to the sustainability of the U.S.-flag fleet.

In our report we noted that the Department had completed a draft strategy in 2016 but that it was subject to the new administration's review. At that time officials told us that they viewed the existing draft strategy as predecisional and could provide no timeline for when they plan to move forward. We recommended DOT complete the strategy and establish timeframes for its issuance, and since then the 2019 Defense Reauthorization Act set a new deadline of February 2020, which DoD plans to meet.

Our report also identified two key challenges to sustaining the fleet for defense needs: maintaining the financial viability of operators under the U.S. flag and ensuring a sufficient number of mariners to crew the Reserve Fleet during a military activation.

With respect to maintaining financial viability, the additional cost of operating a U.S.-flag vessel compared to a foreign-flag vessel has continued to increase while the volume of Government cargo has fallen. These two trends have made it harder for vessel operators to remain viable.

In 2016, as a response to these challenges, Congress increased the maritime security stipend from $3½ million to $5 million per vessel annually. Outside of increasing the stipend, officials and

stakeholders cited a range of options as having potential to reduce the costs of operating a U.S.-flag vessel, which would in turn make operators more competitive commercially and less dependent on Government support.

These options include looking at any additional costs of meeting Coast Guard requirements relative to international standards, options related to controlling and reducing crew costs, such as mariner income tax relief and liability insurance reform and eliminating the ad valorem tax U.S.-flag vessels must pay on the cost of maintenance performed in a foreign shipyard.

Stakeholders also identified options to address the decline in Government cargo. These options include increasing the percentage of Government cargo that must be shipped on U.S.-flag vessels or requiring that certain export commodities, such as oil or liquefied natural gas, be carried on those vessels.

However, at the time of our review, MARAD officials had not yet determined the potential of these options to address the underlying issues or the tradeoffs involved. For example, increasing cargo preference requirements can result in additional cargo for certain U.S.-flag vessels but also result in higher shipping costs that could impact the mission of civilian agencies or reduce demand for certain exports.

Turning to the second challenge, a MARAD working group has estimated a potential shortage of mariners in the case of a drawn-out military effort of about 1,800. However, there is some uncertainty around this number. The shortage may be understated if some of the available mariners are unwilling or unable to continue sailing during times of national emergency as they are not required to crew the Reserve Fleet.

On the other hand, additional mariners are listed in the Coast Guard's database as having unlimited credentials but are not currently employed on oceangoing vessels. Their availability and continuing proficiency remains unknown, although we have recommended that MARAD take steps to study the availability of those mariners.

Two options were identified by the working group to address the potential shortage. One was to create a mariner reserve program where the Government would train them and help maintain their credentials for which mariners would in turn be obligated to sail in the event of a defense need, and the other was to expand the U.S.-flag fleet to support more mariner jobs.

The working group did not analyze costs or tradeoffs associated with these options and instituting a mariner reserve program or expanding the fleet would require additional Government financial support.

Until the maritime strategy is in place that examines such costs and tradeoffs and makes recommendations accordingly, decision-makers will lack important information to make policy choices that consider all aspects of this complex issue.

Mr. Chairman, this concludes my statement. I would be happy to address any questions you or members of the subcommittee may have. Thank you.

[Mr. Von Ah's prepared statement follows:]

Prepared Statement of Andrew Von Ah, Director of Physical Infrastructure, U.S. Government Accountability Office

MARITIME SECURITY: DOT IS STILL FINALIZING STRATEGY TO ADDRESS CHALLENGES TO SUSTAINING U.S.-FLAG FLEET

Chairman Mast, Ranking Member Garamendi, and members of the subcommittee:

Thank you for the opportunity to discuss our work on efforts by the Departments of Transportation (DOT) and Defense (DoD) to draft a national maritime strategy that addresses challenges the government faces in supporting the fleet of U.S.-flag vessels.[1] DoD largely relies on internationally trading U.S.-flag vessels (vessels registered in the United States that must be mainly crewed by U.S. citizens) for sealift—the process of transporting government equipment and supplies by sea for military purposes. However, it has long been recognized that the operating costs of U.S.-flag vessels are higher than the operating costs of foreign-flag vessels, and that government support is therefore necessary to maintain a fleet of internationally trading U.S.-flag vessels.[2] To help ensure an adequately sized U.S.-flag fleet for defense needs, the government supports internationally trading U.S.-flag vessels in the following ways: (1) through the Maritime Security Program (MSP), which provides the operators of selected U.S.-flag vessels a stipend in exchange for their agreeing to provide sealift support in times of war or crisis, and (2) through "cargo preference" requirements that specify that Federal agencies must transport certain percentages of international government cargo on U.S.-flag vessels.

Despite the MSP and cargo preference requirements that have helped support the U.S.-flag fleet, concerns have been raised about the fleet's future sustainability The U.S.-flag fleet has been in decline for many years and increasingly faces difficulties in competing for international cargo due to the higher costs of operating under the U.S. flag. Notably, the number of U.S.-flagged vessels has continued to decline—from 199 vessels at the end of 1990 to just 82 vessels by the end of 2017, creating a potential shortage of U.S. citizen mariners to crew government-owned reserve vessels in times of need.[3] Recognizing these and other challenges, Congress statutorily mandated in 2014 that DOT develop national strategies related to the sustainability of the U.S.-flag fleet, including recommendations for the future. In the John S. McCain National Defense Authorization Act for Fiscal Year 2019,[4] the statutory deadline for the national maritime strategy was extended from February 2015 to February 2020.

My statement today provides information on (1) the status of the mandated national strategies and (2) challenges that stakeholders identified related to sustaining the U.S.-flag fleet for defense needs and options DOT has considered for addressing them. This statement is based on our August 2018 report on challenges to sustaining U.S.-flag vessels for military needs.[5]

For the 2018 report, we reviewed relevant laws, regulations, guidance, prior GAO reports, and studies related to MSP and maritime economics. We also analyzed data for fiscal year 2012 through 2017 on international cargo shipped by government agencies. In addition, we spoke with officials from DOT, DoD, and selected agencies

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[1] GAO, *Maritime Security: DOT Needs to Expeditiously Finalize the Required National Maritime Strategy for Sustaining U.S.-Flag Fleet*, GAO–18–478 (Washington, DC.: Aug. 8, 2018).

[2] The U.S. Government also supports U.S.-flag vessels operating in domestic trade through what is commonly referred to as the Jones Act (Merchant Marine Act of 1920, Pub. L. No.66–261, § 27, 41 Stat. 988, 999 (1920) (codified as amended at 46 U.S.C.§ 55102)), which, in general, requires that maritime transport of cargo between points in the United States be carried by vessels that are U.S. flag and constructed in the United States. Jones Act vessels may be called upon to support sealift by DoD in certain circumstances. However, our August 2018 report focused on the internationally trading U.S.-flag fleet, thus it does not focus on the Jones Act. For more information about the Jones Act, see GAO, *Puerto Rico: Characteristics of the Island's Maritime Trade and Potential Effects of Modifying the Jones Act*, GAO–13–260 (Washington, DC.: Mar. 14, 2013).

[3] According to DoD and DOT, mariners are necessary to crew not only the U.S.-flag commercial vessels but also the U.S. government-owned reserve cargo vessels. These vessels are held in reduced operating status with minimal crew in peacetime. When put into full operating status the government needs to add additional trained and qualified mariners to operate them. Because mariners work on vessels for months at a time, commercial vessels typically have at least two full sets of mariners to crew a single vessel—one set of which is on the vessel while the other is on leave. In times of crisis, one set of mariners could continue to work on the commercial vessel, while some of those on leave could be called upon to voluntarily crew vessels in the government-owned reserve fleet.

[4] Pub. L. No. 115–232, § 3513(b), 132 Stat. 1636 (2018).

[5] GAO–18–478.

subject to cargo preference requirements, as well as MSP vessel operators, academics knowledgeable about maritime issues, and other stakeholders. Detailed information on our scope and methodology can be found in our issued report. For this statement, to update the status of DOT's efforts on the national maritime strategy, we reviewed the John S. McCain National Defense Authorization Act for Fiscal Year 2019[6] and spoke to DOT officials. We conducted the work on which this statement is based in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

DOT HAS NOT FINALIZED A NATIONAL MARITIME STRATEGY BUT PLANS TO DO SO BY NEW FEBRUARY 2020 DEADLINE

In 2014, Congress issued two separate mandates to DOT to develop strategies related to challenges facing the U.S.-flag fleet, specifically:

- The Secretary of Transportation was directed to develop a national maritime strategy with recommendations to, among other things, help U.S.-flag vessels remain competitive.[7]
- The Secretary of Transportation and the Maritime Administration (MARAD) within DOT were directed to develop, in collaboration with DoD, a national sealift strategy to ensure the long-term viability of U.S.-flag vessels and U.S.-citizen mariners.[8]

As we reported in August 2018, according to MARAD and DoD officials, MARAD has been working on a single draft maritime strategy to meet both mandates because the broader national maritime strategy would need to encompass the national sealift strategy, as well.

While there is no statutory deadline for the completion of the national sealift strategy, in the John S. McCain National Defense Authorization Act for Fiscal Year 2019,[9] the statutory deadline for the national maritime strategy was extended from February 2015 to February 2020. In our August 2018 report, we noted that MARAD officials had completed a draft strategy in 2016, but they told us that the strategy was subject to the new administration's review. At that time, MARAD and DOT officials told us that they viewed the existing draft strategy as pre-decisional and could provide no timeline for when they planned to move the strategy forward. In our report, we concluded that the delay in submitting the strategy to Congress had resulted in decisionmakers not having the information they needed and recommendations from the agency to inform policymaking in this area. We recommended that DOT complete the national maritime strategy and establish timeframes for its issuance. DOT concurred with our recommendation. In our recent discussions with DOT officials after passage of the John S. McCain National Defense Authorization Act for Fiscal Year 2019, they told us that DOT now plans to meet the new statutory deadline and issue the strategy by February 2020.

STAKEHOLDERS IDENTIFIED TWO PRIMARY CHALLENGES TO SUPPORTING THE U.S.-FLAG FLEET FOR DEFENSE NEEDS, AND DOT HAS IDENTIFIED VARIOUS OPTIONS TO ADDRESS THEM

Stakeholders we spoke with for our August 2018 report identified two primary challenges to ensuring that the U.S.-flag fleet would continue to meet DoD's national defense needs.[10] First, they described maintaining the financial viability of U.S.-flag vessels participating in MSP as a challenge. Second, stakeholders identified a potential shortage of U.S. citizen mariners available to crew the government-owned reserve fleet during a military activation as a challenge, in part due to the declining numbers of U.S.-flag vessels that employ these mariners. In our August report, we noted that MARAD had identified some options to address the competitiveness of U.S.-flag vessels and the long-term viability of the U.S.-citizen mariners—issues that are very similar to the key challenges identified by stakeholders. However, DOT and MARAD officials had stated that they were not yet ready to address the feasibility of these options, or formally propose them.

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[6] Pub. L. No. 115–232, 132 Stat. 1636 (2018).
[7] Pub. L. No. 113–281, § 603, 128 Stat. 3022, 3061 (2014).
[8] Pub. L. No. 113–76, 128 Stat. 5, 598 (2014).
[9] Pub. L. No. 115–232, § 3513(b), 132 Stat. 1636 (2018).
[10] These stakeholders included MARAD and DoD officials, MSP vessel operators, labor unions, an international ship-registry service, a maritime association, and academics with backgrounds in defense transportation, food assistance, and maritime economics.

Maintaining Financial Viability of the U.S.-Flag Fleet

According to MARAD officials, the relative cost of operating a U.S.-flag vessel compared to a foreign-flag vessel has increased in recent years, making it more challenging for vessel operators to remain economically viable under the U.S. flag. In our August report we found that financial support to U.S.-flag vessels through both the MSP stipend and the government cargo preference requirements has helped ensure a sufficient number of internationally trading U.S.-flag vessels are available to meet DoD's most recently stated cargo capacity needs from such vessels.[11] On the other hand, according to MARAD officials, the additional cost of operating a U.S. flag vessel compared to a foreign-flag vessel has increased—from about $4.9 million annually in 2009 and 2010 to about $6.2 to $6.5 million currently—making it harder for such vessels to remain financially viable. This cost differential results primarily from the rising relative costs of employing U.S. versus foreign mariners as crew. Compounding the increasing costs of operating U.S. flag vessels, the volume of government cargo—a key source of revenue for many U.S.-flagged vessels—has fallen in recent years as the international military presence of the United States and funding for food aid overseas have both declined. In response to these challenges, Congress increased the MSP stipend from $3.5 million to $4.99 million per vessel from fiscal year 2016 to 2017. MARAD officials said this increase has temporarily stabilized the financial situation of MSP vessel operators. However, they added that trends in operating costs and government cargo suggest that the ability to retain an adequate number of financially viable U.S.-flagged vessels will remain an ongoing challenge.

MARAD officials identified the following options as having potential to reduce the costs of operating a U.S.-flag vessel—which would in turn make U.S.-flag vessels more competitive in the international cargo market:

- MARAD is part of a U.S. Registry Working Group[12] looking at a range of actions to decrease the time and cost of bringing vessels under the U.S. flag, including the cost of meeting Coast Guard requirements. For example, the group is looking at a recommendation for the broader application of internationally recognized vessel standards to U.S.-flag vessels to meet Coast Guard requirements.
- In the current strategic plan for 2017 through 2021, MARAD identified two areas of reform—mariner income-tax relief and liability insurance reform—that could reduce the crew costs of operating under a U.S. flag.
- According to MARAD officials, some stakeholders have recommended that MARAD consider requesting the elimination of a tax on U.S.-flag vessels receiving maintenance overseas to reduce maintenance costs for U.S.-flag vessels. In general, maintenance and repairs on U.S.-flag vessels not conducted at U.S. shipyards are subject to a statutory 50 percent *ad valorem* tax on the cost of maintenance performed in a foreign country. According to 12 of the 14 MSP vessel operators we spoke with for our August report, U.S. shipyards are typically more expensive than foreign shipyards or may not be close to the vessel's location or route, so they typically choose to pay the tax and have the maintenance performed overseas. Four MSP vessel operators we spoke to stated that they send U.S.-flag vessels to U.S. shipyards for maintenance when it makes sense from a logistical and financial perspective. MARAD officials we spoke to said they are considering the effect of eliminating the tax, a step that would reduce costs for vessel operators but would potentially negatively affect the financial viability of U.S. shipyards, which the law was designed to assist. However, MARAD officials stated that they have not yet evaluated these tradeoffs.

MARAD and DoD's Transportation Command (Transportation Command) officials have also identified—but not officially proposed—several options to address the decline in government cargo carried on U.S.-flag vessels, which would also make U.S.-

[11] The MSP stipend provides a fixed financial incentive for vessel operators to maintain vessels under the U.S. flag, but on its own is not sufficient to support the higher costs of operating U.S.-flag vessels, according to MARAD officials and MSP operators we spoke to. The other key way that MSP vessel operators can make up the difference in operating costs between U.S.-flag and foreign-flag vessels is through the transport of government cargo under "cargo preference" requirements. According to a 2015 MARAD report, the higher freight rates that DoD and other Federal agencies pay to transport government cargo on U.S.-flag vessels are critical to these vessels' financial viability.

[12] According to MARAD, this working group was created to address findings from the following study: Transportation Research Board of the National Academies of Sciences, Engineering, and Medicine, *Impact of United States Coast Guard Regulations on United States Flag Registry* (2016). The working group was created under the National Defense Transportation Association and includes participants from MARAD, the Coast Guard, the American Bureau of Shipping, the Transportation Institute, and U.S.-flag vessel operators, among others.

flag vessels more competitive by providing more revenues. In our August 2018 report, Transportation Command officials and ship operators to whom we spoke told us that they consider access to U.S. Government cargo to be a critical means of sustaining U.S.-flag vessels.

- Transportation Command and MARAD officials stated that one way to increase the amount of commercial cargo on U.S.-flag vessels would be to require that certain energy export commodities, such as oil or liquefied natural gas, be carried on U.S.-flag vessels. While this option has been considered in the past, it would require new legislation and would potentially have a negative impact on the export market for liquefied natural gas. In 2015, we analyzed the potential effects of a requirement that U.S. liquefied natural gas exports be carried on U.S.-built and -flagged vessels.[13] We found that such a requirement could potentially increase the number of U.S.-flag vessels by 100 over the course of many years; however, due to their higher operating costs, this would increase the cost of transporting liquefied natural gas from the United States, decrease the competitiveness of U.S. liquefied natural gas in the world market, and in turn, reduce demand for U.S. liquefied natural gas. MARAD officials stated that another option would be increasing the percentage of other cargo, such as food aid, that civilian agencies are required to transport on U.S.-flag vessels. This would also require an amendment to existing legislation and would also have tradeoffs, since cargo requirements such as these can result in higher shipping costs that can negatively affect the missions of civilian agencies, in particular food aid agencies.
- Another option identified by MARAD officials to address declining government cargo volumes would be to increase the MSP stipend to replace some of the government support previously provided through cargo preference requirements, as was done for fiscal year 2017.

