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COAST GUARD ACQUISITIONS

Opportunities Exist to Improve Shipbuilding Outcomes

Statement of Shelby S. Oakley, Director, Contracting and National Security Acquisitions

GAO-24-107488

May 7, 2024

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GAO Highlights

Highlights of GAO-24-107488, a testimony before the Subcommittee on Transportation and Maritime Security, Committee on Homeland Security, House of Representatives

Why GAO Did This Study

The Coast Guard, a component of DHS, employs a variety of ships that conduct many missions, including drug interdiction, migrant interdiction, search and rescue, and ice operations. The Coast Guard plans to invest billions of dollars in two of its highest priority programs—acquiring three heavy icebreakers, known as Polar Security Cutters, and a fleet of 25 Offshore Patrol Cutters, to replace its older ships.

This statement addresses (1) how the Coast Guard acquires and oversees its shipbuilding programs, including its highest priority ones, (2) the primary challenges the Coast Guard has faced in acquiring and overseeing its highest priority shipbuilding programs and the resulting outcomes, and (3) recent GAO work on leading practices for acquiring new ships. This statement is based on information from GAO-24-106573, GAO-23-105805, GAO-23-105949, and GAO-24-105503, among other work. Information about the scope and methodology of prior work on which this statement is based can be found in those products.

What GAO Recommends

Over the past decade, GAO has made 40 recommendations to DHS and the Coast Guard on how to better manage the Coast Guard's acquisition programs. GAO also made three recommendations that DHS update its acquisition policies to fully implement product development principles. DHS concurred with the recommendations. GAO will continue to monitor DHS's and the Coast Guard's progress in addressing these recommendations.

View GAO-24-107488. For more information, contact Shelby S. Oakley at (202) 512-4841 or oakleys@gao.gov.

What GAO Found

The U.S. Coast Guard manages its major shipbuilding programs—generally those with cost estimates of $1 billion or greater—using the Department of Homeland Security's (DHS) acquisition framework. GAO's prior work found that the Coast Guard continues to face challenges in its highest priority shipbuilding acquisition programs—the Offshore Patrol Cutter and the Polar Security Cutter.

Design instability. The shipbuilders have yet to stabilize their designs, which has contributed to schedule delays and cost growth for both programs. For example, the Offshore Patrol Cutter program began ship construction without a matured critical technology, which led to redesign of portions of the ship and contributed to delays of the lead ship by almost 4 years. GAO recommended in June 2023 that the program mature this same critical technology before moving forward through design on the next set of ships. DHS did not concur. GAO closed this recommendation in April 2024 after the Coast Guard approved a design review without maturing the critical technology. However, GAO stands by the intent of the recommendation to minimize risk to the program.

Program oversight. Both programs lack key milestones in their acquisition program baselines—a document that sets the program's cost, schedule, and performance goals—to ensure adequate program oversight and accountability. For example, the Coast Guard did not include the delivery date of the last Polar Security Cutter in its acquisition program baseline. If included as a key event, failure to meet this date would trigger a formal assessment by DHS. In July 2023, GAO recommended that DHS and the Coast Guard include this delivery date in the acquisition program baseline, and the department concurred. Coast Guard officials told GAO they plan to include ship delivery dates in its revised baseline.

The Coast Guard's Offshore Patrol Cutter and Polar Security Cutter

Source: Eastern Shipbuilding Group (left image); Bollinger Mississippi Shipbuilding (right image). | GAO-24-107488

In May 2024, GAO identified leading practices in ship design, such as using iterative design to accelerate design maturity and employing robust in-house ship design capabilities and tools. These practices build on previous leading practices that GAO identified in product development and shipbuilding. Over the past decade, GAO has recommended numerous actions to the Coast Guard and DHS reflecting those practices—such as attaining design stability and developing solid business cases—to achieve successful shipbuilding outcomes.

May 7, 2024

Chairman Gimenez, Ranking Member Thanedar, and Members of the Subcommittee:

Thank you for the opportunity to discuss the U.S. Coast Guard's shipbuilding programs and challenges. The Coast Guard, a component within the Department of Homeland Security (DHS), is the principal federal agency responsible for maritime safety, security, and environmental stewardship in U.S. ports and waterways. The Coast Guard's fleet of ships, also known as cutters, enable the Coast Guard to perform a wide variety of critical missions, including drug interdiction, migrant interdiction, search and rescue, and ice operations.

As a part of its efforts to modernize its aging fleet of ships, the Coast Guard is acquiring several ships, including Offshore Patrol Cutters (OPC), Polar Security Cutters (PSC), National Security Cutters, and Fast Response Cutters. It plans to invest over $28 billion to acquire these ships and over $87 billion to operate and maintain them over their lifetimes. The Coast Guard intends for these new ships to augment its current fleet and provide additional capabilities beyond those offered by its older ships. However, its shipbuilding programs have faced significant schedule delays and cost increases that are contributing to capability and affordability gaps. Over the last decade, we have made 40 recommendations to DHS and the Coast Guard on how to better manage the Coast Guard's acquisition programs. Currently, we have 11 recommendations that remain open and that the Coast Guard has not fully addressed and seven others that have not been acted upon by the Coast Guard or overcome by events. The Coast Guard's persistent challenges in managing its programs within established cost and schedule goals highlight the need for the Coast Guard to reexamine how it manages shipbuilding programs.

My statement today will address (1) how the Coast Guard acquires and oversees its shipbuilding programs, including its highest priority ones; (2) the primary challenges the Coast Guard has faced in acquiring and overseeing these programs, and the resulting outcomes; and (3) our recently identified leading practices for acquiring new ships. This statement is based on our recent work examining the Coast Guard's OPC and PSC acquisitions, including our February 2024 report on DHS

acquisitions, our June 2023 report on the OPC, and our July 2023 report on the PSC, among others.[1]

For the reports cited in this statement, among other methodologies, we analyzed Coast Guard guidance, data, and documentation; and interviewed Coast Guard officials to determine the extent to which Coast Guard acquisition programs are meeting their cost, schedule, and performance goals. Each report cited in this statement provides further detailed information on its objectives, scope, and methodology. For this cited work, we obtained some updated information from the Coast Guard on the design and delivery status of the OPC and PSC.

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 that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

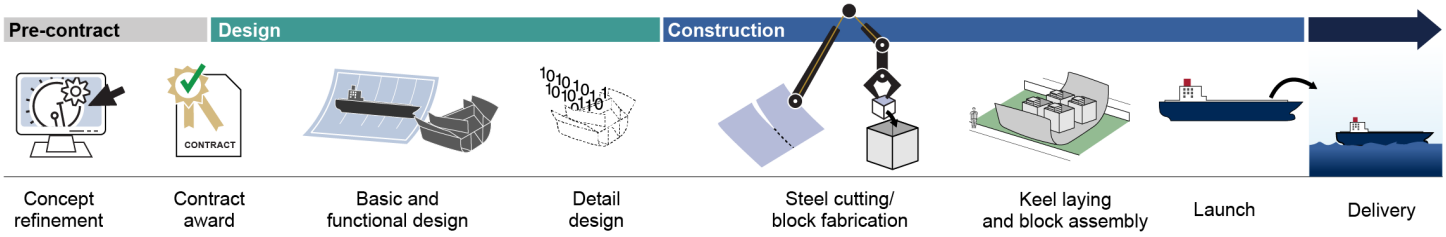
Background

Shipbuilding Is Complex and Centered on Key Design and Construction Events

Shipbuilding is a complex, multistage industrial activity that includes common key events regardless of the type of ship construction or nature of the buyer—Coast Guard, Navy, or commercial. As shown in figure 1, key events are sequenced among three primary stages that move from concept through design and construction to delivery of a new ship.

