COLUMBIA CLASS SUBMARINE

Overcoming Persistent Challenges Requires Yet Undemonstrated Performance and Better-Informed Supplier Investments

Report to Congressional Committees

September 2024
GAO-24-107732
United States Government Accountability Office

Accessible Version

GAO Highlights

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Why GAO Did This Study

The Navy plans to invest almost $130 billion to acquire 12 *Columbia* class nuclear-powered ballistic missile submarines, the sea-based leg of the nation's air, land, and sea nuclear deterrent. Congress included a provision in statute for the Navy to provide updates on the *Columbia* class program's design and construction goals and for GAO to assess this information.

This report assesses (1) the extent to which submarines are on track to meet cost and schedule targets and how risks could affect construction progress; and (2) the extent to which actions in the *Columbia* class supplier base are helping to achieve construction goals and mitigate risks.

GAO reviewed Navy and shipbuilder documents to identify construction status and costs; assessed the program's performance data against selected best practices to understand progress and challenges; and interviewed Navy, shipbuilder, and supplier officials. This is a public version of a sensitive report that issued in July 2024. Information deemed sensitive has been omitted.

What GAO Recommends

GAO is making five recommendations, including that the Navy require the shipbuilder to revise its estimated cost at completion and include thorough analysis in its reporting; and that the program identify information it needs to determine whether investments in the supplier base support *Columbia* class construction goals. The Department of Defense concurred with the recommendations and cited actions that it will take to address them.

What GAO Found

Based on current construction performance, the Navy reported in April 2024 that the first (lead) *Columbia* class submarine is estimated to be delivered 12 to 16 months after its originally planned date. This would result in delivery between October 2028 and February 2029. A late delivery could ultimately jeopardize the lead submarine's planned availability for operations in 2030.

According to GAO's analysis of program data from January 2022 through May 2023, cost and schedule performance for lead submarine construction has consistently fallen short of targets. Through early 2024, those trends had not improved, and future risks will likely add to current cost and schedule growth. The program has reported that the shipbuilder needs to take swift and significant actions to address the causes of poor construction performance. However, as GAO has previously reported, the program has tried to mitigate some of these causes—such as late materials and detailed design products—for years.

Lead *Columbia* Class Submarine Stern during Transport between Shipyards

Source: Copyright © 2024 General Dynamics Electric Boat. | GAO-24-107732

Based on data through May 2023, GAO estimated that lead submarine construction costs at completion could be hundreds of millions of dollars more than the Navy's planned costs. Although the shipbuilder is also expecting cost increases, its estimated overrun is smaller and assumes significant future improvement that GAO's past work suggests is unrealistic. Further, program reporting on submarine construction progress did not always include a thorough analysis of why the program missed cost and schedule goals. Without realistic cost estimates and adequate analysis, the program will struggle to address continuing and future risks that could further degrade construction performance.

The Navy has not consistently defined information needed to determine whether investments made in the supplier base have increased supplier production or generated cost savings and how those results support the program's goals. Since 2018, the Navy reported receiving more than $2.6 billion to invest in the submarine supplier base and help achieve *Columbia* class construction goals. Without identifying consistent information, the Navy is not well positioned to ensure that these investments will effectively spur their intended benefits for the program.

Contents

Abbreviations

AUKUS	Australia-United Kingdom-United States enhanced security partnership
DCMA	Defense Contract Management Agency
DOD	Department of Defense
EAC	estimate at completion
Electric Boat	General Dynamics Electric Boat
EVM	earned value management
Newport News	Huntington Ingalls Industries Newport News Shipbuilding
SDF	supplier development funding
SUPSHIP	Supervisor of Shipbuilding, Conversion, and Repair

U.S. GOVERNMENT ACCOUNTABILITY OFFICE
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September 30, 2024

Congressional Committees

The Navy plans to invest almost $130 billion to research, develop, and purchase 12 *Columbia* class submarines to replace the current fleet of 14 *Ohio* class ballistic missile submarines, the sea-based leg of the nation's strategic nuclear deterrence. According to the Navy, as *Ohio* class submarines begin to retire in 2027, the lead *Columbia* class submarine must be ready for its first patrol in fiscal year 2031 to avoid a gap in deterrence requirements. Late delivery of *Columbia* class submarines could jeopardize the start of this planned transition.

Over the last 7 years, we have made 13 recommendations for the *Columbia* class program. We have consistently found that the program faced significant challenges with the lead submarine's technology maturation, design, and construction.[1] We also reported that, as some of these challenges have persisted, the program is less likely to achieve its optimistic cost and schedule goals. In 2023, we recommended that the Navy ensure the construction schedule is reliable.[2] The Department of Defense (DOD) partially concurred with the recommendation but has yet to address it. Most recently, an April 2024 Navy review of shipbuilding programs concluded that, based on current construction performance, the lead submarine will be delivered 12 to 16 months after the current contract delivery date.[3]

The National Defense Authorization Act for Fiscal Year 2018 included a requirement for the Navy to prepare and submit information on the *Columbia* class program's design and construction goals and progress. It also includes a provision that we assess this information.[4] This report assesses (1) the extent to which *Columbia* class submarines are on track to meet cost and schedule targets and how risks could affect construction progress; and (2) the extent to which the Navy's and shipbuilders' actions regarding the *Columbia* class supplier base are helping to achieve construction goals and mitigate risks.