Potential Shortage of U.S.-Citizen Mariners

The second challenge identified by stakeholders related to maintaining adequate sealift for defense needs is the potential shortage of U.S.-citizen mariners available to crew the government-owned reserve fleet during a crisis. The government's reserve fleet vessels are held in reduced operating status with minimal crew in peacetime. When put into full operating status—such as for a surge related to a wartime effort—these vessels need additional crew, and DoD counts on mariners working on oceangoing U.S.-flag vessels to meet this need. MARAD and DoD have raised concerns about the sufficiency of U.S.-citizen mariners to meet this need. For example, in January 2018, in a statutorily mandated report, MARAD's Maritime Workforce Working Group estimated a shortage of over 1,800 mariners in the case of a drawn-out military effort, although it also recommended data improvements to increase the accuracy of the count of available mariners.[14]

Specifically, in this report, the working group estimated approximately 11,768 qualified and available U.S.-citizen mariners as of June 2017—11,839 less than the 13,607 mariners the working group estimates would be needed for sustained operation of the reserve and commercial fleet.[15] The working group based its identification of 11,768 existing qualified U.S.-citizen mariners on the number of U.S.-citizen mariners actively sailing on U.S.-flag commercial and government-owned oceangoing vessels. For the vessels in full operating status, the working group accounted for 2 mariners employed for each crew position. The double crew, which according to MARAD officials is typical for a commercial U.S.-flag vessel operating in international trade, allows each mariner, over the course of a year, to work for 6 months on the vessel and take 6 months of earned leave. The working group assumed that during a military activation, commercial operations would continue at the same level as during peacetime—but that some U.S-citizen mariners currently working on commercial vessels would be willing to reduce the amount of earned leave they took in order to work on government-owned reserve vessels. The working group analyzed this scenario by changing the ratio of crew positions to crew from 2 to 1.75. As illustrated in figure 1, under this scenario, with an average of 26 crew positions per ves-

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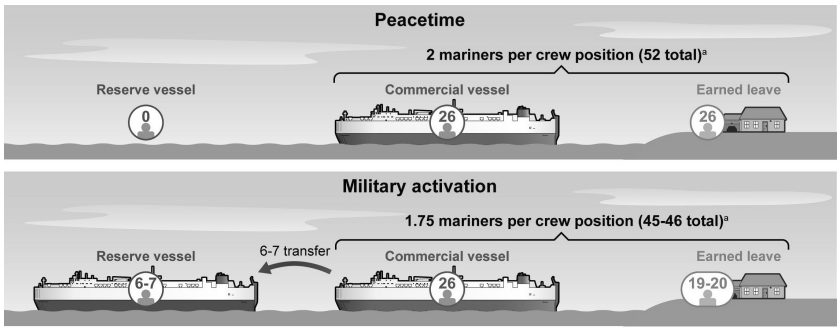
[13] GAO, *Maritime Transportation: Implications of Using U.S. Liquefied-Natural-Gas Carriers for Exports*, GAO–16–104 (Washington, DC.: Dec. 3, 2015).

[14] U.S. Department of Transportation, Maritime Administration, *Maritime Workforce Working Group Report* (Washington, DC, Sept. 29, 2017). The National Defense Authorization Act for Fiscal Year 2017, (Pub. L. No. 113–328, Div. C, § 3517, 130 Stat. 2000, 2789 (2017)), required the creation of a Maritime Workforce Working Group to examine and assess the size of the pool of citizen mariners necessary to support the U.S. flag fleet in times of national emergency.

[15] The working group considered mariners to be qualified if they had certain credentials, referred to as unlimited mariner credentials, and had sailed on large oceangoing U.S. flag vessels within the last 18 months.

sel, between 6 and 7 mariners per existing commercial oceangoing U.S.-flag vessel are made available to crew the reserve fleet.

Figure 1: Illustration of the Potential Distribution of the Approximately 52 U.S.-citizen Mariners Hired per U.S.-Flag Commercial Vessel during Peacetime and during a Military Activation



Source: GAO. | GAO-19-260T

[a] Ratios of 2 mariners per crew position in peacetime and 1.75 mariners per crew position during a military activation are taken from the Maritime Administration's (MARAD) Maritime Workforce Working Group Report, 2017. The number of approximately 52 U.S. citizen mariners employed per U.S.-flag commercial vessel is calculated based on information in the same MARAD working group report. Because 26 crew positions multiplied by 1.75 mariners per crew position equals 45.5, the number of mariners per crew position, on earned leave, or on a reserve vessel during military activation is expressed as a range.

According to the working group's methodology, given the size of the current U.S.-flag oceangoing fleet and the number of currently employed mariners on this fleet, there are enough U.S.-citizen mariners to crew the reserve fleet during an initial surge, but not for a sustained activation, during which the working group estimated that the reserve vessels themselves would need a double crew to allow for crew rotations. This need for crew rotations on the reserve vessels led the working group to estimate a shortage of 1,839 U.S.-citizen mariners. Moreover, the working group's report found that the shortage of mariners may be understated if some of the estimated available mariners are unable or unwilling to continue sailing during times of national emergency, as available mariners are not required to crew the reserve fleet.

Although the working group concluded that there is a shortage of mariners for sustained operations, its report also details data limitations that cause some uncertainty regarding the actual number of existing qualified mariners and, thus, the extent of this shortage. The working group's approach—driven, in part, by limitations of the U.S. Coast Guard's data base that tracks mariner credentials—did not count any qualified mariners who are no longer employed on U.S.-flag oceangoing vessels or who are employed on other types of vessels but may have the required credentials. In fact, according to the working group's analysis, over 15,000 mariners listed in the U.S. Coast Guard's data base have unlimited credentials but are unaccounted for, as they are neither currently employed on large, oceangoing vessels nor serving as civil-service mariners committed to government-owned vessels. The working group stated that the availability and continuing proficiency of these mariners remains unknown. MARAD officials emphasized to us, however, that mariners who have not worked on the right types of vessels for more than 18 months are likely to need additional training before they would be qualified to crew the reserve fleet during a military activation.

The working group's report contains several recommendations related to improving information on the number of available and willing mariners. These recommendations include replacing the Coast Guard data base with one that would enable a more accurate account of available mariners, and establishing a periodic survey of the U.S.-citizen mariner pool to allow MARAD to determine, with reasonable certainty, how many qualified mariners would be available and willing to sail on U.S.-government reserve vessels if called upon to do so. The report concluded that until these agencies improve the tracking of licensed mariners who may be available to crew the government-owned reserve vessels when activated into full operating status, the extent to which there is a shortage of mariners for defense needs will

remain unclear.[16] The lack of information on the extent to which there is a shortage of mariners limits the U.S. government's ability to effectively plan for such needs. In January 2018, MARAD's administrator testified that MARAD is working with the Coast Guard and the maritime industry to better track licensed mariners who may no longer be sailing but could serve in a time of crisis, and in March 2018, MARAD officials told us they are taking steps to initiate a new survey of mariners, as recommended in the working group's report.[17]

In its report, the working group also identified options to address the challenge of ensuring a sufficient number of U.S.-citizen mariners for defense needs. It identified two actions that could help increase the number of U.S.-citizen mariners—one focused specifically on mariners and the other focused more broadly on the merchant marine, which encompasses U.S.-flag vessels and U.S.-citizen mariners. However, the working group's report did not discuss specific costs or tradeoffs related to either action or elaborate any further on them. The report identified the following actions:

- MARAD should develop a broad-based reserve program that would identify and support qualified mariners willing to sail in commercial and government-owned vessels during an emergency. MARAD would provide limited financial assistance in training mariners and maintaining credentials, in turn for which mariners who participate would be obligated to sail in the event of a defense need.
- MARAD and other U.S. Government agencies should support a healthy merchant marine (which encompasses U.S.-flag vessels and U.S.-citizen mariners). The government should fully support programs including MSP, requiring the government to ship certain cargo on U.S flag vessels, the Jones Act, and government chartering of privately owned vessels. If DoD determines that national needs require more mariners and vessels than can be provided through current programs, those programs should be expanded to meet such needs.

In conclusion, the U.S.-flag fleet is increasingly facing challenges that threaten its ability to meet future defense needs. In response to congressional mandates, MARAD has been working on a national maritime strategy and plans to issue one by February 2020. However, until such a strategy is in place, decisionmakers will have limited information to make important policy choices that consider all the relevant tradeoffs associated with this complex issue.

Chairman Mast, Ranking Member Garamendi, and members of the subcommittee, this concludes my prepared statement. I would be pleased to respond to any questions.

Mr. MAST. Thank you, Mr. Von Ah.

Mr. O'Rourke, you are recognized to give your statement.

Mr. O'ROURKE. Chairman Mast, Ranking Member Garamendi, distinguished members of the subcommittee, thank you for the opportunity to appear before you today to testify on icebreakers and the National Maritime Strategy.

In my 34 years as a CRS naval analyst, I have covered Coast Guard ship acquisition for 20 years, the icebreaker program specifically for 10 years, and military sealift ships for 28 years.

There has been some discussion recently of how certain Coast Guard programs, including icebreakers, would not be affordable if the Coast Guard's procurement account in coming years were limited to about $1.1 billion per year. The notion that the account will be limited to that level, however, is no longer strongly supported by recent data on funding requests or enacted funding levels or projected future funding requests.

More important, in relation to maintaining Congress' status as a coequal branch of Government, including the preservation and use of congressional powers and prerogatives, an analysis that assumes or predicts that future funding levels will resemble past funding

[16] We reported on data issues related to determining the number of mariners available for sealift in GAO, *International Food Assistance: Cargo Preference Increases Food Aid Shipping Costs, and Benefits Are Unclear*, GAO–15–666 (Washington, DC.: Aug. 26, 2015).

[17] According to MARAD officials, the last such survey was conducted in 2003 and it found that only two-thirds of the mariner pool were willing to serve in time of crisis.

levels can encourage an artificially narrow view of congressional options regarding future funding levels, which could deprive Congress of agency in the exercise of its constitutional power to set funding levels and determine the composition of Federal spending.

One of the most notable changes in the icebreaker program over the last year has been the reduction in their estimated procurement cost. The cost had earlier been estimated informally at roughly $1 billion per ship, but the Coast Guard and Navy informed CRS and CBO in March that they now believe that three heavy polar icebreakers could be acquired for an average of about $700 million per ship.

Reductions in the estimated procurement cost strengthen the business case for the program. A reduction to $700 million would strengthen it substantially.

The baseline plan calls for acquiring the icebreakers using a contract with options. Contracts with options are not multiyear contracts. Instead, they operate more like annual contracts, and they cannot achieve the kinds of savings that are possible with multiyear contracts.

Procuring three heavy icebreakers under a block-buy contract, which is a type of multiyear contract, might reduce their combined cost by upwards of $150 million. Last year's National Academies report on icebreakers recommended that the Coast Guard use an acquisition strategy that includes block-buy contracting.

Coast Guard officials have said they may procure the first icebreaker under a single-ship contract and then use a block-buy contract for subsequent ships. In support of that possible approach they have noted the risks involved in building a lead ship and the fact that the U.S. hasn't built a heavy polar icebreaker in more than 40 years.

Supporters of including the first icebreaker in a block-buy contract could argue that block-buy contracting was invented to a large degree expressly to permit the lead ship to be included in the contract, and that the Navy has included lead ships in block-buy contracts in the *Virginia*-class submarine program and the *John Lewis*-class oiler program, and that the Navy is considering a block-buy contract that includes the lead ship for the *Columbia*-class ballistic missile submarine program. The *Columbia*-class design is more complex than the icebreaker, and the U.S. hasn't produced a new class of ballistic missile submarine in more than 40 years.

The cost of the new polar icebreakers might be further reduced by procuring both heavy and medium polar icebreakers to a common design, as recommended in the National Academies report. This approach could save more than $100 million in design costs and millions more in production costs for each medium polar icebreaker.

GAO has identified a risk of the first icebreaker being delivered later than currently scheduled. CRS agrees with that assessment. A late delivery could equate to an increase in the cost of building the ship. The Government can insulate itself against that risk by using a fixed-price contract, which the Coast Guard and Navy plan to do.

The possibility of a late delivery is something Congress may consider in connection with investments for maintaining the *Polar Star* and/or seeking a short-term bridging charter of an existing icebreaker. The possibility of a late delivery could also become an argument for starting construction of the new icebreaker as soon as its design is brought to a high level of completion and the ship is otherwise ready to begin construction.

Finally, regarding the National Maritime Strategy, I will just pick out one of the points I make in my statement, which is that a recently acknowledged potential shortfall of Navy escorts for protecting sealift ships in wartime could affect the willingness of civilian mariners to serve on those ships. If that were to happen, it could exacerbate the currently projected shortfall of available mariners.

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.

[Mr. O'Rourke's prepared statement follows:]

Prepared Statement of Ronald O'Rourke, Specialist in Naval Affairs, Congressional Research Service

Chairman Mast, Ranking Member Garamendi, distinguished members of the subcommittee, thank you for the opportunity to appear before you today to testify on icebreaker acquisition and the need for a national maritime strategy. In my work as a CRS analyst on naval and maritime military issues for the past 34 years, I have covered Coast Guard ship acquisition for Congress for 20 years,[1] the polar icebreaker program specifically for 10 years,[2] and issues relating to military sealift ships periodically for 28 years.[3] My biography is shown in Appendix A.

Appendix B to this statement presents a general summary of some lessons learned in government shipbuilding. Appendix C presents some considerations relating to the use of warranties in government shipbuilding. Appendix D presents some considerations relating to avoiding procurement cost growth vs. minimizing procurement costs in government shipbuilding. Appendix E presents discussion of the Coast Guard's National Security Cutter (NSC) program, Offshore Patrol Cutter (OPC) program, Fast Response Cutter (FRC) program, and Waterways Commerce Cutter (WCC) program, which help form the context for Coast Guard icebreaker procurement in a situation of finite Coast Guard procurement funding.

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[1] See, for example: CRS Report 98–830 F, *Coast Guard Integrated Deepwater System: Background and Issues for Congress*, by Ronald O'Rourke, first version October 5, 1998, final (i.e., archived) version June 1, 2001; CRS Report RS21019, *Coast Guard Deepwater Program: Background and Issues for Congress*, by Ronald O'Rourke, first version September 25, 2001, final (i.e., archived) version December 8, 2006; CRS Report RL33753, *Coast Guard Deepwater Acquisition Programs: Background, Oversight Issues, and Options for Congress*, by Ronald O'Rourke, first version December 18, 2006, final (i.e., archived) version January 20, 2012; and CRS Report R42567, *Coast Guard Cutter Procurement: Background and Issues for Congress*, by Ronald O'Rourke, first version June 13, 2012, current version October 26, 2018.

[2] See CRS Report RL34391, *Coast Guard Polar Security Cutter (Polar Icebreaker) Program: Background and Issues for Congress,* by Ronald O'Rourke, first version February 26, 2008, current version October 26, 2018.

[3] See, for example: CRS Report 90–446 F, *Sealift and Operation Desert Shield*, by Ronald O'Rourke, September 17, 1990; CRS Report 91–421 F, *Persian Gulf War: Defense-Policy Implications for Congress*, coordinated by Ronald O'Rourke, May 15, 1991 (section on sealift); CRS Report RL31946, *Iraq War: Defense Program Implications for Congress*, coordinated by Ronald O'Rourke, June 14, 2003 (section on sealift); and CRS Report RL32513, *Navy-Marine Corps Amphibious and Maritime Prepositioning Ship Programs: Background and Oversight Issues for Congress*, by Ronald O'Rourke, first version August 5, 2004, final (archived) version July 26, 2006.