[1]GAO, *DHS Annual Assessment: Most Programs Are Meeting Current Goals, but Some Continue to Face Cost and Schedule Challenges*, GAO-24-106573 (Washington, D.C.: Feb. 22, 2024); *Coast Guard Acquisitions: Offshore Patrol Cutter Program Needs to Mature Technology and Design*, GAO-23-105805 (Washington, D.C.: June 20, 2023); *Coast Guard Acquisitions: Polar Security Cutter Needs to Stabilize Design Before Starting Construction and Improve Schedule Oversight*, GAO-23-105949 (Washington, D.C.: July 27, 2023); *Leading Practices: Agency Acquisition Policies Could Better Implement Key Product Development Principles*, GAO-22-104513 (Washington, D.C.: Mar. 10, 2022); and *Navy Shipbuilding: Increased Use of Leading Design Practices Could Improve Timeliness of Deliveries*, GAO-24-105503 (Washington, D.C.: May 2, 2024). While the Navy shipbuilding report does not cover the Coast Guard's efforts, the Navy and Coast Guard rely on many of the same shipbuilders, and the Coast Guard utilizes Navy acquisition and technical expertise for some of its programs, including the PSC.

Figure 1: Notional Ship Design and Construction Process



Source: GAO analysis of shipbuilding information; GAO (illustration). | GAO-24-107488

The design stage after contract award progresses from outlining the ship's structure to routing systems that are distributed throughout the ship and then finalizing design details that facilitate construction.[2] Table 1 depicts key tasks generally common to all ship design phases.

Table 1: Ship Design Phases and Key Tasks

Design phase	Key tasks involved
Basic and functional design	• Fix ship steel structure and set hydrodynamics • Design safety systems and get approvals from applicable authorities • Route all major distributive systems, including electricity, water, and other utilities • Provide information on position of piping, ventilation, equipment, and other outfitting in each basic unit, or "block," of ship construction • Usually includes 3D modeling of the ship structure and major systems, with vendor-furnished information (VFI) incorporated to support understanding of final system design. VFI reflects the characteristics for ship equipment and components. This includes requirements for space, weight, power, water, and other utilities that feed ship systems
Design stability achieved upon completion of basic and functional design	
Detail design	• Use 3D modeling information to generate work instructions for each block that show detailed system information and support construction, including guidance for subcontractors and suppliers, installation drawings, schedules, material lists, and lists of prefabricated materials and parts

Source: GAO analysis of commercial ship design information. | GAO-24-107488

[2]GAO-24-105503.

Once the ship design is sufficiently defined, builders move into the construction phase. This begins with the cutting and welding of large steel plates into the basic building units of ship construction, referred to as "blocks." The blocks form completed or partial compartments, including engine rooms, storage areas, and accommodation spaces. Blocks are generally outfitted in the early stages of construction with pipes, brackets for machinery or cabling, ladders, and any other equipment that may be available for installation. This approach allows a block to be installed as a completed unit with connectors to adjacent blocks. Each block is ultimately welded together with other blocks to form larger sections that compose the ship's structure. Once the shipbuilder has enough blocks and larger sections assembled, it lays the ship's keel—or bottom of the ship—in preparation for ship erection.

After the keel is laid, other constructed sections are welded to the surrounding sections. During this stage, the shipbuilder also performs outfitting of machinery, engines, propeller shafts, and other large items requiring the use of overhead cranes. When the ship is watertight, the decision is made to float, or "launch," the ship. The ship is then put into the water (or the drydock is flooded) and it is towed into a dock area for final outfitting and testing of machinery and equipment.

Shipbuilding Leading Practices Emphasize Importance of Design Stability

Since 2009, we have applied leading practices that we identified in commercial shipbuilding to our work evaluating Coast Guard and Navy shipbuilding programs. We have recommended numerous actions reflecting those practices intended to improve outcomes.[3] The practices and our recommendations emphasized ensuring high levels of knowledge at key junctures throughout the acquisition process to achieve successful results. For example, shipbuilding leading practices we identified in 2009 found that design phases should include specific tasks that ensure increasing degrees of maturity as designs progress. This supports timely and predictable outcomes. These tasks culminate in design stability, which is achieved upon the completion of basic and functional designs, which are described above in table 1.[4]

[3]GAO, *Best Practices: High Levels of Knowledge at Key Points Differentiate Commercial Shipbuilding from Navy Shipbuilding*, GAO-09-322, (Washington, D.C.: May 13, 2009); *Coast Guard Acquisitions: Polar Icebreaker Program Needs to Address Risks before Committing Resources*, GAO-18-600 (Washington, D.C.: Sept. 4, 2018); and *Coast Guard Acquisitions: Opportunities Exist to Reduce Risk for the Offshore Patrol Cutter Program*, GAO-21-9 (Washington, D.C.: Oct. 28, 2020).

[4]GAO-09-322.

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. Additionally, according to these shipbuilding leading practices, any critical technologies—hardware and software technologies critical to the fulfillment of the key objectives of an acquisition program—must be matured and proven before a design can be considered stable. If a program proceeds into construction with immature critical technologies or with an incomplete design, it increases the risk of completing out-of-sequence construction and rework, which can result in increased costs and schedule delays.

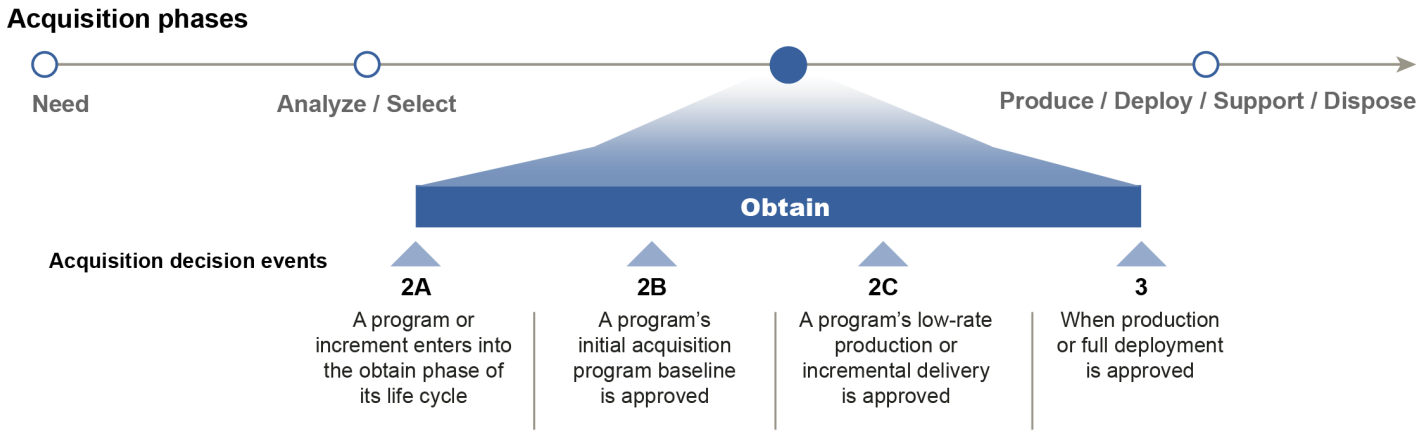
Coast Guard Manages and Oversees Its Highest Priority Shipbuilding Programs under a Tailored Acquisition Approach