To address these objectives, we reviewed Navy, shipbuilder, and DOD documentation. To assess the program's progress toward meeting its cost and schedule targets and the extent to which risks could affect progress, we compared plans for design, construction completion, and costs against actual progress and spending reported in program and Navy documentation. We also assessed the *Columbia* class program's

[1]For example, see GAO, *Columbia Class Submarine: Program Lacks Essential Schedule Insight amid Continuing Construction Challenges*, GAO-23-106292 (Washington, D.C.: Jan. 24, 2023); *Columbia Class Submarine: Delivery Hinges on Timely and Quality Materials from Atrophied Supplier Base*, GAO-21-257 (Washington, D.C.: Jan. 14, 2021); and *Columbia Class Submarine: Immature Technologies Present Risks to Achieving Cost, Schedule, and Performance Goals*, GAO-18-158 (Washington, D.C.: Dec. 21, 2017).

[2]GAO, *Columbia Class Submarine: Construction Schedule Is Not Reliable*, GAO-23-105683SU (Washington, D.C.: Mar. 20, 2023).

[3]In January 2024, the Secretary of the Navy directed the Assistant Secretary of the Navy for Research, Development, and Acquisition and the Commander of Naval Sea Systems Command to conduct a comprehensive assessment of the Navy's shipbuilding portfolio, causes of shipbuilding challenges, and recommendations for achieving a healthier U.S. shipbuilding industrial base.

[4]Pub. L. No. 115-91, § 231 (2017). We provided an initial assessment of information included in the Navy's February 2023 report in response to the National Defense Authorization Act for Fiscal Year 2018 through briefings, and we include additional information in this report.

contract performance information against selected best practices from our prior work.[5] Specifically, we analyzed shipbuilder-reported information to determine whether the program is adequately monitoring progress toward program completion and analyzing trends in cost and schedule to improve performance. We determined that the program's contract performance information was sufficiently reliable for this purpose.

To assess actions taken by the Navy and the shipbuilders regarding the *Columbia* class supplier base and whether these actions are supporting construction goals, we examined supplier development funding agreement documentation and investments that the Navy and the shipbuilders made at submarine suppliers, as well as their intended outcomes. We reviewed shipbuilder evaluations for those suppliers in the years after awards were received. In addition, we reviewed the shipbuilders' plans to optimize construction by having suppliers execute work at their facilities that has traditionally been completed at the shipyards, referred to as outsourcing. We also reviewed the Navy's planning for conducting quality assurance oversight at supplier facilities.

For both objectives, we interviewed Navy and DOD officials and shipbuilder and supplier representatives to understand steps they have taken to achieve program objectives, address challenges, and mitigate risks. See appendix I for a detailed description of our objectives, scope, and methodology.

This report is a public version of a sensitive report that we issued in July 2024. DOD deemed some of the information in our July 2024 report to be sensitive, which must be protected from public disclosure. Therefore, this report omits sensitive information about the program's efforts to assess and address construction challenges, *Columbia* class supplier performance and investments, and Navy oversight of the supplier base. Although the information is more limited, the report addresses the same objectives as the sensitive report and uses the same methodology.

We conducted this performance audit from January 2023 to July 2024 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. We worked with DOD from June 2024 to September 2024 to prepare this unclassified version of the original sensitive report for public release. This public version was also prepared in accordance with these standards.

Background

Construction of U.S. Nuclear Submarines

Two U.S. shipbuilders—General Dynamics Electric Boat (Electric Boat) and Huntington Ingalls Industries Newport News Shipbuilding (Newport News)—design and build nuclear submarines. Electric Boat is the prime

[5]GAO, *Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Program Costs*, GAO-20-195G (Washington, D.C.: Mar. 20, 2020).

contractor for both design and construction of the *Columbia* class program, with Newport News serving as a major subcontractor. Both shipbuilders also construct and deliver *Virginia* class attack submarines.

Electric Boat and Newport News are executing the most significant increase in nuclear-powered submarine and ship construction in over 30 years. To meet the Navy's submarine fleet goals, the shipyards are planning to start serial production of one *Columbia* class submarine and two *Virginia* class submarines per year in 2026. Construction of *Columbia* and *Virginia* class submarines is taking place concurrently at Electric Boat—which has facilities located in Groton, Connecticut, and Quonset Point, Rhode Island—and at Newport News, which has a facility in Newport News, Virginia. The shipbuilders are also completing various activities necessary to sustain existing submarines and, in the case of Newport News, building *Ford* class aircraft carriers.