ICEBREAKER ACQUISITION

Funding and Acquisition Context

PC&I Account Funding Levels

There has been some discussion recently of how certain Coast Guard procurement priorities, including icebreakers, would not be affordable if the Coast Guard's Procurement, Construction, and Improvements (PC&I) account in coming years were limited to an average of about $1.1 billion per year.[4] An average PC&I funding level of about $1.1 billion per year would have that effect. In 2013, then-Coast Guard Commandant Robert Papp testified that an annual PC&I funding level of about $1 billion per year "almost creates a death spiral for the Coast Guard."[5] The notion that the PC&I funding level will be limited to an average of about $1.1 billion per year, however, is no longer strongly supported by recent data on Coast Guard annual funding requests,[6] annual enacted funding levels,[7] or projected future annual funding requests as shown in Coast Guard 5-year Capital Investment Plans (CIPs).[8]

In assessing future funding levels for executive branch agencies, a common practice is to assume or predict that the figure in coming years will likely be close to where it has been in previous years. While this method can be of analytical and planning value, for an agency like the Coast Guard, which goes through periods with less acquisition of major platforms and periods with more acquisition of major platforms, this approach might not always be the best approach, at least for the PC&I account.

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

As one example of how past funding levels were not the best guide to future funding levels, and of how Congress has exercised its constitutional power to set funding levels and determine the composition of Federal spending, during the period FY2018–FY2015, when the Navy's shipbuilding account averaged about $14.7 billion per year in then-year dollars, there was recurring discussion about the challenge of increasing the account to the substantially higher annual funding levels that would soon be needed to begin implementing the Navy's 30-year shipbuilding plan. Projec-

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[4] See Government Accountability Office, *Coast Guard Acquisitions[:] Actions Needed to Address Longstanding Portfolio Management Challenges*, GAO–18–454, July 2018, Figure 4 on page 22, and GAO's spoken testimony during the question-and-answer portion of a July 24, 2018, hearing on Coast Guard acquisition programs and mission balance and effectiveness before the Coast Guard and Maritime Transportation subcommittee of the House Transportation Committee, during which Figure 4, which depicts a funding funnel, was shown on the hearing room's display screens. (The funnel, which compares an annual PC&I account funding figure of $1.1 billion to a higher figure of $2 billion consistent with the Coast Guard's preferred PC&I account annual funding level, is not drawn to scale: Although $1.1 billion is 55 percent of $2 billion, the narrower $1.1-billion bottom of the funnel has an opening with a diameter than is no more than 22 percent as wide as that of the larger, $2-billion top of the funnel.) In report GAO–18–454, see also Figure 3 on page 15, which indicates an average requested funding level of about $1.1 billion per year for the period FY2014–FY2018, as well as the discussion on pages 13–14.

[5] Admiral Papp's spoken testimony during a May 14, 2013, hearing on the Coast Guard's proposed FY2014 budget before the Homeland Security subcommittee of the Senate Appropriations Committee, as reflected in the transcript for the hearing.

[6] While the Coast Guard's annual budget submissions for the 5-year period FY2014 through FY2018 requested an average of about $1,065 million per year for the PC&I account, the Coast Guard's most recent request for the account—the request in its proposed FY2019 budget—is for $1,886.8 million (a figure that reflects a late addition of $720 million to the request for the polar icebreaker program), and the Coast Guard's annual budget submissions for the 5-year period FY2009–FY2013 requested an average of about $1,322 million for the account.

[7] Over the last 10 fiscal years (FY2009–FY2018), enacted funding levels for the PC&I account (including rescissions of unobligated balances) have averaged about $1,560 million per year. Only once during this period, in FY2015, was the enacted figure less than $1,200 million (it was $1,166.6 million that year). In the other 9 years, it was more than $1,200 million, and sometimes substantially more. The figures for the three most recent fiscal years—FY2016, FY2017, and FY2018—were $1,928.4 million, $1,370.0 million, and $2,282.4 million, respectively.

[8] Although the projected funding requests in the FY2014, FY2015, and FY2016 CIPs (showing figures for FY2014–FY2018, FY2015–FY2019, and FY2016–FY2020, respectively), averaged about $1,114.8 million per year, the projected funding requests in the FY2017 CIP (for the period FY2017–FY2021) averaged about $1,427.5 million, and those in the FY2018 CIP (for the period FY2018–FY2022) averaged about $1,533.1 million.

tions were prepared by CBO showing the decline in the size of the Navy that would occur over time if funding levels in the shipbuilding account did not increase substantially from the average level of about $14.7 billion per year. Congress, after assessing the situation, increased the shipbuilding account to $18.7 billion in FY2016, $21.2 billion in FY2017, $23.8 billion in FY2018, and $24.2 billion in FY2019. These increasing funding levels occurred even though the Budget Control Act, as amended, remained in operation during those years. At the most recent figure of $24.2 billion, the Navy's shipbuilding account is now 74 percent greater in then-year dollars than it was as recently as FY2010.

Coast Guard's Non-Use of Multiyear Contracting

In connection with my work on ship acquisition, I maintain the CRS report on multiyear procurement (MYP) and block buy contracting.[9] In both that report and in testimony I have given to other committees in recent years on Coast Guard ship acquisition,[10] I have noted the stark contrast between the Navy—which uses multiyear contracting (in the form of MYP or block buy contracting) extensively to reduce its ship-and aircraft-procurement costs by billions of dollars—and the Coast Guard, which to date has never used multiyear contracting in its ship or aircraft acquisition programs.

The Navy in recent years, with congressional approval, has used multiyear contracting for, among other things, all three of its year-to-year shipbuilding programs—the *Virginia*-class attack submarine program, the DDG–51 destroyer program, and the Littoral Combat Ship (LCS) program.[11] The Navy has been using multiyear contracting for the *Virginia*-class and DDG–51 programs more or less continuously since the late 1990's. Savings from the use of MYP recently have, among other things, helped Congress and the Navy to convert a nine-ship buy of DDG–51 class destroyers in FY2013-FY2017 into a 10-ship buy, and a nine-ship buy of *Virginia*-class attack submarines in FY2014-FY2018 into a 10-ship buy. The Navy is also now using block buy contracting for the six initial ships in the *John Lewis* (TAO–205) class oiler program, and is considering or anticipating using them for procuring LPD–17 Flight II amphibious ships, FFG(X) frigates, and *Columbia*-class ballistic missile submarines. The Navy's use or prospective use of multiyear contracting for its year-to-year shipbuilding programs is arguably now almost more of a rule than an exception in Navy shipbuilding. For Congress, granting approval for using multiyear contracting involves certain tradeoffs, particularly in connection with retaining year-to-year control of funding.[12] In the case of Navy shipbuilding, Congress has repeatedly accepted these tradeoffs.

In contrast with Navy practice, the Coast Guard often uses contracts with options in its ship-procurement programs. Contracts with options can be referred to as *multiple-year* contracts, but they are not *multiyear* contracts. Instead, contracts with options operate more like annual contracts, and they cannot achieve the kinds of savings that are possible with multiyear contracts.[13] Like the other military services,

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[9] 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.

[10] See, for example, CRS Testimony TE10020, *Building a 21st-Century Infrastructure for America: Coast Guard Sea, Air, and Land Capabilities: Part 2*, by Ronald O'Rourke, and CRS Testimony TE10004, *The Status of Coast Guard Cutter Acquisition Programs*, by Ronald O'Rourke.

[11] The term year-to-year shipbuilding program is used here to mean a shipbuilding program in which at least one ship of that kind is procured each year. The Coast Guard plans to execute the OPC program as a year-to-year shipbuilding program.

[12] 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 acquisition programs in response to unforeseen changes in strategic or budgetary circumstances (which can cause an y 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 orders of selected components for some or all of the end items that are to be procured under a multiyear contract); 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. Congress has considered these tradeoffs in deciding whether to grant the Navy authority for using multiyear contracting in the service's shipbuilding and other acquisition programs.

[13] For additional discussion, see CRS Report R41909, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, by Ronald O'Rourke and Moshe Schwartz, particularly the section entitled "MYP and BBC vs. Contracts with Options."

the Coast Guard has statutory authority to use MYP contracting and can be granted authority by Congress to use block buy contracting.

Polar Security Cutter (PSC) (aka Polar Icebreaker)

The CRS report on the polar icebreaker program, which the Coast Guard now refers to as the Polar Security Cutter (PSC) program, provides substantial discussion of various aspects of the program.[14] Below, as requested, are some focused observations on the program.

Reduction in Estimated Procurement Cost and Business Case

One of the most notable changes in the PSC program over the last year or two has been the reduction in the estimated unit procurement cost of the ships. The procurement cost of a new heavy polar icebreaker had earlier been estimated informally at roughly $1 billion, but the Coast Guard and Navy informed CRS and CBO in March 2018 that they now believe that three polar icebreakers could be acquired for a total cost of about $2.1 billion, or an average of about $700 million per ship.[15] (The first ship will cost more than the other two because it will incorporate design costs for the class and be at the start of the production learning curve for the class.) The March 2, 2018, Request for Proposals (RFP) for the PSC program states that "For informational purposes only, the government has established an estimate for the HPIB [heavy polar icebreaker] shipbuilder costs in the amount of $746M [million] for the lead ship . . . with an average ship price of $615M across three HPIBs . . . "[16] Other information reported by GAO identifies a smaller reduction in procurement cost, to something more than $900 million per ship.[17] Other things held equal, reductions in the estimated unit procurement cost of the polar icebreaker strengthen the business case for the program. A reduction in estimated unit procurement cost to an average of $700 million per ship would strengthen it substantially.

Option for Block Buy Contract

The baseline plan for the PSC program calls for acquiring the ships using a contract with options, but Coast Guard and Navy officials are open to the idea of instead using a block buy contract to acquire at least some of the ships, and requested information on this possibility as part of the RFP for the PSC program that was released on March 2, 2018. Using the above-mentioned $2.1 billion estimated cost for a three-ship procurement of PSCs, and based on savings estimates provided by the Navy in the past for Navy shipbuilding programs that were being proposed for multiyear contracting, using a block buy contract that included authority for making economic order quantity (EOQ) purchases[18] rather than a contract with options might reduce the combined acquisition cost of three PSCs by upwards of 7 percent, 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 (emphasis as in original):

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[14] CRS Report RL34391, *Coast Guard Polar Security Cutter (Polar Icebreaker) Program: Background and Issues for Congress*, by Ronald O'Rourke.

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

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

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

[18] EOQ purchases are up-front batch orders of selected components for some or all of the end items (ships in this case) that are to be procured under a multiyear contract.

> 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 lifec ycle cost metrics. . . .
>
> A block buy authority for this program will need to contain specific language for economic order quantity purchases for materials, advanced design, and construction activities. A block buy contracting program with economic order quantity purchases enables series construction, motivates competitive bidding, and allows for volume purchase and for the timely acquisition of material with long lead times. It would enable continuous production, give the program the maximum benefit from the learning curve, and thus reduce labor hours on subsequent vessels. . . .
>
> If advantage is taken of learning and quantity discounts available through the recommended block buy contracting acquisition strategy, the average cost per heavy icebreaker is approximately $791 million, on the basis of the acquisition of four ships.[19]

Although Coast Guard officials have expressed interest in using a block buy contract for procuring PSCs, they are considering the option of procuring the first PSC under a single-ship contract and then using a block buy contract to procure subsequent PSCs. In support of that option, Coast Guard officials have noted the risks involved in building a lead ship and the fact that the United States has not built a heavy polar icebreaker in more than 40 years. Opponents of including the first PSC in a block buy contract might argue, for example, that problems with the design of PSC components might be transmitted from the first PSC to later PSCs by up-front EOQ purchases of those components made under a block buy contract. They might additionally argue that excluding the first PSC from a block buy contract preserves more government flexibility on whether and when to procure a second PSC, which could be advantageous for responding to potential changes in operational needs or budgetary circumstances.

Supporters of including the first PSC in a block buy contract could argue that block buy contracting was invented to a large degree expressly to permit a lead ship to be included in the contract, that the Navy has included lead ships in block buy contracts in the *Virginia*-class attack submarine program and the TAO–205 class oiler program, and that the Navy is considering using a block buy contract that includes the lead ship for procuring the initial ships in the *Columbia*-class ballistic missile submarine program. The comparison with the Navy's plans for the *Columbia*-class, they could argue, is of particular note, because the United States has not procured the lead ship of a new class of ballistic missile submarines in more than 40 years, the *Columbia*-class design is more complex in certain regards than the PSC design, and the *Columbia*-class design will incorporate a new-design electric-drive propulsion plant'something that the United States has never before done on a series-production nuclear-powered submarine.

The lead ship in the PSC program will carry a risk of requiring design changes to fix problems in the design that are only discovered as a result of building the design. That risk, however, will exist regardless of whether the lead ship is built under a single-ship contract of a block buy contract, and it is not clear how much more chance there would be under a block buy contract of transmitting any such design problems to the second PSC, because the Coast Guard's notional schedule for the PSC program calls for procuring the second ship about 18 months after the first (i.e., while construction of the first PSC is still in progress). To the extent that there would be a greater chance of transmitting design problems to the second PSC under a block buy contract, the question would then become one of weighing the potential cost of fixing those design problems against the added economies of including the first PSC in a block buy contract. Supporters of including the lead ship in a block buy contract could argue that the risks of encountering a design problem in the first ship have been mitigated by the industry's shift since the last polar icebreakers

[19] 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.

were built from paper designs to computer-aided design, by the Navy's involvement in the PSC program, and by the PSC program's strategy of using a parent design (i.e., an existing polar-capable icebreaker design) as the basis for the PSC design. As shown in Appendix B, a key lesson-learned in government shipbuilding is to bring the design of the ship in question to a high level of completion before beginning construction of the ship, precisely so as to minimize the risk of design problems. Supporters of including the lead ship in a block buy contract could argue that if there is a significant risk of substantial design problems in the lead ship, that is not an argument against including the lead ship in a block buy contract—it is an argument against beginning construction of the ship under any form of contract.

Risk of Delayed Delivery of Lead Ship

GAO has identified a risk of the first PSC being delivered later than its currently scheduled delivery date.[20] CRS agrees with that assessment. The Navy's experience in building lead ships suggests that there is a substantial risk of the first PSC being delivered late—perhaps as much as a year or more later than currently scheduled. A late delivery could equate to an increase in the cost of building the ship, because it could reflect having to use more labor hours to build the ship than had been estimated, and because the ship will absorb more of the shipyard's overhead costs by remaining in the shipyard for a longer period of time. The government can insulate itself against the risk of such cost growth by using a fixed-price contract to build the ship (which the Coast Guard and Navy plan to do).

The possibility of a late delivery is something the Coast Guard and Congress may consider preparing for in terms of investments for maintaining *Polar Star* as an operational ship and/or seeking a short-term bridging charter of a foreign polar icebreaker. To the extent that a delay in delivering the lead ship would extend a gap in time between the retirement of *Polar Star* and the entry into service of the first PSC, that could become an argument for starting construction of the lead PSC as soon as its design is brought to a high level of completion and the ship is otherwise ready to begin construction.

Option for Using a Common Design for Heavy and Medium PSCs

The Coast Guard envisages procuring up to three new medium icebreakers after it procures three new heavy polar icebreakers—a plan known as 3+3. The July 2017 NASEM report 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. (That is not particularly surprising—the Coast Guard's current medium polar icebreaker, *Healy*, is actually somewhat larger than the Coast Guard's heavy polar icebreaker, *Polar Star*. *Healy* has less icebreaking capability than *Polar Star*, but more capacity for supporting onboard science operations.) Given this probable similarity in size, the NASEM report recommended building a single medium polar icebreaker to the same common design as the three new heavy polar icebreakers (i.e., 4+0), and operating these four new ships in conjunction with *Healy* to produce a five-ship polar icebreaker fleet. The 4+0 production strategy, the report concluded, would reduce the cost of the medium icebreaker by avoiding the cost of developing a second icebreaker design and 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. An abstract from the NASEM report on this proposal is shown in Appendix F to this statement.

If policymakers decide to procure a second or third new medium polar icebreaker, the same general approach recommended by the NASEM report could be followed, leading to a 5+0 or 6+0 acquisition. The potential percentage savings under a five- or six-ship block buy contract with EOQ authority could be greater than the figure of upwards of 7 percent mentioned earlier for a three-ship block buy—they could be closer to 10 percent. Building a single common icebreaker design rather than two designs to meet needs for heavy and medium polar icebreakers might also reduce life-cycle operation and support costs.

An April 12, 2018, press report states:

> As the Coast Guard prepares to review industry bids for a new heavy polar icebreaker, the service is keeping its options open for the right number and mix of polar icebreakers it will need in the future, Adm. Paul Zukunft, the [then-]Commandant of the Coast Guard, said on Wednesday [April 11].