Coast Guard Major Shipbuilding Programs Use a Tailored Approach under DHS's Acquisition Framework

As a component of DHS, the Coast Guard manages and oversees its major shipbuilding programs using DHS's acquisition framework, which is set forth in DHS acquisition policy.[5] DHS's acquisition policy requires programs to manage their acquisition risks throughout the program's life cycle. As a program moves through its life cycle, it advances through a series of critical milestones called acquisition decision events (ADE), where DHS leadership assesses whether the program is ready to proceed to the next step (see fig. 2).

[5]See DHS Directive 102-01, *Acquisition Management Directive* (July 28, 2015) (incorporating change 1, Feb. 25, 2019); DHS Instruction 102-01-001, *Acquisition Management* (Jan. 10, 2023).

Figure 2: DHS Acquisition Decision Events in the Obtain Phase for Major Acquisition Programs



Source: GAO analysis of Department of Homeland Security (DHS) information. | GAO-24-107488

Note: DHS acquisition decision events (ADE) in the obtain phase include ADE 2A—when a program or increment enters into the obtain phase of its life cycle; ADE 2B—when a program's initial acquisition program baseline, which establishes the program's cost, schedule, and performance goals, is approved; ADE 2C—when low-rate production, or incremental delivery is approved; and ADE 3—when full-rate production or deployment is approved.

The DHS Under Secretary for Management serves as the decision authority for the department's largest acquisition programs—level 1 programs with life-cycle cost estimates of $1 billion or greater. This includes the Coast Guard's major shipbuilding programs. The Vice Commandant of the Coast Guard serves as the component acquisition executive, the senior acquisition official within the Coast Guard.

In addition, the acquisition program baseline—required by DHS acquisition policy—is a key document used by the acquisition decision authority and other stakeholders to hold programs accountable. This document is the fundamental agreement between the program, the component, and department-level officials on what will be delivered, how it will perform, when it will be delivered, and what it will cost. Specifically, the acquisition program baseline establishes objective (target) and threshold (maximum acceptable costs, latest acceptable milestones, and minimum or maximum acceptable performance) parameters for a program. According to DHS policy, a program that has not met or will not meet any of its cost, schedule, or performance thresholds approved in the

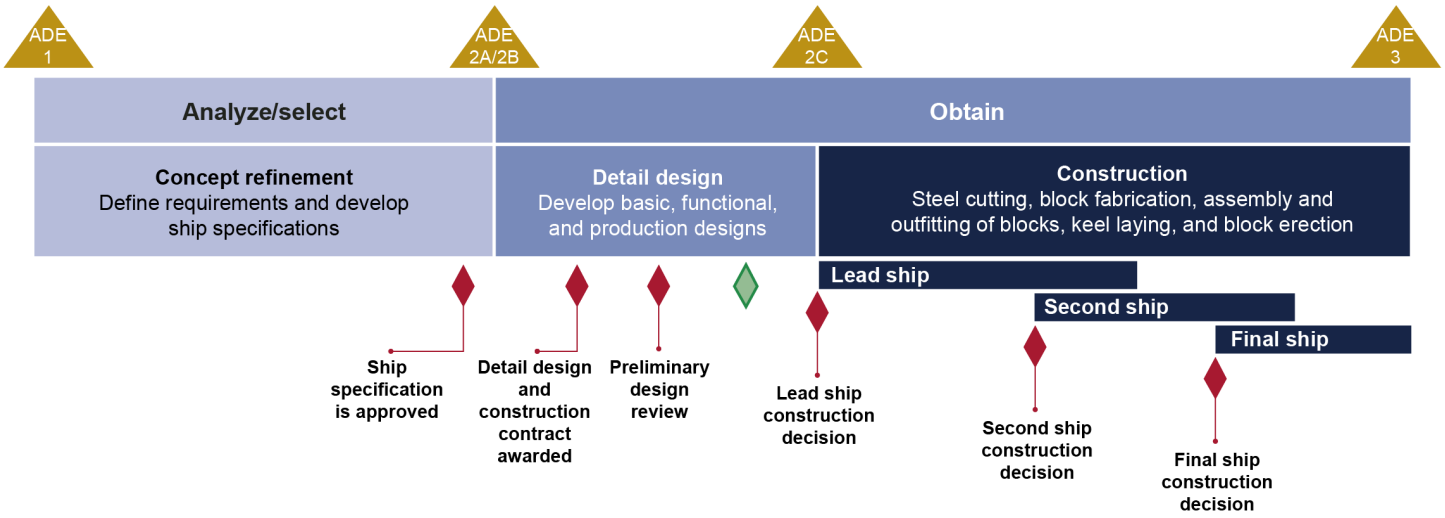
acquisition program baseline will be considered to be in breach status.[6] Programs in breach status are required to develop a remediation plan that outlines a time frame for the program to either return to its parameters, rebaseline (i.e., establish new cost, schedule, or performance parameters), or have a DHS-led program review that results in recommendations for a revised baseline.

The DHS acquisition framework can be tailored if necessary. As approved by the Deputy Under Secretary for Management, certain Coast Guard shipbuilding programs use a tailored approach under the DHS acquisition framework. Under this approach, for shipbuilding programs where ADE 2C—when DHS approves a program to begin low-rate production—occurs within a year of ADE 2B, ADE 2C will be held prior to commencing construction of the lead ship.[7] Within the acquisition framework, our 2009 shipbuilding leading practices call for design stability at ADE 2C for shipbuilding programs. Figure 3 shows how the Coast Guard applies the acquisition framework to the PSC within the shipbuilding phases.

[6]If it is determined that an acquisition program cannot meet an approved cost, schedule, or performance parameter due to a necessary change in program scope resulting from circumstances beyond the program's control—such as a natural event or changes in funding, among others—the acquisition decision authority may approve an administrative update.

[7]For Coast Guard acquisition policies and procedures that provide updated guidance for the implementation of the Department of Homeland Security (DHS) acquisition management and review process, see Coast Guard Commandant Instruction 5000.10H, *Major Systems Acquisition Management (MSAM)* (Aug. 2023).