In 2021, Australia, the United Kingdom, and the United States announced a trilateral partnership—referred to as AUKUS—intended to provide Australia with conventionally armed, nuclear-powered submarines and enhance joint advanced military capabilities. As part of the arrangement, the United States intends to sell three *Virginia* class submarines to Australia beginning in the early 2030s, with the potential to sell up to two additional submarines if needed.[6] Construction of *Virginia* class submarines planned for sale to Australia will add to existing submarine construction and maintenance demands at the shipyards.

Columbia Class Construction

Construction of the first and second *Columbia* class submarines is being conducted under a cost-plus-incentive-fee contract, which is a type of cost-reimbursement contract. Under a cost-reimbursement contract, the government pays allowable costs incurred by the contractor, to the extent prescribed by the contract, such as certain compensation costs for work performed. Under these types of contracts, the government generally assumes the risk of a cost overrun because, although the contractor is to make a good-faith effort to meet contract requirements within the estimated cost, the government is not promised a completed item or service within that cost. A cost-plus-incentive-fee contract is intended to motivate the contractor to effectively manage costs by providing for an initially negotiated fee to be adjusted later by a formula based on the relationship of total allowable costs to total target costs.

We have previously reported that the Navy, in an effort to ensure on-time delivery, shortened the lead *Columbia* class submarine's planned construction duration from 84 months to 78 months.[7] This accelerated schedule moved up planned delivery from October 2027 to April 2027. To achieve the lead submarine's earlier delivery, the shipbuilders planned to complete construction of most of the submarine's six large hull segments, called super modules, in less time than under the original schedule. This plan involved conducting more work in parallel than called for in the original plan, completing key contract and government equipment deliveries earlier than planned, and reducing the time between when the hull becomes watertight and submarine delivery.

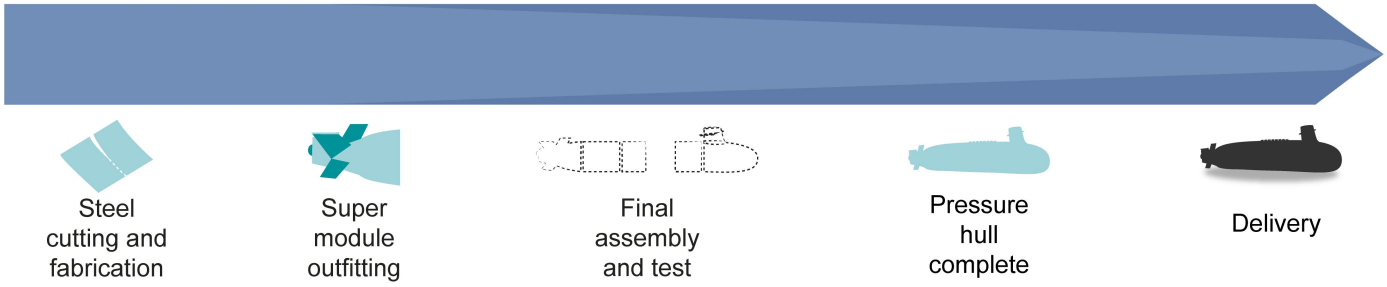
The shipbuilders construct the *Columbia* class super modules and outfit them with systems and connections before delivering them to Electric Boat's shipyard in Groton for final assembly and test. Once at Groton, Electric Boat will integrate and test the super modules and their systems and address any issues discovered during testing. When Electric Boat completes the watertight pressure hull, the submarine will be ready to enter

[6]Congress has authorized the initial sale of three *Virginia* class submarines to Australia. National Defense Authorization Act for Fiscal Year 2024, Pub. L. No. 118-31, § 1352 (2023).

[7]GAO-23-106292.

the water, where the shipbuilder will finish any remaining work. Figure 1 summarizes key submarine construction events for the *Columbia* class submarines.

Figure 1: Notional Depiction of Key Submarine Construction Events



Source: Representation of GAO, Navy, and shipbuilder information. | GAO-24-107732

In January 2023, we reported that issues with work instructions and late materials were contributing to construction delays.[8] Problems with work instructions—detailed design products that describe how to construct the submarine—including poor quality have primarily resulted from inexperienced planning staff. Material availability—timely delivery of components to the shipyard—has been strained by supplier and shipbuilder manufacturing delays.