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[20] See Government Accountability Office, *Coast Guard Acquisitions[:] Polar Icebreaker Program Needs to Address Risks before Committing Resources*, GAO–18–600, September 2018, pp. 33–40.

> 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, DC.
>
> 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.[21]

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;
- 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.[22]

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.[23] *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.[24]

Coast Guard officials have stated that they do not view the procurement of additional Great Lakes icebreakers as an urgent near-term acquisition need. In support of this assessment, they cite the capabilities of the current Great Lakes icebreaking fleet, the relatively young age of *Mackinaw* (which entered service in 2006), service life extension work being done on the ice-breaking tugs that is designed to add 15 years to their service lives,[25] and Canada's own Great Lakes icebreaking capabilities. A 2016 1Coast Guard report to Congress on the Great Lakes icebreaking mission stated:

> 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

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

[22] 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.

[23] 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.

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

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

> 2014 and 2015 ice seasons were a 20-year anomaly, consuming almost twice as many cutter resource hours as in any other year since 2005.
>
> 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.[26]

The Coast Guard's position notwithstanding, some Members of Congress in recent years have expressed interest in the possibility of bolstering the Coast Guard's Great Lakes icebreaking fleet by procuring a second icebreaker with capabilities generally similar to those of *Mackinaw*. Interest in this option was reinforced by the winters of 2013–2014 and 2014–2015, which featured particularly high levels of ice coverage on the Great Lakes.[27] The committee report language requiring the above-quoted Coast Guard report to Congress is one example of this interest.[28] Another example is Section 215 of S. 1129, the Coast Guard Authorization Act of 2017 as reported in the Senate (S.Rept. 115–89 of June 15, 2017), which states:

> SEC. 215. Great Lakes icebreaker acquisition.
>
> (a) Icebreaking on the Great Lakes.—For fiscal years 2018 and 2019, the Commandant of the Coast Guard may use funds made available pursuant to section 2702(2) of title 14, United States Code, as amended by section 101 of this Act, for the selection of a design for, and the construction of, an icebreaker that is at least as capable as the Coast Guard Cutter *Mackinaw* to enhance icebreaking capacity on the Great Lakes.
>
> (b) Initial survey and design work.—The Commandant of the Coast Guard shall commence initial survey and design work associated with the acquisition of a new Coast Guard icebreaker that is at least as capable as the Coast Guard Cutter *Mackinaw* to enhance icebreaking capacity on the Great Lakes.
>
> (c) Acquisition plan.—Not later than 45 days after the date of enactment of this Act, the Commandant shall submit a plan to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Transportation and Infrastructure of the House of Representatives for acquiring an icebreaker described in subsections (a) and (b). Such plan shall include—
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> (1) the details and schedule of the acquisition activities to be completed; and

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[26] 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).

[27] 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.

[28] S.Rept. 114–68 stated: GREAT LAKES ICEBREAKING CAPACITY The Coast Guard is required by law to maintain a heavy icebreaking capability on the Great Lakes to assist in keeping channels and harbors open to navigation in response to the reasonable demands of commerce to meet the winter shipping needs of industry. The Committee is concerned that the Coast Guard does not possess adequate capacity to meet its statutorily required icebreaking mission on the Great Lakes, with negative consequences to the regional and national economy as well as to the safety of local communities. While the Committee fully supports the Coast Guard's Service Life Extension Project for its nine-vessel 140-foot icebreaking tugs as part of the In-Service Vessel Sustainment Program, it notes that additional assets may be necessary to successfully operate in the heavy ice conditions often experienced by the Great Lakes. The Committee directs the Coast Guard to undertake an updated mission analysis study to determine the assets necessary to effectively carry out its icebreaking requirements on the Great Lakes, including consideration of a second heavy icebreaker for the Great Lakes, consistent with the capabilities of the *Mackinaw*. The updated mission analysis should factor in recent historically high levels of ice coverage and the economic costs of reduced Great Lakes shipping associated with maintaining only one heavy icebreaker. The updated mission analysis shall be submitted to the Committee not later than 180 days after the date of enactment of this act. (Page 75)

(2) a description of how the funding for Coast Guard acquisition, construction, and improvements that was appropriated under the Consolidated Appropriations Act of 2017 (Public Law 115–31) will be allocated to support the acquisition activities referred to in paragraph (1).[29]

An examination of procurement costs for *Mackinaw*, the National Science Foundation's ice-capable research ship Sikuliaq, new oceanographic research ships being procured for NOAA, and OPCs suggests that a new *Mackinaw*-sized heavy Great Lakes icebreaker built in a U.S. shipyard might have a design and construction cost between $175 million and $300 million, depending on its exact capabilities and the acquisition strategy employed.[30] The design portion of the ship's cost might be reduced if *Mackinaw*'s design or the design of some other existing icebreaker were to be used as the parent design. Depending on the capabilities and other work load of the shipyard selected to build the ship, the construction time for a new heavy Great Lakes icebreaker might be less than that of a new heavy polar icebreaker.

NEED FOR A NEW NATIONAL MARITIME STRATEGY

Regarding the issue of the need for a national maritime strategy,[31] four observations can be made.

Shift in Security Environment; New National Defense Strategy

The first observation relates to two legislative requirements from 2014 for the Department of Transportation (DOT) to issue a national sealift strategy and a national maritime strategy. GAO notes that these two requirements have not been met, and that this has deprived Congress of information for supporting decisionmaking relating to the U.S.-flag merchant fleet.[32]

If DOT had issued such a strategy in the period 2014–2016 or even in 2017, they would have reflected the Obama Administration's defense strategy rather than the Trump Administration's defense strategy, an unclassified summary of which was

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[29] In addition, Section 314 of S. 1129 as reported in the Senate states (emphasis added):

SEC. 314. Inland waterway and river tender, and **bay class icebreaker** acquisition plan.

(a) Acquisition plan.—Not later than 545 days after the date of enactment of this Act, the Commandant of the Coast Guard shall submit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Transportation and Infrastructure of the House of Representatives a plan to replace the aging fleet of inland waterway and river tenders, and the **bay class icebreakers**.

(b) Contents.—The plan described in subsection (a) shall include—

(1) a schedule for the acquisition to begin;

(2) the date the first vessel will be delivered;

(3) the date the acquisition will be complete;

(4) a description of the order and location of replacements;

(5) an estimate of the cost per vessel and for total acquisition program of record; and

(6) an analysis of whether existing vessels can be used.

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

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

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

[31] As used here, the term *national maritime strategy* means a strategy for ensuring that the U.S. merchant marine fleet and the U.S. civilian mariner workforce are adequate for, among other things, meeting DoD needs for military sealift capacity in time of crisis or conflict. In other contexts, the term *maritime strategy* can have other meanings. Navy officials, for example, have often used the term to refer to a strategy for how to employ naval forces in a major conflict.

[32] Government Accountability Office, *Maritime Security[:] DOT Needs to Expeditiously Finalize the Required National Maritime Strategy for Sustaining U.S.-Flag Fleet*, GAO–18–478, August 2018, summary page and pp. 34–35.

not published until January 2018.[33] More broadly, a national maritime strategy issued in the period 2014–2017 might not have fully reflected the shift in the international security environment from the post-cold war era to the current era of renewed great power competition.[34]

This shift was not placed explicitly at the forefront of declared U.S. national security strategy until the Trump Administration released its national security strategy in December 2017.[35]

In light of this, it might be argued that if a national maritime strategy had been issued in 2014–2017, it would today be in need of update, revision, or replacement. That does not negate the impact to policymakers of having been deprived of such a strategy in 2014–2017, but it suggests that even if such a strategy had been issued during that period, policymakers might nevertheless be in a situation today of wanting a new version to be prepared. A similar observation can be made about the Navy's current force-level goal for achieving and maintaining a fleet of 355 ships. As discussed in the CRS report on Navy force-structure and shipbuilding plans, this force-level goal was based on a force structure analysis conducted in 2016, and thus reflects the Obama Administration's defense strategy rather than the Trump Administration's defense strategy.[36] As noted in the CRS report, the Navy has acknowledged this issue and has stated that it is preparing an update or revision to its 355-ship force-level goal that will be based on the Trump Administration's defense strategy.

Mobility Capabilities and Requirements Study 2018 (MCRS–18)

A second observation relates to Section 144(b) of the National Defense Authorization Act for Fiscal Year 2018 (H.R. 2810/P.L. 115–91 of December 12, 2017), which requires DoD to conduct a new mobility capability and requirements study, and to brief the congressional defense committees on the results of the study not later than September 30, 2018. DoD states that it started the study, which it refers to as the Mobility Capabilities and Requirements Study 2018 (MCRS–18), on March 8, 2018, and that it is scheduled for completion in the fall of 2018.[37] In connection with the point made in the previous section, the Commander of U.S. Transportation Command (USTRANSCOM), Air Force General Darren W. McDew, testified earlier this year that MCRS–18 "will reflect requirements articulated in the new National Defense Strategy . . . ."[38]

A September 25, 2017, press report about MCRS–18 states that "Since the early 1990's, Pentagon mobility studies have consistently identified a requirement for about 20 million square feet of roll-on/roll-off capacity to quickly transport material in support of a contingency."[39] Mobility studies conducted from the 1990's until recently, however, were all done in the post-cold war era, when U.S. military force planning focused to a large degree on potential crises and conflicts against regional military powers such as Iran and North Korea. Given the recent shift from the post-cold war era to the new era of renewed great power competition and the resulting formal shift in U.S. military force planning toward a primary emphasis on potential challenges posed by China and Russia, it is not clear that MCRS–18 will leave the figure of 20 million square feet of roll-on/roll-off capacity unchanged. A change in this figure could have implications for the content of a new national maritime strategy.

Recapitalization of DoD Sealift Fleet

A third observation relates to DoD's aging fleet of surge sealift ships. Since 2016, the condition of this fleet and DoD's strategy for recapitalizing it in coming years

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[33] Department of Defense, *Summary of the 2018 National Defense Strategy of the United States of America, Sharpening the American Military's Competitive Edge*, undated, released January 19, 2018, 11 pp.

[34] For more on this shift, see CRS Report R43838, *A Shift in the International Security Environment: Potential Implications for Defense—Issues for Congress*, by Ronald O'Rourke.

[35] White House, *National Security Strategy of the United States of America*, December 2017, 55 pp. For further discussion of this shift and its acknowledgment in the U.S. national security strategy, see CRS Report R43838, *A Shift in the International Security Environment: Potential Implications for Defense—Issues for Congress*, by Ronald O'Rourke.

[36] CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

[37] Source: U.S. Transportation Command, "Mobility Capabilities and Requirements Study Gets Underway," March 29, 2018.

[38] Statement of General Darren W. McDew, United States Air Force, Commander, United States Transportation Command, Before the Senate Armed Services Committee On the State of the Command, April 10, 2018, p. 12.

[39] Jason Sherman, "DOD Eyes 2018 to Set Assumptions, Scenarios for Mobility Capability Study," *Inside the Navy*, September 25, 2017.

have become matters of concern for policymakers. In February 2017, the Army reportedly sent an information paper to Congress warning of an "unacceptable risk in force projection" within the next 5 years if the Navy does not act quickly to address the situation.[40] In May 2016, the House Armed Services Committee directed GAO to report on the readiness of Military Sealift Command Ships (MSC) and employment plans.[41] GAO's report, issued in August 2017, focused in part on declining readiness rates for DoD's surge sealift ships.[42]

In March 2018, the Navy reportedly submitted to Congress a report on a proposed strategy for recapitalizing the surge sealift fleet, as well as requested legislative authorities for implementing the strategy.[43] Section 1021 of the National Defense Authorization Act for Fiscal Year 2018 (H.R. 2810/P.L.–115–91 of December 12, 2017) and Sections 1012 and 1013 of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (H.R. 5515/P.L. 115–232 of August 13, 2018) amended 10 U.S.C. 2218—the statute governing the National Defense Sealift Fund (NDSF)—to, among other things, provide DoD with authority, subject to certain conditions, to purchase used vessels, including a limited number of foreign-built vessels, as part of its effort to recapitalize the surge sealift fleet. Section 1019 of P.L. 115–232 requires the Navy, in consultation with the Maritime Administration (MARAD) and USTRANSCOM, submit to the congressional defense committees a report setting forth a business case analysis of recapitalization options for the Ready Reserve Force (RRF).[44] How, and how quickly, the surge sealift fleet is recapitalized could have implications for the content of a new national maritime strategy.

Potential Shortfall of Navy Escorts and Possible Impacts on Mariners

A fourth observation relates to the availability of U.S.-citizen mariners to crew DoD sealift ships in wartime. GAO notes MARAD's September 2017 estimate of a potential shortage of U.S.-citizen mariners available to crew U.S.-owned reserve sealift ships during a crisis or conflict.[45] The challenge of finding adequate numbers of appropriately trained mariners to crew DoD sealift ships in time of crisis or conflict is a longstanding issue, dating back at least to 1990, when mariners in their 50's, 60's, and 70's (and one aged 81), some brought out of retirement, were reportedly needed to help fill out the crews of DoD sealift ships that were activated for Operation Desert Shield (the initial phase of the U.S. reaction to Iraq's 1990 invasion of Kuwait).[46] Problems in filling out ship crews reportedly contributed to delays in activating some RRF sealift ships to participate in the operation.[47] A potential

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[40] David B. Larter, "US Army Warns of Crippling Sealift Shortfalls During Wartime," *Defense News*, November 11, 2018. See also John Grady, "Official: U.S. Military Sealift Capacity is 'On the Ragged Edge," *USNI News*, April 11, 2018; David B. Larter, "The US Army Is Preparing to Fight in Europe, But Can It Even Get There?" *Defense News*, October 8, 2018. David B. Larter, "The US Navy Will Have to Pony Up and Race the Clock to Avoid a Sealift Capacity Collapse," *Defense News*, October 20 2018.

[41] H.Rept. 114–537 of May 4, 2016, on H.R. 4909, the National Defense Authorization Act for FY2017, pp. 126–127.

[42] Government Accountability Office, *Navy Readiness[:] Actions Needed to Maintain Viable Surge Sealift and Combat Logistics Fleets*, GAO–17–503, August 2017, 33 pp.

[43] See, for example, Justin Katz, "Navy Sends Congress $242 Million Plan to Recap Surge Sealift," *Inside Defense (Daily News)*, March 29, 2018. See also Justin Katz, "DOD Requests Authorities for Sealift Surge Force Procurement in FY–19 Defense Policy Bill," *Inside Defense (The Insider)*, April 3, 2018.

[44] Section 1019 states that the business case analysis is to include each sealift capability area and associated capacity for which RRF ships are required to be recapitalized through FY2018, and that the categories of ships to be considered are to include U.S. purpose-built vessels such as Common Hull Auxiliary Multi-mission Platform (CHAMP) ships; U.S. non-purpose built vessels such as vessels formerly engaged in Jones Act trade; foreign-built ships that participated in the Maritime Security Program (MSP); foreign-built vessels that did not participate in the MSP; and foreign-designed, U.S.-built ships.

[45] Government Accountability Office, *Maritime Security[:] DOT Needs to Expeditiously Finalize the Required National Maritime Strategy for Sustaining U.S.-Flag Fleet*, GAO–18–478, August 2018, summary page and pp. 29–33. MARAD's estimate is presented in U.S. Department of Transportation, Maritime Administration, *Maritime Workforce Working Group Report*, undated, transmission letter dated September 29, 2017, 137 pp. See also John Grady, "MARAD: U.S. Short Almost 2,000 Mariners to Supply American Force in War," *USNI News*, March 8, 2018.

[46] See, for example, Lourdes Rodriguez-Florido, "Worth Their Salt; Scarcity of Trained Mariners During Gul War Prompts Call-Up of Some Old Men of the Sea," *Sun-Sentinel*, February 6, 1992; Robert Little, "Merchant Marine's Demise Endangers War Readiness," *Baltimore Sun*, August 5, 2001.

[47] See, for example, CRS Report 90–446 F, *Sealift and Operation Desert Shield*, by Ronald O'Rourke, September 17, 1990, p. 21. For an example of an analysis expressing concern about

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shortage of U.S.-citizen mariners for manning DoD sealift ships in wartime has been a recurring matter of concern since then.