Figure 3: Acquisition Framework for Polar Security Cutter Program



ADE = Acquisition decision event

Source: GAO analysis of Department of Homeland Security, Coast Guard, and Navy information. | GAO-24-107488

Several organizations participate in the oversight and execution of the Coast Guard's shipbuilding programs, including:

- **Program office**. An office led by a program manager who executes the program in accordance with its cost, schedule, and performance baselines.
- **Project resident office**. An office set up by the program that provides on-site supervision of ship construction.
- **Defense Contract Management Agency**. An agency in the Department of Defense that assists the Coast Guard by assessing shipbuilder earned value management systems—a tool to measure value of work completed against work expected—to ensure the shipbuilder's data are valid.

PSC and OPC Are Two of the Coast Guard's Highest Priority Shipbuilding Programs

The Coast Guard's newest ships are intended to deliver greater capability than the older ships they will replace. Some examples of capabilities include the ship's range and the time a ship can spend at sea. Figure 4 depicts the OPC and PSC, which are Coast Guard's highest priority shipbuilding programs.

Figure 4: Coast Guard's Offshore Patrol Cutter and Polar Security Cutter

Source: Eastern Shipbuilding Group (left image); Bollinger Mississippi Shipbuilding (right image). | GAO-24-107488

- **OPC**. As of 2023, the Coast Guard planned to invest about $14 billion to acquire 25 OPCs and about $50 billion to maintain them. The OPCs will conduct multi-mission operations including homeland security, law enforcement, and search and rescue. They are intended to replace the Coast Guard's aging Medium Endurance Cutters. The OPC is designed for longer-distance transit, extended on-scene presence, and operations with deployable aircraft and small boats. In September 2016, the Coast Guard selected Eastern Shipbuilding Group (ESG) as OPC's shipbuilder and authorized the shipbuilder to proceed with detail design.[8] The Coast Guard subsequently authorized construction of the lead ship in September 2018. After a 2018 hurricane devastated the shipbuilder's facilities, the Coast Guard

[8]The Coast Guard selected ESG among three vendors previously awarded contracts for preliminary design work for the OPC. The Coast Guard selected ESG to proceed with its work by exercising ESG's contract option for detail design in September 2016, and an option for construction of the lead ship in September 2018.

split the program into two stages, with stage 1 covering OPCs 1-4 and stage 2 covering OPCs 5-15. Since then, the Coast Guard has proceeded with construction on OPCs 2-4. In June 2022, the Coast Guard awarded a contract for detail design and construction of stage 2 ships to Austal USA, LLC, and according to officials, the program plans to start construction of OPC 5 by September 2024. The Coast Guard plans to acquire OPCs 16-25 in a future effort.

- **PSC**. As of 2023, the Coast Guard planned to invest about $3 billion to acquire three PSCs and $9 billion to maintain them. The PSCs will replace the Coast Guard's only operational heavy polar icebreaker. These ships will be the first heavy polar icebreakers that any U.S. government agency has bought in almost 50 years. The Coast Guard is responsible for meeting the nation's icebreaking needs in the Arctic and Antarctic. However, the Coast Guard has assessed that it currently does not have the capacity or capability to assure presence and reliable access to the Arctic. In 2019, the program awarded VT Halter Marine, Inc. a contract for detail design and construction of up to three ships. In November 2022, Bollinger Shipyards of Louisiana bought VT Halter, which was renamed Bollinger Mississippi Shipbuilding. As of October 2023, after government approval, Bollinger began production on a limited number of prototype units to help mitigate PSC production risks.
- **Other shipbuilding programs**. The Coast Guard also has several other current and upcoming major shipbuilding programs, such as the Waterways Commerce Cutter, the Great Lakes icebreaker, and the potential Arctic icebreakers. The Coast Guard plans to replace its legacy fleet of construction and river/inland buoy tenders—which maintain and replace navigational buoys—with 30 Waterway Commerce Cutters. There will be three variants of these cutters. The Coast Guard awarded a design and engineering contract to Birdon America, Inc. for the first variant. The first variant includes 27 ships. Their mission is to establish, maintain, and operate aids to maritime navigation on the western rivers and inland waterways.

  The Coast Guard also plans to procure a Great Lakes heavy icebreaker to augment its only heavy domestic icebreaker in the region. The Great Lakes heavy domestic icebreaker assists in keeping channels and harbors open to navigation in response to the reasonable demands of commerce to meet the winter shipping needs of industry. In addition, Congress directed the Coast Guard to assess its fleet mix to include medium icebreakers, and depending on the outcome of that assessment, stand up a program office for the acquisition of medium polar icebreakers, specifically the Arctic

Security Cutter, no later than January 1, 2025.[9] The Coast Guard also has two late-stage shipbuilding programs—the National Security Cutters and the Fast Response Cutters. As of April 2024, the shipbuilders had delivered 10 of 11 National Security Cutters and 56 of 65 Fast Response Cutters.

Design, Oversight, and Contractor Challenges Continue to Plague Coast Guard's Highest Priority Shipbuilding Programs

The Coast Guard's highest priority shipbuilding programs—OPC and PSC—are well behind schedule and have experienced significant cost growth. According to program officials, the OPC stage 1 shipbuilder is going through a review to assess risks of exceeding schedule targets. In addition, the PSC program has breached its cost and schedule baselines. Our prior work has found that these poor outcomes are driven by the Coast Guard's challenges in three main areas: (1) design instability, (2) program baselines missing key events to enable oversight, and (3) poor contractor performance.

Design Instability Drove Schedule Delays and Cost Increases

Both the OPC and PSC have struggled with achieving a stable design to support construction, as called for by the shipbuilding leading practices we identified in 2009. Years after we first identified these deficiencies, the Coast Guard still has not gained the requisite knowledge for either program. These deficiencies have contributed to delays in delivery of the OPC and PSC lead ships by almost 4 and 5 years, respectively. Further, the OPC and PSC cost estimates have increased by nearly $11 billion and more than $2 billion past their original estimates, respectively.