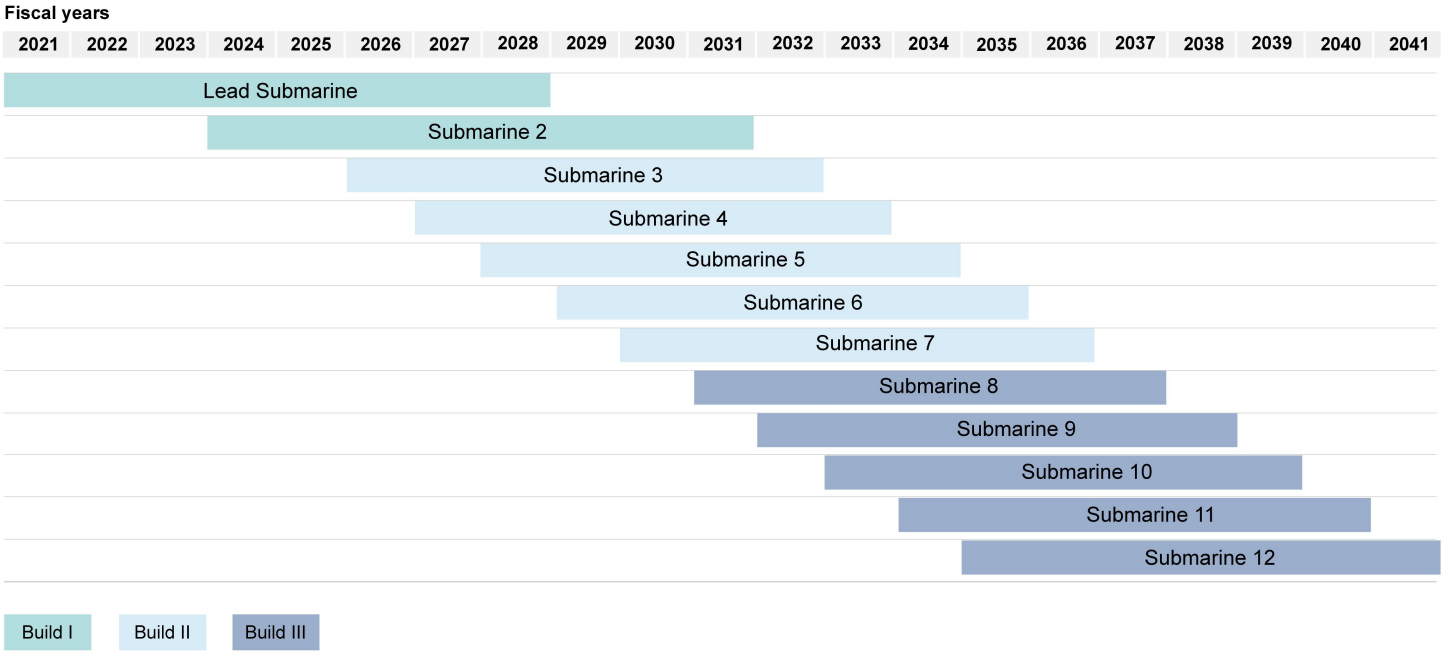
In September 2023, the *Columbia* class program's milestone decision authority approved formal construction of the second submarine.[9] Formal construction began in October 2023. Electric Boat plans to deliver the second submarine in April 2030 following an 80-month construction duration.

Construction of the first two *Columbia* class submarines is collectively referred to as Build I. The Navy plans to request authorization for construction of the remaining 10 submarines at a rate of one per year from fiscal year 2026 through 2035. Builds II and III include submarines 3-7 and 8-12, respectively (see fig. 2).

[8]GAO-23-106292.

[9]The milestone decision authority is a designated individual with overall responsibility for a program and with the authority to approve program entry into the next phase of the acquisition process. The milestone decision authority for this program is the Under Secretary of Defense for Acquisition and Sustainment. The Navy started production on part of the second submarine before September 2023, called advance construction. Advance construction is allowable under expanded acquisition authorities provided by Congress under the National Sea-Based Deterrence Fund. We refer to construction activities that occur after the program was authorized to begin construction in earnest as formal construction.

Figure 2: Planned Construction Durations for *Columbia* Class Submarines (by Fiscal Year)



Source: GAO representation of *Columbia* class program documentation. | GAO-24-107732

Accessible Data for Figure 2: Planned Construction Durations for Columbia Class Submarines (by Fiscal Year)

Build	Authorization fiscal year	Delivery fiscal year
I	2021	2028
I	2024	2031
II	2026	2032
II	2027	2033
II	2028	2034
II	2029	2035
II	2030	2036
III	2031	2037
III	2032	2038
III	2033	2039
III	2034	2040
III	2035	2041

Source: GAO representation of Columbia class program documentation. I GAO-24-107732

Note: The construction durations reflect the time from the submarine's expected fiscal year of authorization of formal construction through its latest acceptable delivery, based on program documentation.

Earned Value Management

Electric Boat and the *Columbia* class program monitor submarine design and construction progress toward completion using earned value management (EVM).[10] According to our cost guide, EVM is a tool for program managers to gain insight into contractor cost and schedule performance.[11] Measuring program performance gives objective information for identifying and managing risk. Programs can make better decisions that lead to greater success if they have accurate progress assessments of program status. Objective information about progress also allows early detection and resolution of problems by helping to anticipate what could go wrong based on past trends. The ability for program management to act quickly to resolve program problems depends on having information on the causes of problems early.