This longstanding issue, however, may now be affected by a new factor that relates to the defense of DoD sealift ships in wartime. From 1990 until recently (i.e., during the post-cold war era), the defense of DoD sealift ships was not a pressing concern. In the new era of renewed major power competition, it has become a concern, given current and potential future Chinese and Russian capabilities for interdicting ships. Section 1072 of the National Defense Authorization Act for Fiscal Year 2018 (H.R. 2810/P.L. 115–91 of December 12, 2017) requires the Navy to submit a report on its plans for defending combat logistics and strategic mobility forces—meaning Navy underway replenishment ships, RRF sealift ships, and MSC surge sealift ships—against potential wartime threats. The report is to include, among other things, a "description of the combat logistics and strategic mobility forces capacity, including additional combat logistics and strategic mobility forces, that may be required due to losses from attacks," an "assessment of the ability and availability of United States naval forces to defend combat logistics and strategic mobility forces from the threats," and a "description of specific capability gaps or risk areas in the ability or availability of United States naval forces to defend combat logistics and strategic mobility forces from the threats . . . ."

The question of how DoD sealift ships will be defended in wartime, including the possibility of capability gaps for defending them, could have implications for the potential shortage of U.S.-citizen mariners for crewing DoD sealift ships in wartime. An October 10, 2018, press report stated:

> In the event of a major war with China or Russia, the U.S. Navy, almost half the size it was during the height of the cold war, is going to be busy with combat operations. It may be too busy, in fact, to always escort the massive sealift effort it would take to transport what the Navy estimates will be roughly 90 percent of the Marine Corps and Army gear the force would need to sustain a major conflict.
>
> That's the message Mark Buzby, the retired rear admiral who now leads the Department of Transportation's Maritime Administration, has gotten from the Navy, and it's one that has instilled a sense of urgency around a major cultural shift inside the force of civilian mariners that would be needed to support a large war effort.
>
> "The Navy has been candid enough with Military Sealift Command and me that they will probably not have enough ships to escort us. It's: 'You're on your own; go fast, stay quiet,'" Buzby told Defense News in an interview earlier this year.
>
> Along with Rear Adm. Dee Mewbourne at Military Sealift Command, who would get operational control of the whole surge force in a crisis, Buzby has been working to educate mariners on things that might seem basic to experienced Navy personnel but are new to many civilian mariners. . . .
>
> . . . significant losses among the available pool of mariners would likely dissuade some from volunteering (bad) and would mean the loss of mariners with critical skills needed to operate the fleet for months or even years in a major contingency (worse). And even without losses, MARAD estimates the country is about 1,800 mariners short if any kind of rotational presence is needed . . . .
>
> To try and offset these daunting challenges, MSC and the Maritime Administration are getting their mariners to think more like sailors when it comes to digital emissions. . . .
>
> "Adm. Mewbourn at Military Sealift Command and I have talked a lot about this and we have been trying to get the word out to people that we are going to have to do things differently," Buzby said.
>
> "Turn your navigation lights off, turn your [Automatic Identification System] off, turn your radars off, tell your crews not to use their cell phones—all those [Emissions Condition] things that we in the Navy are familiar with that are completely foreign to a merchant mariner and are seen as an imposition. . . .

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this issue even before 1990, see Stephen D. Boyce, *Strategic Mobility and the Decline of the United States Merchant Marine*, Air War College Research Report, 1989, 78 pp.

> Military Sealift Command is focusing more on operating inside contested waters, said Tom Van Leunen, the command's spokesman.
>
> "We are operationalizing the force, that's been Adm. Mewborne's focus since he got here. We're focused on preparing mariners for the more complex operational environment," Van Leunen said.
>
> As part of those efforts, the command has developed a basic and advanced operations course for its mariners and has been participating in more fleet exercises, he said.
>
> Mewborne's efforts on "mariner resiliency" have been setting the right tone, Buzby said. The effort focuses on containing electronic emissions, becoming physically fit to be able to combat damage over long periods and a sobering reminder at the end, he added.
>
> "The last bullet point on one of the slides is 'Learn how to swim,'" he said. "It's to that point. There's not going to be a bunch of destroyers around us as we take those ships over there. We're going to be hitting the sea buoy, cranking it up and going hell-bent for leather, hoping to stay undetected."
>
> . . . while the [NATO] alliance continues to scrape the rust off its large-scale logistics trains, the question of whether the mariners will show up to man the lift vessels is an open one, and one that Buzby thinks about from his office at the MARAD.
>
> "We are going into a contested environment, so we are going to have attrition to deal with, in both ships and the people who sail on them," Buzby said. "Who knows, that might dissuade some people.
>
> "The tradition of the Merchant Marine is we go to sea no matter what, damn the torpedoes. Most of us believe that our people will not be dissuaded. But until they walk up the gangway, you never know."[48]

An Implication from the Above Observations

One implication of these four observations is that the situation concerning the future of military sealift is currently complex and dynamic, with multiple issues and developments unfolding in parallel. This will make the task of assessing sealift needs and capabilities and developing a supporting national maritime strategy more challenging.

Chairman Mast, 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.

APPENDIX A. BIOGRAPHY—RONALD O'ROURKE

Mr. O'Rourke is a Phi Beta Kappa graduate of the Johns Hopkins University, from which he received his B.A. in international studies, and a valedictorian graduate of the University's Paul Nitze School of Advanced International Studies, where he received his M.A. in the same field.

Since 1984, Mr. O'Rourke has worked as a naval analyst for CRS. He has written many reports for Congress on various issues relating to the Navy, the Coast Guard, defense acquisition, China's naval forces and maritime territorial disputes, the Arctic, the international security environment, and the U.S. role in the world. He regularly briefs Members of Congress and congressional staffers, and has testified before congressional committees on many occasions.

In 1996, he received a Distinguished Service Award from the Library of Congress for his service to Congress on naval issues.

In 2010, he was honored under the Great Federal Employees Initiative for his work on naval, strategic, and budgetary issues.

In 2012, he received the CRS Director's Award for his outstanding contributions in support of the Congress and the mission of CRS.

In 2017, he received the Superior Public Service Award from the Navy for service in a variety of roles at CRS while providing invaluable analysis of tremendous benefit to the Navy for a period spanning decades.

Mr. O'Rourke is the author of several journal articles on naval issues, and is a past winner of the U.S. Naval Institute's Arleigh Burke essay contest. He has given presentations on naval, Coast Guard, and strategy issues to a variety of U.S. and international audiences in government, industry, and academia.

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[48] David B. Larter, "'You're On Your Own': US Sealift Can't Count on Navy Escorts in the Next Big War," *Defense News*, October 10, 2018.

APPENDIX B. A SUMMARY OF SOME ACQUISITION LESSONS LEARNED FOR GOVERNMENT SHIPBUILDING

This appendix presents a general summary of lessons learned in government shipbuilding, reflecting comments made repeatedly by various sources over the years.[49] These lessons learned include the following:

- *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 percent-to-80 percent solution (i.e., a design that is intended to provide 70 percent–80 percent 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, multiyear procurement (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 arguably not the hard part—most if not all these points have been cited for years. The hard part, arguably, is living up to them without letting circumstances lead program-execution efforts away from these guidelines.

APPENDIX C. SOME CONSIDERATIONS RELATING TO WARRANTIES IN GOVERNMENT SHIPBUILDING AND OTHER GOVERNMENT ACQUISITION

This appendix presents some considerations relating to warranties in shipbuilding and other defense acquisition.[50]

In discussions of government shipbuilding, one question that sometimes arises is whether including a warranty in a shipbuilding contract is preferable to not including one. The question can arise, for example, in connection with a GAO finding that "the Navy structures shipbuilding contracts so that it pays shipbuilders to build ships as part of the construction process and then pays the same shipbuilders a second time to repair the ship when construction defects are discovered."[51]

Including a warranty in a shipbuilding contract (or a contract for building some other kind of end item), while potentially valuable, might not always be preferable to not including one—it depends on the circumstances of the acquisition, and it is not necessarily a valid criticism of an acquisition program to state that it is using a contract that does not include a warranty (or a weaker form of a warranty rather than a stronger one).

Including a warranty generally shifts to the contractor the risk of having to pay for fixing problems with earlier work. Although that in itself could be deemed desirable from the government's standpoint, a contractor negotiating a contract that will have a warranty will incorporate that risk into its price, and depending on how much the contractor might charge for doing that, it is possible that the government could wind up paying more in total for acquiring the item (including fixing problems

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[49] This appendix is adapted from Appendix J of CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke. See also Government Accountability Office, *Navy Shipbuilding[:] Past Performance Provides Valuable Lessons for Future Investments*, GAO–18–238SP, June 2018, 36 pp.

[50] This appendix is adapted from Appendix K of CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

[51] See Government Accountability Office, *Navy Shipbuilding[:] Past Performance Provides Valuable Lessons for Future Investments*, GAO–18–238SP, June 2018, p. 21. A graphic on page 21 shows a GAO finding that the government was financially responsible for shipbuilder deficiencies in 96 percent of the cases examined by GAO, and that the shipbuilder was financially responsible for shipbuilder deficiencies in 4 percent of the cases.

with earlier work on that item) than it would have under a contract without a warranty.

When a warranty is not included in the contract and the government pays later on to fix problems with earlier work, those payments can be very visible, which can invite critical comments from observers. But that does not mean that including a warranty in the contract somehow frees the government from paying to fix problems with earlier work. In a contract that includes a warranty, the government will indeed pay something to fix problems with earlier work—but it will make the payment in the less-visible (but still very real) form of the up-front charge for including the warranty, and that charge might be more than what it would have cost the government, under a contract without a warranty, to pay later on for fixing those problems.

From a cost standpoint, including a warranty in the contract might or might not be preferable, depending on the risk that there will be problems with earlier work that need fixing, the potential cost of fixing such problems, and the cost of including the warranty in the contract. The point is that the goal of avoiding highly visible payments for fixing problems with earlier work and the goal of minimizing the cost to the government of fixing problems with earlier work are separate and different goals, and that pursuing the first goal can sometimes work against achieving the second goal.[52]

The Department of Defense's guide on the use of warranties states the following:

> Federal Acquisition Regulation (FAR) 46.7 states that "the use of warranties is not mandatory." However, if the benefits to be derived from the warranty are commensurate with the cost of the warranty, the CO [contracting officer] should consider placing it in the contract. In determining whether a warranty is appropriate for a specific acquisition, FAR Subpart 46.703 requires the CO to consider the nature and use of the supplies and services, the cost, the administration and enforcement, trade practices, and reduced requirements. The rationale for using a warranty should be documented in the contract file. . . .
>
> In determining the value of a warranty, a CBA [cost-benefit analysis] is used to measure the life cycle costs of the system with and without the warranty. A CBA is required to determine if the warranty will be cost beneficial. CBA is an economic analysis, which basically compares the Life Cycle Costs (LCC) of the system with and without the warranty to determine if warranty coverage will improve the LCCs. In general, five key factors will drive the results of the CBA: cost of the warranty + cost of warranty administration + compatibility with total program efforts + cost of overlap with Contractor support + intangible savings. Effective warranties integrate reliability, maintainability, supportability, availability, and life-cycle costs. Decision factors that must be evaluated include the state of the weapon system technology, the size of the warranted population, the likelihood that field performance requirements can be achieved, and the warranty period of performance.[53]

APPENDIX D. SOME CONSIDERATIONS RELATING TO AVOIDING PROCUREMENT COST GROWTH VS. MINIMIZING PROCUREMENT COSTS

This appendix presents some considerations relating to avoiding procurement cost growth vs. minimizing procurement costs in shipbuilding and other government acquisition.[54]

The affordability challenge posed by government shipbuilding plans can reinforce the strong oversight focus on preventing or minimizing procurement cost growth in

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[52] It can also be noted that the country's two largest builders of Navy ships—General Dynamics (GD) and Huntington Ingalls Industries (HII)—derive about 60 percent and 96 percent, respectively, of their revenues from U.S. Government work. (See General Dynamics, *2016 Annual Report*, page 9 of Form 10-K [PDF page 15 of 88]) and Huntington Ingalls Industries, 2016 Annual Report, page 5 of Form 10-K [PDF page 19 of 134]). Thus, even if a warranty in a shipbuilding contract with one of these firms were to somehow mean that the government did not have pay under the terms of that contract—either up front or later on—for fixing problems with earlier work done under that contract, there would still be a question as to whether the government would nevertheless wind up eventually paying much of that cost as part of the price of one or more future contracts the government may have that firm.

[53] Department of Defense, *Department of Defense Warranty Guide, Version 1.0*, September 2009, accessed July 13, 2017, at https://www.acq.osd.mil/dpap/pdi/uid/docs/departmentofdefensewarrantyguide[1].doc.

[54] This appendix is adapted from Appendix L of CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

government shipbuilding programs, which is one expression of a strong oversight focus on preventing or minimizing cost growth in DoD acquisition programs in general. This oversight focus may reflect in part an assumption that avoiding or minimizing procurement cost growth is always synonymous with minimizing procurement cost. It is important to note, however, that as paradoxical as it may seem, avoiding or minimizing procurement cost growth is not always synonymous with minimizing procurement cost, and that a sustained, singular focus on avoiding or minimizing procurement cost growth might sometimes lead to higher procurement costs for the government.

How could this be? Consider the example of a design for the lead ship of a new class of ships. The construction cost of this new design is uncertain, but is estimated to be likely somewhere between Point A (a minimum possible figure) and Point D (a maximum possible figure). (Point D, in other words, would represent a cost estimate with a 100 percent confidence factor, meaning there is a 100 percent chance that the cost would come in at or below that level.) If the government wanted to avoid cost growth on this ship, it could simply set the ship's procurement cost at Point D. Industry would likely be happy with this arrangement, and there likely would be no cost growth on the ship.

The alternative strategy open to the government is to set the ship's target procurement cost at some figure between Points A and D—call it Point B—and then use that more challenging target cost to place pressure on industry to sharpen its pencils so as to find ways to produce the ship at that lower cost. (Government officials sometimes refer to this as "pressurizing" industry.) In this example, it might turn out that industry efforts to reduce production costs are not successful enough to build the ship at the Point B cost. As a result, the ship experiences one or more rounds of procurement cost growth, and the ship's procurement cost rises over time from Point B to some higher figure—call it Point C.

Here is the rub: Point C, in spite of incorporating one or more rounds of cost growth, might nevertheless turn out to be lower than Point D, because Point C reflected efforts by the shipbuilder to find ways to reduce production costs that the shipbuilder might have put less energy into pursuing if the government had simply set the ship's procurement cost initially at Point D.

Setting the ship's cost at Point D, in other words, may eliminate the risk of cost growth on the ship, but does so at the expense of creating a risk of the government paying more for the ship than was actually necessary. DoD could avoid cost growth on new procurement programs starting tomorrow by simply setting costs for those programs at each program's equivalent of Point D. But as a result of this strategy, DoD could well wind up leaving money on the table in some instances—of not, in other words, minimizing procurement costs.

DoD does not have to set a cost precisely at Point D to create a potential risk in this regard. A risk of leaving money on the table, for example, is a possible downside of requiring the government to budget for its acquisition programs at something like an 80 percent confidence factor—an approach that some observers have recommended—because a cost at the 80 percent confidence factor is a cost that is likely fairly close to Point D.

Procurement cost growth is often embarrassing for the government and industry, and can damage their credibility in connection with future procurement efforts. Procurement cost growth can also disrupt congressional budgeting by requiring additional appropriations to pay for something Congress thought it had fully funded in a prior year. For this reason, there is a legitimate public policy value to pursuing a goal of having less rather than more procurement cost growth.

Procurement cost growth, however, can sometimes be in part the result of government efforts to use lower initial cost targets as a means of pressuring industry to reduce production costs—efforts that, notwithstanding the cost growth, might be partially successful. A sustained, singular focus on avoiding or minimizing cost growth, and of punishing the government for all instances of cost growth, could discourage the government from using lower initial cost targets as a means of pressurizing industry, which could deprive the government of a tool for controlling procurement costs.

The point here is not to excuse away cost growth, because cost growth can occur in a program for reasons other than the government's attempt to pressurize industry. Nor is the point to abandon the goal of seeking lower rather than higher procurement cost growth, because, as noted above, there is a legitimate public policy value in pursuing this goal. The point, rather, is to recognize that this goal is not always synonymous with minimizing procurement cost, and that a possibility of some amount of cost growth might be expected as part of an optimal government strategy for minimizing procurement cost. Recognizing that the goals of seeking lower rather than higher cost growth and of minimizing procurement cost can some-

times be in tension with one another can lead to an approach that takes both goals into consideration. In contrast, an approach that is instead characterized by a sustained, singular focus on avoiding and minimizing cost growth may appear virtuous, but in the end may wind up costing the government more.