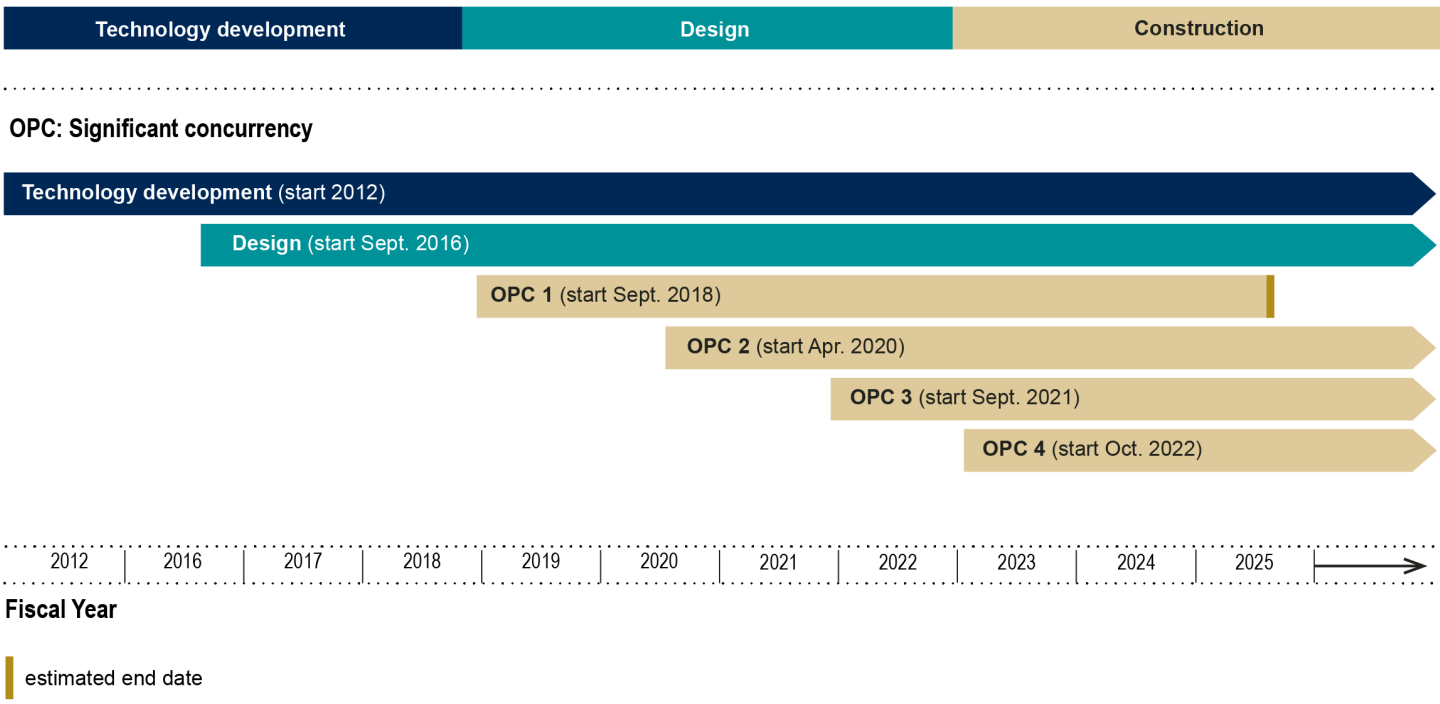
OPC. Since 2020, we have found that DHS and the Coast Guard have allowed the OPC program to repeatedly move forward through key acquisition decisions, despite significant risks, including design instability. We previously found that, in general, concurrency or overlap between the technology development, design, and construction phases of shipbuilding results in poor acquisition outcomes, including cost growth and schedule delays that disrupt multiple ships in the class.[10] Leading practices call for

[9]James M. Inhofe National Defense Authorization Act for Fiscal Year 2023, Pub. L. No. 117-263, § 11218 (2022).

[10]GAO, *Navy Shipbuilding: Past Performance Provides Valuable Lessons for Future Investments*, GAO-18-238SP (Washington, D.C.: June 6, 2018).

minimal concurrency. We found that OPC had significant concurrency between technology development, design, and construction (see fig 5).[11]

Figure 5: Offshore Patrol Cutter (OPC) Program Continues Risky Approach of Overlapping Acquisition Phases



Source: GAO analysis of U.S. Coast Guard documentation. | GAO-24-107488

Note: While some overlap between the design and construction phases is normal, the OPC program has significant overlap between all three phases. The OPC's design phase in this figure refers to the detail design effort that began after the Coast Guard exercised Eastern Shipbuilding Group's contract option for detail design in September 2016.

Further, contrary to our 2009 shipbuilding leading practices, DHS and the Coast Guard authorized the program to start construction on all four OPCs without:

1. **Maturing a critical technology**. The davit—a crane that lowers and raises a ship's small boats—is the OPC's sole critical technology and a key enabling technology for carrying out its missions. We

[11]GAO-21-9; and GAO-23-105805.

recommended in October 2020 that the program mature this technology for stage 1 ships prior to moving further through construction, and in June 2023 that the program develop a plan to mature the technology.[12] DHS concurred with both of these recommendations. However, as of August 2023, the Coast Guard said that they were still tracking two remaining high-risk issues with the system—one of which may have implications for completing the design of a portion of the ship. Further, the Coast Guard awarded a detail design and construction contract for the stage 2 ships without adequately maturing the stage 2 davit. We also recommended in June 2023 that the program mature the davit for stage 2 ships prior to moving forward through design. DHS did not concur with this recommendation, and we subsequently closed this recommendation in April 2024 after the Coast Guard approved a design review without maturing the critical technology. However, we stand by the intent of the recommendation to minimize risk to the program. Without maturing critical technologies early in development, the likelihood that it will lead to design, manufacturing, and construction changes later on increases significantly. These changes often lead to delays and cost increases when the contractor has to address these issues late in the program.

2. **Completing functional design**. The Coast Guard authorized construction on the lead ship prior to the stage 1 shipbuilder completing the functional design. We recommended in October 2020 and June 2023 that the program complete functional design before proceeding with construction on stage 1 and stage 2, respectively.[13] DHS concurred with our October 2020 recommendation, but did not concur with our June 2023 recommendation. As of April 2024, the stage 1 functional design was 93 percent complete, and the Coast Guard has already proceeded with construction on all four ships. As of February 2024, the stage 2 functional design was 70 percent complete, and the program plans to start construction on OPC 5 by September 2024. We will continue to monitor the program's stage 2 design stability leading up to construction.

We also made recommendations in October 2020 and June 2023 to improve the Coast Guard's policy on technology maturity and design stability.[14] The Coast Guard updated some guidance in response to our

[12]GAO-21-9; and GAO-23-105805.

[13]GAO-21-9; and GAO-23-105805.

[14]GAO-21-9; and GAO-23-105805.

recommendations. For example, it updated guidance to emphasize the importance of its shipbuilding programs completing routing and design of major portions of distributive systems—systems that transport electricity, water, HVAC, and other utilities—prior to the start of lead ship construction. This is in line with our leading practices. However, the Coast Guard has yet to require programs to (1) demonstrate critical technologies in a realistic environment prior to contract award of detail design and construction, and (2) complete 100 percent of functional design prior to start of construction. Because the Coast Guard has made limited progress addressing our recommendations, we also made two matters for congressional consideration in 2023 that target the same issues. As of April 2024, Congress has yet to take action on these matters.

PSC. In July 2023, we found that the PSC's design phase was already more than 2 years longer than originally planned and was not yet close to being complete.[15] The PSC program originally planned to fully mature its design by March 2021. However, as of April 2024, Coast Guard officials said the program was targeting the end of 2024.

We found that four primary factors contributed to the shipbuilder's almost 4-year delay in maturing the PSC's design, according to program officials:

- U.S.-based designers and shipbuilders generally lacked experience designing and building heavy polar icebreakers.
- The ship design is complex, including that it used a specialized steel alloy that required technical study and development of new welding procedures before use.
- The shipbuilder overestimated the extent to which it could leverage the original design and had to make significant design changes to meet government specifications, according to program officials. The shipbuilder also made some design errors, such as selecting the wrong height for the lowest deck of the ship, which required significant, late redesign to correct.
- COVID-19 restrictions limited the extent to which the shipbuilder could collaborate and consult with its domestic and international partners.

We recommended in July 2023 that DHS ensure the lead PSC's functional design is complete prior to approving construction, in line with our 2009 shipbuilding leading practices. DHS concurred with the

[15]GAO-23-105949.

recommendation. In April 2024, Coast Guard officials said they expect the functional design to be 100 percent complete by the end of 2024 to support the start of construction at ADE 2C. Before the program can proceed through ADE 2C, the DHS Under Secretary for Management must approve this milestone.