EVM processes involve the integration of information about the program's required resources, schedule, and cost so that the program can establish a schedule and budget plan, or baseline, against which progress can be assessed. As work is accomplished and measured against the baseline plan, a corresponding budget value is earned. Programs can examine how value has been earned to forecast future cost and schedule performance based on trends, including an estimate at completion (EAC), and to identify variances in cost or schedule compared to plans. Electric Boat measures the lead submarine's progress against the accelerated 78-month construction schedule baseline.

A program's EAC is an assessment of the cost to complete authorized work—including estimated overruns—based on the contractor's historical EVM performance. It includes actual costs and the forecasted cost of work remaining. Our cost guide states that program management can use EAC information to decide whether additional funding should be requested and, if so, support a case for more funds. EAC information can provide early warning of impending funding issues and enable management to take corrective action to avoid any surprises.

Variance analysis is the assessment of differences between actual cost and schedule performance and the program's baseline. According to our cost guide, variance analysis can help determine: (1) the root causes of any cost growth and schedule slippages, (2) the progress of any corrective action plans that are in place, and (3) whether poor performance can be recovered. This information provides management with a view of current and potential problems and can help them identify and manage risks.

Submarine Supplier Base

Supplier Base Health

According to DOD, between the 1980s and 2020 the submarine supplier base, which supports the shipbuilders primarily by providing parts and materials, shrank from approximately 17,000 suppliers to 3,500. As a result, the *Columbia* class shipbuilders rely more on single and sole-source suppliers, and fewer suppliers are

[10]The Federal Acquisition Regulation requires EVM for major acquisitions, and DOD applies this requirement to cost or incentive contracts valued at $20 million or more. See Federal Acquisition Regulation subpart 34.2; Defense Federal Acquisition Regulation Supplement Subpart 234.2.

[11]GAO-20-195G.

competing for contracts.[12] We have previously reported that poor performance by some *Columbia* class suppliers has contributed to delays in the delivery of materials at the shipyards and rework resulting from quality deficiencies.[13]

To monitor supplier base health, the shipbuilders conduct annual assessments of approximately 350 critical submarine suppliers to determine whether they can support increased nuclear shipbuilding construction demand—specifically, serial production of one *Columbia* class submarine and two *Virginia* class submarines per year. The Navy and shipbuilders monitor supplier capacity and quality, among other areas, and they work to improve supplier readiness as needed.

Supplier Development Funding and Outsourcing

Since 2018, the Navy and shipbuilders have coordinated to award supplier development funding (SDF) to improve the health of the submarine supplier base. In 2021, we reported that SDF investments support supplier projects intended to improve readiness and specialized purchases of materials to help the supplier base better predict their workload and optimize use of their facilities.[14] In general, the Navy has provided SDF to the shipbuilders through the *Columbia* class design and construction contract, and the shipbuilders have identified and awarded supplier projects and purchases with these funds. Specifically, the shipbuilders' use of SDF is intended to add capability and capacity to existing suppliers, develop new suppliers to reduce single- and sole-source supplier risks, and improve first-time manufacturing quality.[15] According to the Navy, SDF awards have also helped signal steady demand through purchases of materials designed to help suppliers better predict and manage their work and optimize use of their facilities. Since 2023, BlueForge Alliance, a nonprofit integrator, has supported the execution of SDF for the shipbuilders. According to the Navy, BlueForge Alliance is involved in activities such as engaging unconventional partners like universities, tailoring the scope of work for suppliers receiving SDF, and ensuring return on investment. Navy officials told us they work closely with the shipbuilders and BlueForge Alliance—a subcontractor for Electric Boat—to decide how SDF is invested. See appendix II for more information on the use of SDF.

In some cases, the shipbuilders have awarded SDF to help suppliers prepare for outsourcing. With outsourcing, shipbuilders shift products they previously manufactured to selected suppliers. The shipbuilders reported that they need to outsource work because they face limited space at the shipyards and constrained capacity and capability, such as a limited workforce, at internal manufacturing centers and workshops. Strategic suppliers—suppliers that execute outsourced work—manufacture modules, tanks, decks, and other components. Some strategic suppliers have also implemented a Focus Factory model with Electric Boat. Focus Factory suppliers replicate the shipbuilder's operations at their facilities. To do so, they use Electric Boat's design products, manufacturing processes, and oversight. According to Electric Boat, suppliers that

[12]According to DOD, single-source suppliers produce a particular item that alternative suppliers may be capable of producing but do not, and sole-source suppliers are the only supplier capable of producing a particular item, for example when the item is proprietary.

[13]GAO-21-257.

[14]GAO-21-257.