APPENDIX E. COAST GUARD NSC, OPC, FRC, AND WCC ACQUISITION PROGRAMS

This appendix presents discussion of the Coast Guard's National Security Cutter (NSC) program, Offshore Patrol Cutter (OPC) program, Fast Response Cutter (FRC) program, and Waterways Commerce Cutter (WCC) program, which help form the context for Coast Guard icebreaker procurement in a situation of finite Coast Guard procurement funding. The CRS report on cutter procurement provides in-depth discussions of the NSC, OPC, and FRC programs.[55] Below are some focused comments on these programs and the WCC program.

Adequacy of Planned Quantities of NSCs, OPCs, and FRCs

The Coast Guard's 91-ship program of record (POR) for general-purpose cutters—which dates to 2004 and calls for a force of 8 NSCs, 25 OPCs, and 58 FRCs—will provide substantially more capability than the force of older-generation cutters it will replace. At the same time, it can be useful to recall that Coast Guard studies have concluded that the planned total of 91 NSCs, OPCs, and FRCs would provide only 61 percent of the NSCs, OPCs, and FRCs that would be needed to fully perform the service's statutory missions in coming years, in part because Coast Guard mission demands are expected to be greater in coming years than they were in the past. As shown in Table E–1, the Coast Guard's 2011 Fleet Mix Analysis (FMA) Phase 2—the last general analysis of future Coast Guard ship force structure requirements to be publicly released by the Coast Guard—concluded that fully performing the Coast Guard's statutory missions in coming years would require a total of 149 NSCs, OPCs, and FRCs.[56] This point may be particularly salient right now in connection with the NSC and FRC programs, procurement of which would end soon under the POR figures.

TABLE E–1. PROGRAM OF RECORD COMPARED TO FLEET MIX ANALYSIS PHASE 2 (2011)

Ship Type	Program of Record	Refined Objective Mix from Fleet Mix Analysis, Phase 2 (2011)
NSC	8	9
OPC	25	49
FRC	58	91
Total	91	149

Source: Coast Guard Fleet Mix Analysis, Phase 2, 2011, Table ES–2 on p. iv. For additional discussion, see Appendix A of CRS Report R42567, *Coast Guard Cutter Procurement: Background and Issues for Congress*, by Ronald O'Rourke.

National Security Cutter (NSC) Program

The NSCs were procured at irregular rather than regular intervals, and they were procured with annual rather than multiyear contracts. Both of these aspects of their acquisition made the ships more expensive. If NSCs had instead been procured at regular intervals under multiyear contracts that included EOQ authority, the reduction in their combined procurement cost could have been substantial—possibly enough (or even more than enough) to have paid for one of the 11 NSCs that have been fully funded through FY2018.

As discussed below in the section on the OPC program, building additional NSCs is one option for acquiring replacements for retiring medium-endurance cutters more quickly than currently planned, so as to close more quickly any gap in time between retirements of the medium-endurance cutters and the entry into service of their replacements. The NSCs are bigger and in some respects more capable than OPCs, and they would individually be more expensive to procure and to operate and support than OPCs. The difference in size, capability, and cost between the NSC

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

[56] For additional discussion, see Appendix A of CRS Report R42567, *Coast Guard Cutter Procurement: Background and Issues for Congress*, by Ronald O'Rourke.

and OPC design is not insignificant, but neither is it a night-and-day difference. With an estimated full-load displacement of 3,500 to 3,730 tons,[57] for example, OPCs are to be roughly 80 percent as large as NSCs, which have a full load displacement of about 14,500 tons.[58] In terms of size, capability, and cost, the OPC is a lot closer to the NSC than it is to the FRC, which is a large patrol craft with a full load displacement of 353 tons.

Procurement of NSCs for replacing retiring *Hamilton*-class high-endurance cutters is approaching its end. If additional NSCs were procured in the near term in parallel with OPC procurement as part of a strategy for more quickly replacing retiring medium-endurance cutters, the additional NSCs could be built using the currently open NSC production line, avoiding a break in that production line and thereby maximizing production learning curve benefits. The procurement cost of any additional NSCs might be further reduced by procuring them at regular intervals and using an MYP contract.

OPC Program

The Coast Guard is using a contract with options to procure the first nine OPCs. As stated earlier, although a contract with options might look like a multiyear contract, it is not a form of multiyear contracting. A contract with options operates more like annual contracting and cannot achieve the kinds of savings that are possible with multiyear contracting.[59]

Using multiyear contracting in the 25-ship OPC program—specifically, block buy contracting with EOQ authority for the initial ships in the program, followed by either block buy contracting with EOQ authority or MYP contracting for later ships in the program—rather than annual contracting might reduce the total acquisition cost of the program by about $1 billion. This potential savings of $1 billion—a figure equal to or greater than the acquisition cost of either a polar icebreaker or a 35-ship Waterways Commerce Cutter program—represents a rare opportunity for using multiyear contracting to reduce the cost of an individual Coast Guard acquisition program by such an amount.

Acquiring the first nine ships in the OPC program under the current contract with options could forego roughly $350 million of the $1 billion in potential savings. Much of this $350 million in potential savings might be recaptured by renegotiating the current contract so as to convert it, with congressional approval, into a block buy contract with EOQ authority. If acquisition regulations prohibit such a renegotiation, the Coast Guard alternatively could choose to not exercise most of the options in the current contract and hold a new competition for building the current NSC design under a block buy contract. The current OPC builder—Eastern Shipbuilding of Panama City, FL—would be well positioned to win such a competition, since it would involve building Eastern's own design and Eastern would already have moved down the initial (i.e., the steepest) part of the learning curve for building the design.

The current planned procurement profile for the OPC, which reaches a maximum projected rate of two ships per year, would deliver OPCs many years after the end of the originally planned service lives of the medium-endurance cutters that they are to replace. Coast Guard officials have testified that the service plans to extend the service lives of the medium-endurance cutters until they are replaced by OPCs. There will be maintenance and repair expenses associated with extending the service lives of medium-endurance cutters, and if the Coast Guard does not also make investments to increase the capabilities of these ships, the ships may have less capability in certain regards than OPCs.

One possible option for addressing this situation would be to increase the maximum annual procurement rate of the replacement ships from the currently planned two ships per year to a higher figure. Increasing the rate to three or four ships per year, for example, could result in the 25th ship being delivered about 4 years or 6 years sooner, respectively, than under the currently planned maximum rate. Increasing the procurement rate would require a substantial increase to the Coast Guard's PC&I account, which gets back to the issue discussed earlier of future fund-

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[57] As of May 26, 2017, the OPC's light ship displacement (i.e., its "empty" displacement, without fuel, water, ballast, stores, and crew) was preliminarily estimated at about 2,640 to 2,800 tons, and its full load displacement was preliminarily estimated at about 3,500 to 3,730 tons. (Source: Figures provided to CRS by Coast Guard liaison office, May 26, 2017.)

[58] Source for figure of 4,500 tons: Coast Guard NSC fact sheet, accessed October 3, 2018, at: https://www.dcms.uscg.mil/Portals/10/CG–9/Acquisition%20PDFs/Factsheets/NSC.pdf?ver=2017–04–24–142526–023.

[59] For additional discussion, see CRS Report R41909, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, by Ronald O'Rourke and Moshe Schwartz, particularly the section entitled "MYP and BBC vs. Contracts with Options."

ing levels for that account and Congress' agency in setting funding levels and determining the composition of Federal spending.

From a production point of view, there are at least three options for increasing the annual procurement rate of replacement ships from the currently planned two ships per year to a higher rate, so as to close any gap in time between the retirements of medium-endurance cutters and the entry into service of their replacements. These options are as follows:

- increasing the annual OPC production rate at Eastern Shipbuilding, if Eastern's capacity would permit this;
- building additional OPCs at one or two additional shipyards, such as Bollinger Shipyards of Lockport, LA and/or General Dynamics' Bath Iron Works (GD/BIW) of Bath, ME—the two other finalists in the OPC competition; and
- building additional NSCs at Huntington Ingalls Industries/Ingalls Shipbuilding (HII/Ingalls).

These three options are not mutually exclusive—they could be pursued in combination. Additional OPCs built at Bollinger and/or GD/BIW could be built to the OPC designs that those two shipbuilders submitted for the OPC competition. (Those designs are presumably optimized for the production facilities at Bollinger and GD/BIW. The Coast Guard, moreover, currently does not have data rights for the complete vessel design for Eastern's OPC design.[60]) Building additional OPCs at Bollinger and/or GD/BIW to the designs developed by those two shipbuilders would result in a fleet with two or three classes of OPCs, a situation that would increase OPC life-cycle operation and support costs and complicate the training and assignment of OPC crew members. These additional life-cycle costs and complications, however, might be deemed acceptable in return for avoiding the costs and risks of extending the service lives of medium-endurance cutters and shortening any gap in time between the retirement of medium-endurance cutters and the entry into service of their replacements. The Navy decided in 2010 to fill its requirement for LCSs by building two different LCS designs at the same time, and did so knowing that this would result in some additional life-cycle operation and support costs and crewing-related complications compared to the option of building all LCSs to a single design.[61] The option of building additional NSCs as replacements for retiring medium-endurance cutters was discussed above in the section on the NSC program.

FRC Program

With 50 FRCs procured through FY2018 and four more requested for FY2019, the FRC is approaching the 58-ship figure called for in the Coast Guard's program of record. As shown earlier in Table E–1, however, the Coast Guard's 2011 Fleet Mix Analysis Phase II concluded that a total of 91 FRCs would be needed as part of an overall force of 149 general-purpose cutters to fully perform the service's statutory missions in coming years.

Procuring additional FRCs beyond the 58th would require additional procurement funding, which gets back to the issue discussed earlier of future funding levels for the PC&I account and Congress' agency in setting funding levels and determining the composition of Federal spending. As with the option discussed earlier of procuring additional NSCs, procuring additional FRCs immediately following the procurement of the 58th FRC would permit them to be built using the currently open NSC production line, avoiding a break in that production line and thereby maximizing production learning curve benefits. And as with the NSC option discussed earlier, the cost of any such additional FRCs could be reduced by procuring them under an MYP or block buy contract. The resulting increase in Coast Guard force structure from 58 FRCs to some higher number would increase long-term Coast Guard operation and support costs above currently planned levels.

WCC Program

The WCC program—the program to replace the Coast Guard's current 35-ship inland waterways fleet—is a smaller program than those discussed above. With a notional procurement cost of roughly $25 million per cutter, a 35-ship replacement program might have a total acquisition cost of roughly $900 million.[62] Although the

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[60] Source regarding data rights: Email from Coast Guard liaison office to CRS, September 6, 2017.

[61] For additional discussion of the LCS program, see CRS Report RL33741, *Navy Littoral Combat Ship (LCS) Program: Background and Issues for Congress,* by Ronald O'Rourke. A total of 35 LCSs have been funded through FY2019. Of these 35 ships, 17 will be built to one of the LCS designs, and 18 will be built to the other.

[62] Source for $25 million figure: Spoken testimony of Coast Guard Commandant Karl Schultz during the question-and-answer portion of a September 16, 2018, hearing on Coast Guard mod-

Continued

scale of the program is more modest than that of the NSC, OPC, and FRC programs, the WCC program is of importance in terms of its economic benefit to the Nation (by supporting waterborne commerce) and the bidding opportunity it will provide to U.S. shipyards that are not capable of building larger Coast Guard cutters.

As the Coast Guard begins to develop the details of this program, potential oversight issues could include, among other things, the planned number of replacement cutters (which has not yet been determined and could turn out to be something other than 35), planned annual procurement quantities and the resulting schedule for replacing the existing ships, whether to develop a new design or instead use a parent design, the number of shipyards to be used to build the ships, and the contracting strategy, including whether to use multiyear contracting.

APPENDIX F. NASEM REPORT RECOMMENDATION FOR BUILDING HEAVY AND MEDIUM POLAR ICEBREAKERS TO A COMMON DESIGN

Regarding its proposal to build heavy and medium polar icebreakers to a common design, the July 2017 NASEM report stated (emphasis as in original):

> **2. Recommendation: The U.S. 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. . . .

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ernization and recapitalization before the Coast Guard and Maritime Transportation subcommittee of the House Transportation and Infrastructure Committee, as reflected in the transcript of the hearing. The Commandant stated: "I'm loathed to put a number out, but I think you're talking a $25 million, plus or minus, [cost per] ship." The planned number of new replacement WCCs has not yet been determined and could turn out to be something other than 35. GAO states that "according to Coast Guard officials, the preliminary rough order of magnitude estimate for total acquisition cost is $1.1 billion." Government Accountability Office, *Coast Guard Acquisitions[:] Actions Needed to Address Longstanding Portfolio Management Challenges*, GAO–18–454, July 2018, p. 19.

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 timeframe 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.[63]

Mr. MAST. Thank you, Mr. O'Rourke.

I will now recognize Members for 5 minutes for questions, beginning with myself.

Admiral Haycock, I want to begin with you. There is a statement we used in the Army all the time—I know the Coast Guard is familiar with it and probably most others—and that is simply, if you are failing to plan, you are planning to fail. And this is something that could very easily apply to both the design build and acquisition of polar cutters and any other vessel that we are working on. It can apply to National Maritime Strategy. Certainly to everything that we are talking about today.

And so I just want to ask this very bluntly. Are we going to be welding steel on an icebreaker before we have a completed plan?

Admiral HAYCOCK. So I understand the phrase the Navy uses, and I would like to assure you that we are planning and we are planning to be successful. We have put a lot of work into making

[63] 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.

this thing a success with the Integrated Program Office and the industry design studies. And so I am confident we are going to have a design at a high level maturity before we start cutting steel.

Mr. MAST. Perfect.

Now, when we talk about this design isn't complete, are we talking about the hull length, the engines, or are we just talking about picking out the curtains? Give me an idea of where we are at on this.

Admiral HAYCOCK. So we conducted industry studies over the last year with five shipyards. Each of those shipyards has gone through the industry studies, identified risk areas, things like that, and then they have used that to inform their designers so they could submit designs as part of their proposals. These proposals are in and we are evaluating those.

I haven't actually, myself, seen those, but I think we are going to find that the designs are at a pretty good level of maturity for where we would expect them to be today. There are some details they are going to have to finish. We haven't started detail design. That is the next stage of the design process. And so we have time to flesh out those details during that detail design process.

Mr. MAST. So it was mentioned by Mr. O'Rourke in his remarks a discussion of block buy, and I want to ask a little bit on that. Did the Coast Guard consider the committee's recommendation to use common design and block-buy contracting with a fixed-price incentive fee contract to reduce the costs of acquiring the four heavy icebreakers? What was the conversation on that?

Admiral HAYCOCK. We have listened closely to the committee's recommendations, and I would like to thank the committee for the authorization they put in the Coast Guard Authorization Act to give us those sorts of authorities for block buy, multiyear procurement, and that sort of thing.

We have considered all that for the polar icebreaker program. We have actually reached out to some of the industry teams during the studies to get some of their input on it as well.

Mr. MAST. I want to ask a question that is just important for me as an American, as a soldier, as a Member of Congress. Are our icebreakers going to be better than China and Russia's?

Admiral HAYCOCK. I would say yes. It depends on how you define "better," in what areas you are looking.

Mr. MAST. You define it for me.

Admiral HAYCOCK. We are going to have a multimission cutter that can conduct all Coast Guard missions and project our sovereignty and our presence in the Arctic. We are going to deliver it on time, it will be on budget, and it will meet all of our needs up in the Arctic. We are convinced of that.

We spent a year validating all the requirements, and we know what those requirements are. We know what it is going to cost to do it. We have been able to bring the cost of the icebreaker down as a result of those studies. So I am confident we are going to deliver an icebreaker that meets our Nation's needs.

Mr. MAST. On time and on budget is always a tough one, but we are the United States of America. I think historically about things that we have done. I mean, the easy lookback is World War II,

what we did with ships and aircrafts and Sherman tanks and everything else, that we needed to go out there and do that.

What can we do to be helpful to make sure that we take that reputation that we have had before of being able to deliver on time, on budget, and meet the needs of our Coasties, our warfighters anywhere, meet those needs for national defense? What can we do to be helpful to you in this process?

Admiral HAYCOCK. Well, this committee has been very supportive of this effort from the beginning of time where I actually got started with the program. And your support has been vital to the tremendous progress we have made so far.