Relatedly, in November 2023, the program declared a cost and schedule breach. The program determined it required additional funding in excess of its cost threshold based on updated cost data. The program also determined it would not complete its critical design review by December 2023 as planned. The program's breach remediation plan indicates that the program plans to submit its updated schedule and life-cycle cost estimate to DHS for approval by September 2024. The program also plans to submit its revised acquisition program baseline to DHS by the end of 2024. While the cost estimate is not complete, the remediation plan indicated that updated costs exceeded 20 percent of the previous baseline threshold of $3.1 billion, or at least $600 million.

Program Baselines Did Not Include Key Events to Enable Oversight

For both OPC and PSC, we found that the programs' acquisition program baselines did not include key events—namely, ship delivery dates—to help ensure oversight and hold the programs accountable for schedule delays. DHS acquisition policy states that acquisition program baselines should include dates for milestones such as acquisition decision events and additional key events necessary for the program. Further, when a program fails to achieve a milestone by the threshold date in the acquisition program baseline, DHS acquisition policy generally requires the program to notify its acquisition decision authority and component acquisition executive and develop a remediation plan.

In addition to requirements under the DHS acquisition policy, the Coast Guard's major acquisition programs have additional requirements to report breaches that meet a certain threshold. The Coast Guard must report these breaches to appropriate congressional committees in

accordance with Title 14 of the U.S. Code.[16] As a result, if a Coast Guard major acquisition program is delayed and breaches its schedule, the program must notify the DHS Under Secretary for Management, Vice Commandant of the Coast Guard, and potentially congressional decision-makers, which helps to ensure oversight and hold the program accountable for schedule delays.

- **OPC**. In 2020, we found that the Coast Guard did not include OPC's delivery dates in the stage 1 acquisition program baseline. This resulted in over 5 years between milestone dates that DHS could have used to better monitor the program for schedule slips. The stage 2 preliminary acquisition program baseline similarly did not include the OPC delivery dates, which were notionally scheduled between fiscal years 2026 and 2037. Without including the delivery dates in the baselines, stage 2 would not have acquisition milestones for several years. We made two recommendations to DHS and the Coast Guard to include OPC's delivery dates in the acquisition program baselines for both stage 1 and stage 2. DHS concurred with both. As of April 2024, the Coast Guard had yet to update the baseline for stage 1 nor established the baseline for stage 2. According to program officials, they plan to add the delivery dates of selected ships for both stages 1 and 2 in the new baseline, which they expect to submit for review in June 2024.
- **PSC.** In July 2023, we found that, while the Coast Guard included the lead ship's delivery date in the acquisition program baseline, it did not include the delivery for PSC 3 (the last ship to be delivered). This effectively left a 4-year gap in the acquisition program baseline without a key event that would trigger a milestone review. That time frame covered a critical period of the program's progress, from acquisition decision event 3—which applies only to the lead ship—to the point at which all three PSCs are planned to be fully operational. We recommended that DHS and the Coast Guard include PSC 3's delivery date in the acquisition program baseline. DHS concurred with this recommendation. As of April 2024, the Coast Guard had yet to

[16]Title 14 of the U.S. Code requires the Coast Guard to report to the House Committee on Homeland Security, House Committee on Transportation and Infrastructure, and Senate Committee on Commerce, Science, and Transportation as soon as possible, but not later than 30 days, after the Coast Guard becomes aware of cost, schedule, or performance breaches that exceed certain thresholds set in the acquisition program baselines for level 1 or 2 programs. For cost and schedule breaches, the reporting requirement is triggered when the Coast Guard becomes aware of an acquisition program baseline breach that involves a likely cost overrun of greater than 15 percent or a likely delay of more than 180 days in the delivery schedule for any level 1 or 2 program. 14 U.S.C. § 1135. See also 14 U.S.C. § 1171.

implement the recommendation. The current rebaselining effort, expected to be complete by the end of 2024, presents the opportunity for the Coast Guard to take action on this recommendation.

Shipbuilder Inexperience, Unrealistic Schedules, and Subcontractor Underperformance Hindered Progress

We previously reported on the Coast Guard's challenges with underperforming contractors, including ESG and Bollinger, the respective shipbuilders for OPC stage 1 and PSC. Specifically, these challenges included shipbuilder inexperience, unrealistic schedules, and issues with subcontractor performance.

Shipbuilder inexperience. The OPC stage 1 shipbuilder did not have experience with federal contracts, and the PSC shipbuilder did not have prior experience designing and building heavy polar icebreakers. In addition, neither had the necessary business systems in place to monitor cost and schedule performance on their contracts.

- **OPC**. ESG did not have experience with federal contracts prior to the OPC contract. Coast Guard officials stated that this inexperience contributed to the challenges with ESG's schedule. In addition, ESG's business systems, such as its earned value management system used for tracking costs and schedule and its accounting system, were initially deficient.[17] This hindered the Coast Guard's oversight of ESG and visibility into the OPC program's cost and schedule progress. Defense Contract Management Agency officials stated that the deficiencies were attributable, in part, to ESG's and the Coast Guard's inexperience with the earned value management system. This included ESG's lack of mature system processes and appropriate tools to support a major acquisition program of OPC's scope.
- **PSC**. According to Coast Guard officials and shipbuilder representatives, the U.S. industrial base lacks experience designing and building a heavy polar icebreaker, since the *Polar Star* and *Polar Sea* were designed and built over 45 years ago. Officials told us that, unlike with other shipbuilding programs, there were no existing U.S.-developed hull designs for a heavy polar icebreaker that the shipbuilder could easily leverage as a basis for PSC. To mitigate this inexperience, the shipbuilder initially planned to base the PSC design on a modified version of a polar icebreaking research ship, designed

[17]Earned value management is a project management tool that integrates the technical scope of work with schedule and cost elements and compares the value of work accomplished in a given period with the value of the work expected in that period. When used properly, earned value management can provide objective assessments of project progress, produce early warning signs of impending schedule delays and cost overruns, and provide unbiased estimates of anticipated costs at completion.

by a European company, which has yet to be constructed.[18] However, the shipbuilder and its design subcontractor likely overestimated the extent to which that design could be leveraged, according to program officials.[19] This resulted in the contractor having to make considerable changes to the design of that ship, which led to delays.

In July 2023, we found that the shipbuilder also did not have all six of the appropriate business systems, including an earned value management system, in place to manage the PSC program. The shipbuilder did not have experience with government contracts of this scope because it was building the first heavy icebreaker in decades and had not used these business systems prior to the PSC contract, according to program officials. This resulted in challenges with developing reliable cost and schedule estimates, among other things. Specifically, five of six business systems related to accounting, estimating, and other areas had yet to be determined as acceptable for different reasons. The PSC contract requires the shipbuilder to have acceptable business systems that meet specific criteria set forth in defense acquisition regulations.[20] The Coast Guard and shipbuilder are taking steps to address the data limitations and we will continue to monitor progress.