[15]A single-source risk exists when only one supplier is available for reasons such as (1) no other alternatives have the skills or equipment necessary to produce the required materials or components, or (2) only one supplier is qualified and it is too expensive and time consuming to qualify additional sources.

have implemented Focus Factory primarily perform steel processing, structural fabrication, and outfitting of decks.

Navy Shipbuilding Quality Assurance Oversight and EVM System Surveillance

The Supervisors of Shipbuilding, Conversion, and Repair (SUPSHIP), as the Navy's primary on-site representatives, perform quality assurance oversight and EVM system surveillance at the private shipyards. While the shipbuilders are responsible for the quality of their work, the SUPSHIP offices' quality assurance departments review the shipbuilders' quality management system, inspect and test completed work, and evaluate quality data, among other things.[16] The SUPSHIP offices also conduct surveillance of the shipbuilders' business systems, including their EVM systems. This routine surveillance is intended to ensure the shipbuilders' EVM systems comply with EVM guidelines.[17] Compliant EVM systems provide contract performance data that objectively measure work progress, allow for informed decisions and corrective actions, and enable timely and reliable EACs, among other things.

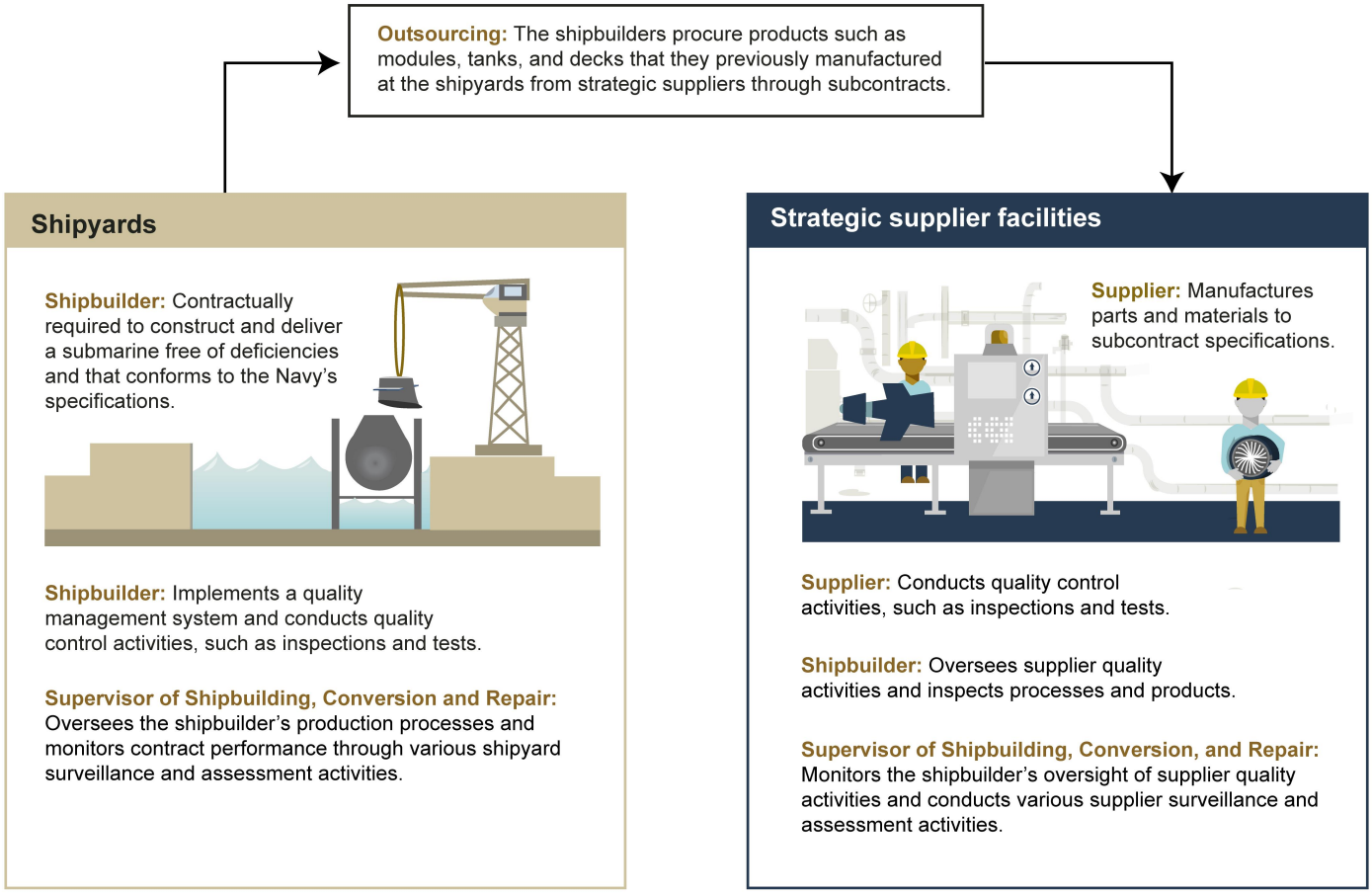
The shipbuilders are responsible for overseeing quality management at their suppliers. However, the SUPSHIP offices also provide quality assurance oversight at supplier facilities when requested and funded by program offices, including for outsourced work that they previously would have monitored at the shipyards. According to a DOD report on the submarine industrial base, the SUPSHIP offices provide concurrent and complementary government oversight at the strategic suppliers and ensure that the shipbuilders discover any supplier issues early and follow through on actions to address them.[18] The SUPSHIP offices employ corrective action requests to inform the shipbuilders of conditions that do not conform with contractual requirements, such as deficient products or processes that may result in a deficient product. Figure 3 shows how the shipbuilders, suppliers, and SUPSHIP offices are responsible for quality at the shipyards and strategic supplier locations.