We have taken some of the cues that you guys have given us. We stood up the Integrated Program Office. We have leveraged best practices from the Navy and Coast Guard prior acquisitions.

I think probably the most important thing that would be of great assistance for us going forward is getting the funding in fiscal year 2019 that we have requested for the polar icebreaker.

The reason we need that funding is because we do have an aggressive schedule, as GAO has pointed out, and I think Mr. O'Rourke has also concurred with, that the schedule is aggressive. But the only way we are going to meet that schedule is if we get the funding on time. If we don't, it puts the program at risk in terms of delivering a lead ship on time and its successors, its follow-on cutters as well. And so that funding support is important to do that.

The other piece of that funding support that is of vital importance to us is it sends a signal. And so the support we have gotten from Congress and the administration over the last couple years has made it clear to the Nation and to the shipbuilding industry that the U.S. Government is serious about national security in the polar regions and that the Government is serious about actually revitalizing the fleet by creating or building the new PSCs.

If we don't get the funding that we need in our budget, in the 2019 budget, that sends a signal to industry that the Nation is second guessing itself and that it is not serious about security in the Arctic regions and that we are not serious about building these ships.

So your support in the past has been phenomenal, but your continued support in the future on this is of vital importance. Otherwise, this program is not going to deliver on time, on budget.

Mr. MAST. Thank you, Admiral Haycock.

My time has expired. I will now recognize Mr. Garamendi for 5 minutes for questions.

Mr. GARAMENDI. Thank you, Mr. Chairman.

It always comes down to money, doesn't it? And the problem is not the Coast Guard. It is not the shipyards. The problem are 435 Members of Congress and 100 Senators and a President.

Let's just get very blunt with ourselves. We are either going to put the money up and build this system out or we are not. And we have been dithering now for the 8 years that I have been around on this committee. Oh, we can't do it. We don't have the money, da, da, da, da. It is us.

And by the way, the question is going to be resolved in the next 2 weeks. The Senate has the money in the appropriation, in their

appropriation bill. The House does not. The House decided to spend $5 billion on a goddamn wall that won't do a thing to protect America. The Senate decided to spend the money, $1.2 billion, on security, which may be a wall, and an icebreaker.

The problem is us. And we are either going to decide to build icebreakers or build a wall, and we are going to do it in the next 2 weeks. It is a choice. Make your choice. What do we want to do? We are going to forget about the polar, the Arctic Ocean?

Oh, Russia is a problem. The National Defense Strategy says there are two major conflicts potential, one Russia, one China. Both China and Russia are moving ahead. And we are going to build a wall on the Mexican border to prevent, what, 5,000—an invasion. My, God.

The problem is us, folks, plain and simple. The money is there. The question is, where are we going to spend it? We haven't even gotten to nuclear bombs yet.

Ms. Mak, you laid it out. We are going to sit here and dither and wait, and then we are going to call Admiral Haycock or his successor in and pillar him or her about not getting the job done when we haven't given him the money or the direction. I will go on and on about this, but I am telling you, the money is there. The question is, where are we going to spend it?

Now, moving on, the cost doesn't have to be $1 billion. I don't need $6 billion out of the defense budget. I only need $4.2 billion over the next 6 to 7 years to build these icebreakers. There is going to be a new team in town in January, but the problem exists in the next 2 weeks.

Now, with regard to the issue of the maritime industry, all of the witnesses have said the same thing: It is all about cargo. Right?

Is that right, Mr. Von Ah?

Mr. VON AH. All of the operators would agree with you. It is all about cargo.

Mr. GARAMENDI. It is all about cargo.

Is there any question? Mak? O'Rourke? Buzby?

So where do we get the cargo? Oh, yes. Well, there is a piece of legislation out there, mentioned by most of you, that we are going to be exporting oil and gas. Why don't we put it on American ships. Piece of legislation, by the way, bipartisan, bicameral support for it. Not going to pass this year, but if it were to pass next year, we would build 30 to 50 ships over the next 15 years and we would put the mariners on it. So we can do that without the Government paying for it.

But the oil and gas industry that is going to make a pile of money based upon one of our natural resources that the public owns, we could do that. It is all about choices, folks. And I think you know where I am going to go on these issues.

Now, with regard to the cost differential—and I am going to wrap up in the next 42 seconds with this one—you suggest that it is more expensive to operate American ships. Have you taken into account in that analysis the subsidies, both direct and indirect, that are provided by our competitors?

Mr. VON AH. Those are not included in that calculation.

Mr. GARAMENDI. I know that. That is why I asked the question. And, therefore, the analysis is not valid. The analysis is not valid.

Other countries are providing massive subsidies for their maritime industry, for the shipbuilding, as well as for the operation. And we do some, but we don't come anywhere close.

The next time you guys appear before any committee in which I happen to be sitting, I want to see that analysis. I don't want to see only half of the equation.

Thank you for your direct answer to my question.

And by the way, we really ought to subpoena Mulvaney. There is the reason why we do not have the report. It is hung up in OMB by Mulvaney's predecessor, at least his operation, and the same two gnomes are sitting there on this report as they have been for the last half decade. And we are not going to get it out of there until we put heavy pressure on that system. I know it is not your problem, Admiral Buzby.

Yield back.

Mr. MAST. Thank you, Mr. Garamendi. I gather you believe the 1980s don't want their foreign policy back, as President Obama quipped.

The Chair will now recognize Mr. Weber for 5 minutes.

Mr. WEBER. Would you all turn your mics on? We want to all hear this going back and forth.

Thank you, Mr. Chairman.

Boy, lots of questions. In regard to the other countries that have icebreakers, I think this was alluded to, how many other countries? Is it just Russia and China? I guess this would be for you, Admiral or the Rear Admiral. Is it just Russia and China that, in your opinion, we should be concerned with?

Admiral HAYCOCK. Russia and China are probably the biggest concerns up in the Arctic.

Mr. WEBER. How many other countries in the world are you aware of have icebreakers?

Admiral HAYCOCK. The Scandinavian countries have icebreakers. I believe Australia has an icebreaker. And there may be some other countries in the Western Pacific that are working on icebreakers, like potentially South Korea.

Mr. WEBER. Who has built the latest icebreaker?

Admiral HAYCOCK. I believe China's *Xue Long* is probably the last icebreaker that was built, to my knowledge.

Mr. WEBER. And how long ago was that built?

Admiral HAYCOCK. That I am not certain, Congressman.

Mr. WEBER. Would it behoove us to check back into those processes and see who has built the last icebreaker and what improvements they have made and how they did it and what the time was and any improvements? Is that something that has been considered, any of you all?

Admiral HAYCOCK. Yes, sir. Yeah. Our industry teams—you know, actually, our program office has gone over and visited some of the countries. South Korea is building an ice-capable LNG carrier, I believe. And so we have gone over there to take a look at some of the welding processes they have done. I know some of the industry teams have done the same.

So we are not doing it in a vacuum. We are looking at other countries and the technologies they bring to bear and things that they have learned, lessons learned. I believe the icebreaker, the

whole design, is largely leveraged off of some of the European work.

Mr. WEBER. OK. And one of you mentioned—it might have been you, I believe it was you, Mr. Von Ah—you mentioned, I think, small or medium or large.

Or was it you, Mr. O'Rourke, in your comments, the icebreakers? Was it you?

Mr. O'ROURKE. Yes.

Mr. WEBER. How many other countries have a medium and a large-scale icebreaker? Do we know?

Mr. O'ROURKE. There are about 18 countries around the world that have icebreakers, and most of those icebreakers actually are medium and small icebreakers. It is only a small number of countries that operate what we refer to as the heavies, and that includes us and the Russians essentially.

Mr. WEBER. I wish you would explain to me what is the advantage of having a small or smaller icebreaker or large icebreaker. Wouldn't you want a ship capable of doing whatever needed to be done and not run afoul of a problem with a smaller ship?

Mr. O'ROURKE. Countries design icebreakers to meet their own national icebreaking needs, and many of these countries only need to operate icebreakers capable of breaking through——

Mr. WEBER. Yeah, but I am talking about for us. Why would we need a medium and a large icebreaker? Why not just build large icebreakers that can handle anything?

Mr. O'ROURKE. We have a mix of needs for icebreakers that includes both heavy icebreaking, especially for the McMurdo breakout mission in Antarctica. But there are occasions when you run into what we would refer to as medium ice, 4½-foot ice that can also occur in the Arctic. And I think the idea in building medium icebreakers is not to put excessive capacity in the ship because it drives up the ship's cost.

What the National Academies report said last year was that they looked at the requirements for heavy and medium icebreakers, and they said, well, the medium is going to be close enough in size to the heavy that the National Academies report then concluded, why don't we just build a single class?

Mr. WEBER. Are they half-priced? Two-thirds price? Any idea, cost comparison?

Mr. O'ROURKE. Well, actually right now our current medium polar icebreaker, the *Healy*, is larger than our two heavy polar icebreakers. It is about a 14,000- or 15,000-ton ship whereas the two polar heavies are 13,000-ton ships. It has less icebreaking capability but more capability for onboard science research support, and that tended to drive the size up.

Mr. WEBER. OK. This may be for you, Admiral Buzby. How many mariners on an icebreaker?

Or is that for you, Admiral Haycock?

Admiral HAYCOCK. For commercial icebreakers or for military icebreakers?

Mr. WEBER. Military icebreakers.

Admiral HAYCOCK. So Coast Guard cutter *Polar Star* has a crew of somewhere around 150, I think.

Mr. WEBER. Of 50?

Admiral HAYCOCK. 150.

Mr. WEBER. 150. And yet we are training 1,800 mariners a year. Is that what I understand? Anybody from the six academies, do we know that?

Admiral BUZBY. Sir, we graduate about 1,000 new graduates every year out of the Merchant Marine Academy.

Mr. WEBER. 1,000. How does that compare to the retirement rate?

Admiral BUZBY. Right now there have been not been too many retirements lately because of the status of the shipping industry. People are hanging in their jobs.

Mr. WEBER. OK. Well, I will agree with my colleague from California, Mr. Garamendi, that we need to be putting more money into it. Our academies need more support. We need more ships. I happen to have Texas A&M at Galveston Maritime Academy in my district. They need a ship. I realize it is not an icebreaker.

I don't want to speak for my friend from California, but I think he would agree that we have got to pay attention, we have got to educate more mariners, and we have got to fund this stuff.

And I am over my time, Mr. Chairman. I appreciate your indulgence. I yield back.

Mr. MAST. Thank you, Mr. Weber.

The Chair will now recognize Mr. Larsen for 5 minutes.

Mr. LARSEN. Thank you, Mr. Chairman.

So I have been here for 18 years, and this may be the closest we have been to getting any one new icebreaker. And then just about the time we do it they change the name of it. So forgive me if I call it an icebreaker. It is a habit.

But, Admiral Haycock, with regards to the Authorization Act, which is headed to the President's desk, it requires the Coast Guard to conduct an enhanced maintenance program on the *Polar Star* to extend its service life. How does extending the service life of the *Polar Star* impact plans to deploy a new icebreaker, a new PSC?

Admiral HAYCOCK. As I know you are aware, we have only one heavy icebreaker in operation. That is *Polar Star*.

Mr. LARSEN. Yeah.

Admiral HAYCOCK. We put some resources into *Polar Star* back in the early 2010 timeframe to extend the service life, and we were able to extend the service life for about 7 to 10 years. And that would mean the end of her service life is about 2023. So we know that we need to invest in *Polar Star* so that we do not have a gap in icebreaking. And so we have a plan in place to do that.

Our goal is to identify—and I think we have identified most of the systems that need to be addressed, and that is what has given us confidence in our cost estimate to do the work. But the goal is to do three phased availabilities to address those systems that need upgrades the most to extend its service life until we have a second Polar Security Cutter delivered.

Mr. LARSEN. Does any of that maintenance have to do with the actual structure of the ship or is this all internal systems?

Admiral HAYCOCK. Most of this is internal. The structure is in fairly decent shape. It is propulsion control systems and habit-

ability, sewage systems, things like that that desperately need help to extend the service life.

Mr. LARSEN. So what do you say to the GAO's conclusion from Ms. Mak with regards to the deployability of the new icebreaker being driven more by a capability gap as opposed to planning well for a new class of icebreakers?

Admiral HAYCOCK. I would concur with the GAO's assessment because it is true.

The problem is, is we are stuck between a rock and a hard place. The *Polar Star* is aging. It is one casualty away from not being able to conduct any of its missions. The systems are dated. Getting that ship underway and conducting its missions is hard on the crew.

We are conducting maintenance availabilities that are very aggressive to keep that thing in operation so it can do its mission every single year. It doesn't have self-rescue capability. It doesn't have another ship to step in if problems occur. So basically we are stuck with a bad situation, right?

If you take a look at the acquisition process and we hadn't done anything to accelerate, we wouldn't have been able to deliver a heavy polar icebreaker, a Polar Security Cutter, until 2026 or maybe 2028. And so we have gone through, and using things like the industry studies and the Integrated Program Office we found ways to bring that back to 2023 to prevent that gap.

It is an aggressive schedule, and we concur with that. But the Nation's need for a heavy polar icebreaker is not driven by our planning process. It is driven by the realities of the situation we are in.

If we had started the process years before, if it had gotten the momentum and the support it needed years back, decades ago, we wouldn't be in this situation.

But the Nation's needs are varied, and it didn't compete well for priorities. And we have been blessed over the last several years that Congress and the administration have recognized the dire situation we are in and provided the support, and we have got great momentum as a result.

Mr. LARSEN. All right. Thanks. We certainly have tried at least over the last 18 years. I can vouch for that.

Ms. Mak, I will just go to your first conclusion about what the GAO found and the concern you had about design. And it seems that what you found about design makes sense. Did DHS explain why they kind of have a backwards design policy? And they said they were going to look at it, evaluate it. Does evaluating it mean they are doing anything about it?

Ms. MAK. Yes. Actually, they are updating their policy. We just followed up earlier this week and expect that policy to be in place by the end of this year so that it will be more knowledge-based. All components under DHS will have to do their preliminary design review before setting the baseline for cost, schedule, and performance. That will make a lot more sense because one has gained a lot more knowledge at that point.

And like the Coast Guard admiral said, they agreed with our recommendations. We expect them to reevaluate cost, schedule, and

performance after they get more information, after preliminary design review.

Mr. LARSEN. All right. Look forward to it. Thank you.

Thank you, Mr. Chairman.

Mr. MAST. Thank you, Mr. Larsen.

Mr. Graves, you are recognized for 5 minutes.

Mr. GRAVES OF LOUISIANA. Thank you, Mr. Chairman.

Admiral Buzby, one of the issues that is supposed to be addressed by the long-awaited National Maritime Strategy is the availability of mariners for our inland waterways as well as our international fleet.

In Louisiana, a few months ago, we had an allision between one of our major river crossings across the Mississippi River and a barge. Is this strategy going to fully address the availability of mariners and improve performance in safety measures? Are those recommendations going to be contained in the ultimate strategy that is issued?

Admiral BUZBY. Short answer is, yes, sir. You know, a grand part of the strategy is going to have to be our maritime workforce, both in numbers and in qualifications. So the training of that workforce, the qualification of that workforce, the sustainment of that workforce, both for the domestic fleet and for the international fleet where I have testified where we have a shortage, those are all key parts of the strategy and will need to be a part of any strategy that we put forward.

Mr. GRAVES OF LOUISIANA. This bridge was completely shut down for months. It was only recently opened, one lane in each direction. It is going to continue to be under restricted access for a long period of time. In this case there was a barge carrying a crane that hit the bridge. I mean, this is a simple math equation that shouldn't take a whole lot of calculations to figure out you couldn't make it.

What steps can be taken in the interim to help improve the safety of mariners and transiting waterways in the United States?

Admiral BUZBY. Well, part of this crosses over to my colleague from the Coast Guard here.

Obviously, we in the Maritime Administration were responsible for the overall training, the processes that result in trained mariners, both licensed and unlicensed. We work closely with the union schools to produce unlicensed mariners and to upgrade continuing education for the licensed folks. We are subject to Coast Guard standard, which is in turn tied to an international standard for international voyages.

But I don't know, perhaps Admiral Haycock could comment further on it.

Mr. GRAVES OF LOUISIANA. Well, I tell you what, I have got two more questions and I have got limited time. Let me jump back to my second with you.

Section 3502 of the John McCain National Defense Authorization Act requires that the Secretary of Defense direct vessels that are in the Ready Reserve Fleet that don't currently meet the Safety of Life At Sea requirements, that those come into compliance. Can you tell me what steps have been taken to direct Ready Reserve Fleet or to come into compliance with section 3502?