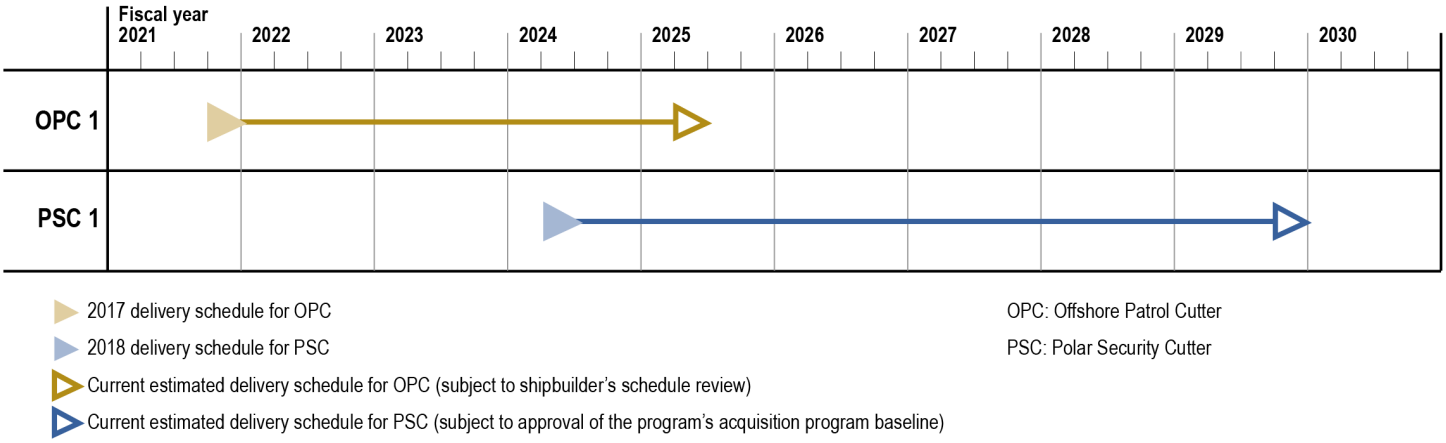
Unrealistic schedules. The Coast Guard adopted unrealistic schedules from the outset of both the OPC and PSC programs. Both programs are now experiencing schedule delays of about 4 years or more (see fig. 6). The programs' schedule challenges have been exacerbated by a lack of reliable schedule data from the shipbuilders that could be used to anchor projections of remaining work to complete the ships.

[18]The original PSC ship design was based on a German design for the Polarstern II.

[19]The program projects that construction of the lead ship will start before the end of 2024.

[20]See Defense Federal Acquisition Regulation Supplement 252.242-7005.

Figure 6: Delivery Delays with the Lead Ship in the Offshore Patrol Cutter and Polar Security Cutter Programs, as of 2024



Source: GAO analysis of U.S. Coast Guard and Department of Homeland Security documentation. | GAO-24-107488

- **OPC**. In October 2020, we found that prior to the construction award for OPC 1, the OPC contractor's schedule contained deficiencies that were contrary to leading practices we identified for developing schedules.[21] Further, we found that the revised post-hurricane delivery dates for the first four OPCs were optimistic and did not fully incorporate schedule risks, increasing the likelihood that the OPCs will not be delivered when promised. In a review of the shipbuilder's schedule, the Defense Contract Management Agency and the Coast Guard found deficiencies, such as that the shipbuilder could not produce a valid critical path (the path of longest duration through the sequence of activities). We recommended that the Coast Guard fully address the deficiencies identified in the contractor's schedule. DHS concurred with this recommendation. As of April 2024, the recommendation remains open, and we will reassess the program's progress after its baseline is approved.

  In June 2023, we found that the schedule remained optimistic given that the program was still having challenges manufacturing the shaft—the part of the propulsion system that transmits power from the engine to the propellers to generate thrust—and developing the davit.[22] In April 2024, program officials told us that the OPC stage 1

[21]GAO-21-9.

[22]GAO-23-105805.

shipbuilder is going through a review to assess risks of exceeding schedule targets, and that they estimate the lead ship will be delivered by June 2025. In total, the program is experiencing about a 4-year delay in delivery of the lead ship.

- **PSC**. In September 2018, we found that the PSC's planned delivery dates were not informed by a realistic assessment of shipbuilding activities.[23] 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. We recommended that the program develop a schedule in accordance with leading practices for project schedules to set realistic schedule goals for all three PSCs before the lead ship contract option was awarded. However, we closed the recommendation as not implemented because the program proceeded with the award in April 2019 without developing a realistic schedule. We will continue to monitor the shipbuilder's progress in addressing these concerns. In July 2023, we found the program had yet to establish a realistic schedule.[24]

  As of April 2024, the program had not yet established an updated schedule. As noted earlier, the program breached its schedule and is in the process of updating its schedule estimates to develop a new acquisition program baseline. As part of its breach remediation plan submitted to DHS, the program developed a preliminary draft schedule baseline, which included a lead ship delivery date by the end of 2029—a delay of over 5 years from its original schedule baseline.[25]

Poor subcontractor performance. The shipbuilders for the OPC and PSC programs used subcontractors to varying degrees to assist with developing the design, maturing critical technologies, and building key components. However, these subcontractors have not always met expectations and their performance has contributed to program delays.

- **OPC**. In October 2020, we found that ESG assumed responsibility for completing more of the detail design after ESG determined that the subcontractor responsible for this effort was underperforming.

[23]GAO-18-600.

[24]GAO-23-105949.

[25]The program has not finalized its schedule baseline. It plans to submit its revised baseline to DHS by December 2024.

According to a Coast Guard engineering review, the additional burden on ESG's staff slowed the planned design development on the remainder of the ship.

In addition, ESG is working with a subcontractor to deliver a novel davit design. The new davit requires integration of existing technologies to meet a requirement to raise and lower a small boat in rough waves ranging from 8 to 13 feet. The Coast Guard proceeded with construction of OPCs 1 through 4 without demonstrating the maturity of the davit or resolving outstanding design issues. As of August 2023, according to Coast Guard officials, the subcontractor had not matured this system. The Coast Guard was also still tracking two remaining high-risk issues with the system: (1) all the equipment cannot fit in the electrical cabinet's designed space, which has led to a significant redesign, and (2) the davit cannot raise and lower small boats in rough conditions, as required. As of April 2024, the davit has not demonstrated maturity or been tested to meet the requirement.

Lastly, ESG has faced difficulties in getting compliant propulsion components from another subcontractor. Initial quality issues resulted in having to remanufacture some of the shaft segments, which according to program officials, has led to program delays.

- **PSC**. As noted above, according to program officials, the shipbuilder, then VT Halter, likely overestimated the extent to which it could leverage the original design and underestimated the magnitude of the design changes required to meet PSC requirements.[26] The design subcontractor also struggled with the complexity of the design work required for PSC, resulting in some fundamental errors that required significant, late design revisions to correct. Since Bollinger Shipyards bought VT Halter in November 2022, program officials said that the new shipbuilder embedded its own design experts with the design subcontractor to help work through issues and provide additional expertise.

[26]GAO-23-105949.