[16]See Federal Acquisition Regulation 46.105. Quality management systems incorporate policies, processes, and procedures for planning and producing materials that meet customer requirements.

[17]See Defense Federal Acquisition Regulation Supplement 252.234-7002.

[18]Department of Defense, *Submarine Industrial Base (SIB) Study Supporting Fiscal Year 2023 Program Review* (May 2022).

Figure 3: Quality Assurance for Submarine Construction at Shipyards and Strategic Suppliers



Source: GAO analysis of Federal Acquisition Regulation, Department of Defense, Navy, and shipbuilder information; GAO (illustration). | GAO-24-107732

The SUPSHIP offices conduct their activities at the major shipyard locations for the program. Offices include SUPSHIP Groton, which oversees Electric Boat's Groton and Quonset Point shipyards; SUPSHIP Newport News, which oversees Newport News's shipyard; and SUPSHIP Gulf Coast, which oversees submarine work at one strategic supplier's facility. The SUPSHIP Management organization, which resides within the Naval Sea Systems Command's Logistics, Maintenance and Industrial Operations Directorate, provides policy, guidance, and resourcing for the SUPSHIP offices. The small group of SUPSHIP Management officials supervise each SUPSHIP office's operations and finances as well as manage budget and staffing requirements.

Poor Schedule and Cost Performance Will Be Difficult to Correct amid Construction Risks and Inadequate Analysis

An estimated delay of more than a year in delivering the lead submarine and projected cost increases will be difficult for the *Columbia* class program to fully correct as it faces additional risks and issues late in construction. Although Electric Boat and the program have ongoing efforts intended to help recover from

persistent challenges, the lead submarine is entering a period of construction that involves additional risks that are likely to contribute to cost and schedule growth. In addition, as the program looks to mitigate future problems, it is doing so with inadequate analysis of cost and schedule information, constraining the program's ability to take appropriate actions to improve performance.

Existing Schedule Delays and Cost Increases Are Likely to Worsen Due to Risks Late in Construction

The *Columbia* class program has experienced persistent design and construction challenges that have contributed to schedule delays and cost growth. These delays and increases will likely worsen due to risks that are expected to be realized when completing complex tasks during final assembly and test. This could hinder the Navy's ability to mitigate current delays and cost increases and its ability to stem future ones.

Persistent Schedule Delays

In April 2024, a Navy review found that at current levels of construction performance, the lead *Columbia* class submarine would be delivered an estimated 12 to 16 months after the current contract delivery date. This would result in delivery in October 2028 at the earliest, or a total construction duration of 96 months. We have consistently reported how design and construction performance has eroded the program's schedule margin, giving the shipbuilders less time to accommodate future problems.[19] Still, program officials maintain that if the shipbuilders immediately and aggressively address some of the systemic issues we have reported—including work instruction problems, an inexperienced workforce, and late materials—they can deliver the lead submarine in October 2027. As construction progresses, however, the window of opportunity when the program can mitigate challenges to limit schedule delays shrinks further.

Halfway through planned construction of the lead submarine, problems with work instruction issuance and material availability that we have previously reported on persist.[20] As of October 2023, the shipbuilder reported that work instruction issuance rates and material availability continued to lag behind plans. Although there have been attempted mitigations, these challenges continue to contribute to problems with schedule performance on the lead submarine's super modules. For example, SUPSHIP Groton officials stated that late deliveries from suppliers and shipyard manufacturing centers have caused problems with material availability. When items are not available as planned, the shipbuilders must modify the schedule to accommodate delays. If work instruction and material availability issues continue, they could have negative ripple effects on construction of the second and follow-on submarines.

Significant Cost Growth

Our independent analysis calculated likely cost overruns that are more than six times higher than Electric Boat's estimates and almost five times more than the Navy's. As a result, the government could be responsible for hundreds of millions of dollars in additional construction costs for the lead submarine.

[19]Margin, or a reserve of extra time also referred to as contingency, accounts for known and unknown risks and uncertainty in the schedule. See GAO, *Schedule Assessment Guide: Best Practices for Project Schedules*, GAO-16-89G (Washington, D.C.: Dec. 22, 2015).