Admiral BUZBY. Primarily that had come down to covered or uncovered life boats, open life boats.

Mr. GRAVES OF LOUISIANA. And fire suppression?

Admiral BUZBY. Right. So we are taking steps to upgrade those vessels, to correct those systems. We recently spent several million dollars to purchase new covered life boats and to upgrade those systems. Coast Guard is working closely with us on inspection regimes to make sure we are complying.

Mr. GRAVES OF LOUISIANA. Thank you.

Admiral Haycock, listening to the testimony, particularly I believe it was Mr. O'Rourke who talked about bringing the vessel cost down for the polars from $1 billion down to $700 million, which certainly is laudable, the more we can bring the cost down, the better. And listening to him make recommendations on a block buy, you are talking about bringing cost down from an initial estimate of $1 billion, if I understood you correctly, down to $550 million, because you said you thought there was an additional $150 million per copy in cost savings.

Mr. O'ROURKE. For all three.

Mr. GRAVES OF LOUISIANA. Oh, for all three. So it would be total cost savings, OK.

But even under that scenario, so you are talking about bringing it from initial estimate of $3 billion down to $2.1 billion, and then you are talking about getting it down to $1.9 billion, in effect, to $1.85 billion.

This is insane, that here we are talking about—and I know, I am going to agree with you, as much as it pains me.

Mr. GARAMENDI. So embarrassing.

Mr. GRAVES OF LOUISIANA. Yeah. You are not kidding, geez.

No, my friend from California is exactly right. So, I mean, this is crazy that we are talking about—I think that Ms. Mak went through in her testimony and laid out the concerns about how these strategies are going to dovetail. Here we have the *Polar Star* that is put together with bubble gum and duct tape. We have been operating on an acquisition strategy that is designed to dovetail.

Look, that should partially inform our schedule. It should. When do we need these vessels?

But if we are forcing it in when we don't have the numbers, the certainty, the acquisition strategy in place—and one of you mentioned some other interim strategies. This is very concerning, that as important as this capability is for the United States, whether it be for a mariner perspective, for a defense perspective, we know what the other Arctic nations are doing, it is very concerning that we have so much uncertainty in this strategy and something that is so important to our Nation.

Could you just briefly respond to that, all the uncertainty, the uncertainty in cost, the uncertainty in technology, the uncertainty in acquisition strategy, the uncertainty in dollars? Can you give us some comfort here that this actually makes sense and there is an interim strategy in place to ensure that we are not left without any polar capabilities?

Admiral HAYCOCK. Yes, sir, I would be happy to. So polar icebreakers in particular are very, very complex, and there's a lot of moving parts. And we do our best to run those acquisitions to mini-

mize risk and to deliver what is needed to be delivered. Folks like the Government Accountability Office come in and they do audits and they find things. And we read their reports with great interest, because there are ways to improve what we are doing.

One of the driving principles on the Polar Security Cutter and the heavy icebreaker program is utilizing state-of-the-market technology to the maximum extent possible. So we had a list of a bunch of things that we used as the guiding principles to [inaudible]. That was one of the things [inaudible].

So we wanted to use technology that already exists, so we are not creating new stuff just for this icebreaker. We tried to leverage existing design work as much as possible to reduce those risks. So could we have had a more proactive effort [inaudible] as we could have, and we intend to do that, but we are comfortable that the technical risk on the polar icebreaker program is bearable, it is reasonable, and it is under control.

Mr. GRAVES OF LOUISIANA. Admiral—Mr. Chairman, I just want to say for the record, I continue to have very strong concerns—and I know many of us have talked about this in this committee—about the interim strategy. What happens when we don't have a new heavy on board and the duct tape and bubble gum on the *Polar Star* are falling apart? I am very concerned about that.

Also, I need to correct the record very quickly, as I just hazed the captain of the barge for not being able to do math. I butchered it myself, $1.95 billion. But, again, going from $3 billion to $1.95 billion, that just indicates an extraordinary level of uncertainty. Yield back. Thank you.

Mr. MAST. Thank you, Mr. Graves.

Did you recently spend a month on a polar icebreaker?

Mr. GRAVES OF LOUISIANA. I feel like I am still there.

Mr. MAST. There is interest in a second round of questioning, so I am going to recognize Mr. Garamendi for another 5 minutes.

Mr. GARAMENDI. I will try to avoid another rant here.

I had the opportunity in August to visit a new medium icebreaker in Finland. They wanted to lease it to the United States. Unfortunately, or fortunately as the case might be, it is a medium and doesn't serve the purposes that we have and certainly doesn't meet the military requirements that all of our icebreakers or Polar Security Cutters must have, so—but it is brandnew. Had been commissioned less than a year. And so there is all the technology that would be used for a heavy icebreaker is known to exist. The application of that technology and the design, as I understand it, is well underway, everything from the various propulsion systems and the like. So, yes, we do know how—we do know that it can be done and it is done recently.

Ultimately, it is going to come down to money here. And I am making a plea to my colleagues here, as we go into this issue of the omnibus, the question will be, before us, whether we move forward with an icebreaker, or polar security—and call it what you want—Polar Security Cutter—it is literally on the line now.

If we do not fund—do not accept the Senate version, which has $750 million in it, for the first icebreaker—Polar Security Cutter—this thing will be delayed, and Ms. Mak will be correct. And I want her to be really, really wrong.

And it is up to us. And so I am making this plea to all of us that we make this an issue to our various caucuses, to our various leadership, that it is now or this thing is going to get pushed back, and Mr. Graves' problem about the interim will happen. It will—it will happen. The *Polar Star* is not going to survive much longer.

We did pass a piece of legislation that is useful in forcing the Coast Guard to develop a strategy, but that strategy is dependent upon the steel and the vacuum tubes and other things that are in this ancient ship, being able to be replaced, which maybe they can, maybe they can't. But there could very well be the problem that Mr. Graves cited. So there are so many different pieces here.

I want to thank the witnesses. You have laid it out. This is a serious issue on the mariners. We talked briefly about the brown water Navy or the brown water merchant system, the same thing applies on the blue water. We need to do that. Ultimately, it comes down to vessels. Are the vessels going to be available? We can make them available by adopting strategies. As I said, there is a—what shall we call it? Presently, we have a piece of legislation that would create opportunities, Energizing American Shipbuilding Act, H.R. 5893, of which some of us are on, and there is a Senate version of the same. And so it is not going to pass this year, but we ought to make that a priority for next year to address all the problems that have been appropriately laid out before us.

Mr. Mast, I know you are going to hopefully stay with this committee. And if you are the ranking member, all for the better, and we will see what happens on our side. But this is really, really important for every reason, and I will let it go at that. Thank you for the opportunity to come back a second time.

Mr. MAST. Thank you, Mr. Garamendi.

I am going to recognize myself for a few more minutes here. I just had a question again for Admiral Haycock and also for Mr. O'Rourke. Two separate issues here, but, Admiral Haycock, if you could just discuss a little bit, what kind of piggybacking goes on among the shipping industry—you name it, go wherever you want with it—in terms of going across those routes that are provided by our icebreakers. What kind of piggybacking would be put in jeopardy if the *Polar Star* ceased to run or we didn't have that capability? What would we lose in terms of that?

Admiral HAYCOCK. So the—our polar icebreakers provide us—or will provide us with year-round assured access to the Arctic regions, and that includes, you know, keeping shipping lanes open as necessary and providing, you know, national defense and that sort of thing.

If we don't have the heavy polar icebreakers, then we have to rely on others to do that sort of thing. You know, that is—the Arctic is in Canada's backyard. They have an icebreaker fleet that they use. And Russia has a pretty good icebreaking fleet that they use. There are sea routes that go up in those areas. And if we don't have an icebreaker fleet to project our sovereignty in the appropriate regions, then we kind of abdicate that responsibility to the other nations.

Mr. MAST. Who is piggybacking us, though? Because we want people piggybacking the United States of America, not

piggybacking Russia, or piggybacking China. Who is piggybacking us? What do we lose if we lose that capability?

Admiral HAYCOCK. I don't know that we have anybody piggybacking us because we only have one medium-duty icebreaker serving the Arctic and one heavy-duty icebreaker that is predominantly serving the Antarctic. So I don't know that we have anybody piggybacking us right now.

Mr. MAST. So the opportunity is for expansion in that world?

Admiral HAYCOCK. Yes.

Mr. MAST. We are basically starting from zero.

Admiral HAYCOCK. Concur.

Mr. MAST. Very good. And so this—I said I had a second question. This goes for Admiral Haycock and also for Mr. O'Rourke. When we talk about the idea of block buy, when we are cutting steel, the moment that we start cutting steel on a ship, does this end the window for a block buy? I mean, building a ship, it takes some period of time. How long out do we have that ability to go out there, in your opinion, and negotiate that idea of a block buy, once we start cutting steel on a new vessel?

Admiral HAYCOCK. I don't know that the opportunity ever goes away until you get to the tail end of construction process. So if you have a large build sequence, where you have a lot of ships, towards the tail end you kind of run out of room. So the sooner you execute in the process, the better it is.

But we have time on some of our programs to do that. OPC, there are some opportunities there. FRC, we are getting towards the tail end; it might be a little late for FRC. We have tried to capitalize on some of the benefits of EOQ, economic order quantity, that you get from block buy, through the use of the options, and the FRC is not a perfect match, but at least we get some of the economies of scale there.

Mr. O'ROURKE. In general, the longer you wait, the smaller the potential savings you will realize out of a block-buy contract. You can be in a situation where you are using a single-ship contract or a contract with options, and then you can renegotiate it into a block-buy contract, but if you wait until that point to renegotiate it, you will not capture as much savings as if you had done the block-buy contract right from the outset.

Mr. MAST. Ms. Mak, by all means.

Ms. MAK. With regards to block buy, it is important to recognize that it is just one tool in the toolbox, and it is not always appropriate in all circumstances. We have done a lot of Navy programs that used block buy in the acquisition process, and we have not been able to prove in any instance where there have been significant savings when they have used the block-buy approach.

In the case of the Polar Security Cutter, it is really important to recognize that there are, at most, three cutters, and the savings that may be achieved by purchasing in advance may be limited. Specifically, if the design is not stable or if the funding is not stable, the Coast Guard could buy parts in advance, and then the design changes and they have to purchase other parts because of that design change.

We are very cautious to recommend block buy until the lead ship is done, at a minimum, and when the design is stable. Then they may consider it.

Mr. O'ROURKE. Right. The Navy is very convinced that they have achieved savings in their uses of block buy and also in multiyear procurement. There is a counterfactual issue here. You can't run it the other way to show what it would have cost. In reality, you can only compare it to an estimate of what these ships would have cost under single-ship contracts or a contract with options.

The Navy is convinced that they have achieved savings of the order of 4 to 5 percent on the *Virginia*-class block buy for the first four *Virginia* class. They are also convinced that they are going to achieve savings on tens of millions of dollars per ship over the first six ships in the *John Lewis*-class oiler program.

They are also interested in using it on the *Columbia* class as part of their strategy for reducing the cost of that. Now, the savings that the Navy is estimating are against an estimate of what they think it would have cost if you had used single-ship contracting. You can't run the experiment twice. So you get into a situation where, of course, you can't prove it, because we can't do it both ways at once.

But these are the estimates that the Navy has put out. They are convinced, and DoD has allowed the Navy to go ahead and do this on any number of programs, in terms of both block buy and multiyear.

Now in terms of the lead ship, it is important to point out that multiyear procurement doesn't allow a lead ship, because the law that regulates multiyear procurement establishes a requirement for design stability that effectively rules out using a lead ship. That is why block-buy contracting was essentially invented by Congress. It was invented, to a large degree, expressly so that you could put a lead ship under the contract and capture a greater amount of savings.

Now, as Ms. Mak pointed out, there are tradeoffs that Congress has to take into account in committing to a block-buy contract. The Congress has looked at those tradeoffs repeatedly for Navy shipbuilding programs and has approved them repeatedly over the years. It is true that if you were to buy components upfront under a block-buy contract, and it turns out that the design of those components is wrong because you wind up making a change in the design of the ship, that you could be left high and dry in terms of your investment.

However, the Coast Guard's current schedule for building these icebreakers is to build them in rapid succession with one another. The second one is only supposed to follow the first by 18 months. And the third follows the second by 12 months. What that means is, there is going to be a risk of transmitting design problems from one ship to the next, arguably, whether you use a block-buy contract or not. Because these ships are going to be built in rapid succession as a part of a strategy for getting a good learning curve on them.

So it is not clear how much additional risk there is of this kind, of doing this under a block buy, as opposed to a contract with options. Because the risk really arises from the fact that the ships are

close together, to one another, perhaps more than it has to do with the contracting strategy.

Mr. MAST. Thank you, Mr. O'Rourke. That was a fantastic explanation of that.

Mr. Larsen, did you require another round of questions?

Mr. LARSEN. A few questions, thanks.

Mr. MAST. You are recognized for 5 minutes.

Mr. LARSEN. Ms. Mak, one of the findings from GAO had to do with technology and technology readiness assessment, which you note is not necessarily a matter of new technology, but perhaps existing technology applied in a new way. Or certainly existing technology applied on a new kind of ship. That certainly theoretically makes sense. Are there GAO examples where you have found that? I know you are applying that lesson to this particular analysis, or is this only theory?

Ms. MAK. This is a typical finding on much of our shipbuilding acquisition work. When the technology has not been demonstrated as mature, the program ends up undergoing rework later, or doing design and construction concurrently, or doing testing concurrently, and then ultimately the acquisition ends up costing more and the schedule slips.

But as I mentioned earlier, the Coast Guard and DHS did concur with our recommendations. They are moving forward to conduct this technology readiness assessment. It is important to recognize that the technologies have been used in different vessels, such as the medium and other international icebreakers, but they are not in the same form, fit, and function that the Polar Security Cutter would need and that is a bit unique.

So we recommend that the key technologies be tested in a standard type of process, which in this case is the technology readiness assessment process.

It is also important to note that although these key components are state-of-the-market, we have found, in our past shipbuilding work, integration is also a big challenge. The key technologies need to be able to work together. Doing an assessment doesn't get rid of the risks. It just lays it out so that the Coast Guard can be more aware of the risks and figure out mitigation strategies ahead of time. That is really what this assessment is for.

Mr. LARSEN. Yeah. And, unfortunately, integration has been a problem, not just with the Coast Guard——

Ms. MAK. Right.

Mr. LARSEN [continuing]. But with other shipbuilding activities.

Ms. MAK. Absolutely, yes.

Mr. LARSEN. Admiral Buzby, what options has MARAD—so I am flipping here—flipping issues here. What options has MARAD identified to reverse the decline in the size and the tonnage of the U.S.-flag fleet and foreign trade? And of those options, have you assessed which are most viable?

Admiral BUZBY. Tough question, sir. As was pointed out by Ranking Member Garamendi, it really comes down to——

Mr. LARSEN. Sorry, you got about 1 minute, because I just got called to vote for the caucus.

Admiral BUZBY. It really comes down to cargo. Having more ships—I mean, we can all want to have more ships, but unless

there is something for them to carry, you know, it is kind of a moot point. So, things that we can do to get more cargo, I mean, he mentioned some of them, you know, taking advantage of some of the exports that we have. Automobiles as well. We export a lot of automobiles from this country. There is a lot of things—grain, agricultural items.

We have to really take a serious look at, you know, what of those do we think makes sense through cargo preference or bilaterals or whatever, to share some of that cargo so that we can have justification for having more vessels to carry that.

Same thing with Government-impelled cargo. You know, there are three pieces to maritime security program: It is the stipend that the Government provides; it is Government cargo; and it is commercial cargo. All of those have to be present for this to work.

Mr. LARSEN. Probably have some followup with you early in the next year, but thanks a lot.

Appreciate it, Mr. Chairman.

Mr. MAST. Thank you, Mr. Larsen. I appreciate it.

If there are no further questions, which I see none, I thank the witnesses for being here today and the Members for their participation. I would ask unanimous consent that the record of today's hearing remain open until such time as our witnesses have provided answers in writing to any questions that may be submitted to the Coast Guard, and unanimous consent that the record remain open for 15 days for any additional comments and information submitted by the Members or witnesses to be included in the record of today's hearing.

Without objection, so ordered.

The subcommittee stands adjourned.

[Whereupon, at 11:20 a.m., the subcommittee was adjourned.]

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