Leading Shipbuilding Practices Prioritize Timeliness, Iterative Designs, and User Involvement

Since our 2009 report on shipbuilding leading practices, we have identified new leading practices in product development and ship design that can inform the Coast Guard's current and future shipbuilding efforts. Current shipbuilding programs include OPC and PSC, and future programs include the Great Lakes icebreaker and the potential Arctic icebreakers. With the new leading practices, DHS, the Coast Guard, and Congress have an opportunity to rethink how ships are acquired, with the ultimate goal of achieving better cost and schedule outcomes.[27]

In 2022, we identified leading practices for product development across different commercial industries, including shipbuilding. We found that successful companies deliver innovative products with predictable schedule and cost outcomes because their approaches are underpinned by four principles:

- attain a sound business case,
- use an iterative design approach,
- prioritize schedule by off-ramping capabilities, and
- use customer feedback to inform improvements.[28]

In our 2022 report, we found that DHS's acquisition policies did not fully reflect these principles. In response to our recommendations, in January 2023, DHS revised its policies to better reflect the leading principles.[29] It is too early to tell whether DHS's acquisition programs, including the

[27]We make recommendations to agencies and also matters for congressional consideration to address problems we have identified. For example, in June 2023, we made two matters for congressional consideration to require the Coast Guard to update its acquisition policy to reflect shipbuilding leading practices. We have found that action by Congress to address open matters can produce billions of dollars in financial savings, improve the effectiveness of federal agencies and programs, and help position the nation to address future challenges.

[28]GAO, *Leading Practices: Agency Acquisition Policies Could Better Implement Key Product Development Principles*, GAO-22-104513 (Washington, D.C.: Mar. 10, 2022). We further updated this leading practice work in our July 2023 report. See GAO, *Leading Practices: Iterative Cycles Enable Rapid Delivery of Complex, Innovative Products*, GAO-23-106222 (Washington, D.C.: July 27, 2023).

[29]We made three recommendations to DHS to update its acquisition policies to fully implement the following principles throughout development: (1) attaining a sound business case, (2) applying iterative design approaches, and (3) off-ramping capabilities when needed to maintain schedule. Based on DHS's January 2023 update to Instruction 102-01-001, *Acquisition Management*, we closed the first and third recommendations as implemented. As of April 2024, the second recommendation remains open as partially addressed.

Coast Guard's programs, have successfully implemented these principles. This is an area that we will continue to monitor.

Building off our 2022 report, we narrowed our focus and identified leading practices used by commercial ship buyers and builders to inform their understanding of design maturity and readiness for construction.[30] Las week, we published the results of our latest work, which builds on the principles we identified in 2022.[31] We found that commercial ship buyers and builders use four primary leading practices, supported by 13 key elements, to enable shorter, predictable cycles for designing and delivering new ships, as discussed in figure 7.

[30]The results from our work over the last 15 years demonstrate that leading practices from commercial industry can be applied thoughtfully to government shipbuilding acquisition to improve outcomes, even when cultural and structural differences yield different sets of incentives and priorities. As part of our 2009 and 2024 analyses on shipbuilding leading practices, we reported on the environments in which commercial and Navy shipbuilding operate. For additional detail on these differences, see GAO-09-322 and GAO-24-105503.

[31]We issued a new report on leading practices in 2023 that further refined the principles we identified in 2022. Our most recent work on shipbuilding leading practices, issued in May 2024, further validated these practices and their applicability to shipbuilding programs. See GAO-23-106222.

Figure 7: Summary of Leading Practices GAO Found in Commercial Ship Design

Leading practice	Key elements
 **Establish business cases and requirements that support predictable design outcomes**	• Prioritize timeliness of ship design and delivery • Avoid overly prescriptive requirements • Maintain a sound business case through continued reevaluation
 **Use iterative design to accelerate design maturity**	• Prioritize user involvement in the ship design process • Leverage existing ship designs and systems in digital libraries • Prioritize timely vendor decisions and information • Make risk-based decisions to off-ramp design features • Minimize and isolate changes to existing designs • Carefully manage design innovation
 **Use efficient ship design collaboration and decision-making practices**	• Use processes that support timely design decisions • Align decision-making with design maturity measures
 **Employ robust in-house ship design capabilities and tools**	• Maintain strong in-house design workforce capabilities • Use ship design tools to shorten cycle time

Source: GAO analysis of commercial company information; GAO (illustrations). | GAO-24-107488

In our May 2024 report, we found that Navy shipbuilding programs often take significantly longer to design and deliver new ships compared with the typical timelines for commercial ships. We found several factors contributed to the differences in the pace of ship design and delivery, including:

- The Navy's practices for setting requirements and designing new ships lack the streamlined and iterative practices that support shorter cycle times for commercial ships.

- The Navy's linear acquisition practices set key program requirements before designs are stable and lack the type of user involvement, timely vendor furnished information, and a robust design library used by commercial ship buyers and builders to support design maturation.
- The Navy's layered review practices extend the time needed to make design decisions, and key program decisions lack the clear connection with design maturity measures that exists within the commercial ship industry.
- The Navy's shortfalls in its in-house design capabilities and tools create challenges for achieving the shorter cycle times achieved for commercial ships.

We recommended that the Navy take several actions to improve design knowledge before beginning construction on new shipbuilding programs, among other things.[32]

While we have not assessed the extent to which the Coast Guard is using ship design leading practices, it is clear that many of the design and schedule challenges that confront the Navy are evident, to varying degrees, in the OPC and PSC programs. DHS and the Coast Guard have an opportunity to incorporate leading practices into these shipbuilding programs and others that have not yet begun, such as the Great Lakes and Arctic icebreakers. Congress also has the opportunity through legislation and appropriations to further support the use of leading practices. For example, in 2023, we made two matters for congressional consideration to require the Coast Guard to update its acquisition policy to reflect shipbuilding leading practices. Our work has found that implementing these leading practices can lead to improved outcomes.

In conclusion, the outcomes that the Coast Guard is experiencing on its highest priority programs has fallen far short of expectations, and the cost overruns of these programs further raises concerns about the overall affordability of its efforts to modernize its fleet. Such outcomes are also threatening the Coast Guard's ability to meet its missions to protect our homeland. Over the past decade, we have provided numerous opportunities through our recommendations for the Coast Guard and DHS to change their acquisition approach and align with leading practices for acquisition. While they have taken some action, they continue to make decisions that imperil their highest priority programs. Moving forward,

[32]The Navy agreed with seven of our eight recommendations and partially agreed with one. We stand by our recommendations and will follow up with the Navy on its efforts to address them. GAO-24-105503.

addressing our many open recommendations and being mindful of our updated work on ship design leading practices would provide the Coast Guard with a more solid foundation to acquire the capabilities it needs to meet its important missions. We will continue to assess the Coast Guard's efforts in this area.

Chairman Gimenez, Ranking Member Thanedar, and Members of the Subcommittee, this completes my prepared statement. I would be pleased to respond to any questions that you may have at this time.

GAO Contact and Staff Acknowledgments

If you or your staff have any questions about this testimony, please contact Shelby S. Oakley, Director, Contracting and National Security Acquisitions, at (202) 512-4841 or oakleys@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement.

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