[20]GAO-21-257.

Slow work instruction issuance, poor work instruction quality, and lower than planned material availability have consistently contributed to lead submarine cost growth to date. For example, we have previously reported that when Electric Boat added more staff to help develop design products, like work instructions, the program's design costs would increase.[21] In addition, Electric Boat previously reported that material availability is key to avoiding cost increases. Delays in the availability of relatively simple commodities can cause major delays resulting in cost increases.

Risks to Lead Submarine Construction

The *Columbia* class program faces significant risks with compressed final assembly and test, concurrency, and continued poor construction performance.

- **Compressed final assembly and test.** The program's accelerated schedule attempted to reduce risk by having the shipbuilders deliver the super modules earlier than previously planned, according to Navy officials. As a result, Electric Boat expected to have more time to resolve any issues that it discovered during final assembly and test—a complex phase of construction when the shipbuilder will have to manage hull and system integration issues and problems identified during testing. However, since July 2022, the projected delivery of all super modules has been delayed. A shipbuilder representative stated that plans to deliver some super modules in close succession could slow their follow-on integration and testing work. As a result, the program will have less time than planned to identify and resolve problems, increasing the risk of additional delays to delivery.
- **Increased concurrency.** As of October 2023, the shipbuilders were completing the replanning of parts of the super modules' schedules. The replans would increase the number of activities being conducted concurrently at the shipbuilder during final assembly and test. High levels of concurrent work strains resources and can complicate the Navy and shipbuilder's identification of the critical path—the sequence of events that determines the minimum time needed to deliver the submarine.
- **Poor historical performance.** According to our analysis of program data from January 2022 through May 2023, cost and schedule performance for lead submarine construction has consistently fallen short of targets. Through early 2024, those trends had not improved.

According to our cost guide, studies of more than 700 defense programs have shown that, at this point in construction, there is limited opportunity for getting back on track.[22] To recover from existing schedule delays, the shipbuilders would need to perform at levels of efficiency they have yet to demonstrate. Lead submarine cost performance is also unlikely to improve—and if additional risks are realized, costs could grow further. Our cost guide also states that once a program is 20 percent complete, the cumulative cost performance does not vary much from its current value. To the extent that cost performance does vary, however, it most often tends to get worse as the project nears completion. As of November 2023, construction of the lead submarine was 40 percent complete. Our previous shipbuilding work has also shown that the full extent of cost growth does

[21]GAO, *Columbia Class Submarine: Overly Optimistic Cost Estimate Will Likely Lead to Budget Increases*, GAO-19-497 (Washington, D.C.: Apr. 8, 2019).

[22]GAO-20-195G.

not manifest itself until a ship is more than 60 percent complete, when key systems are installed and integrated.[23]

The delays to the lead submarine's schedule put its planned first patrol date in late 2030 at increased risk. Navy officials stated that the service has started planning to extend the service life of up to five *Ohio* class submarines in case *Columbia* class submarines are not available for operations as planned. Additional planned maintenance would extend these five *Ohio* class submarines' service life by 36 months—from 45 years to 48 years—to mitigate potential nuclear strategic deterrence gaps.

Inadequate Shipbuilder Analysis Constrains Program's Ability to Mitigate Future Cost and Schedule Problems

We found that Electric Boat's cost and schedule estimates and analysis are inadequate and constrain the program's ability to mitigate future problems. Compared with Navy and DOD EVM guidance and our best practices, some of the shipbuilder's estimates do not adequately incorporate risk factors or reflect past performance. Further, shipbuilder reporting does not include detailed analysis of variance—deviations from the baseline plan. The shortcomings that we identified hinder an effective understanding of program risk and performance that would better enable the program to mitigate future cost and schedule problems.

According to contract reporting requirements, the shipbuilder must provide the most accurate EACs possible, to include consideration of known and anticipated risks.[24] However, despite worse than planned lead submarine construction performance to date, Electric Boat's EAC assumes a dramatic performance improvement instead of more likely performance levels informed by historical trends. Our analysis of data from January 2022 through May 2023 showed that the shipbuilder was performing very inefficiently in cost compared with its baseline. Despite this historical performance, the shipbuilder assumed it will perform significantly better going forward. Without adequately accounting for past performance, the EAC may not accurately forecast total cost of work required to complete the submarines.

We also found insufficient analysis of cost and schedule variance in program reporting. While reporting identified significant cost and schedule variances, it did not sufficiently identify root cause, assess potential impacts, or develop planned corrective actions. For example, in cases where the reporting documented schedule variances, it lacked important information, such as the status of specific activities, milestones, and other critical events. Additionally, none of the reporting discussed the effects of cost and schedule variance on the program, including potential increases to the EAC and the ability to achieve contractual milestones, like delivery. DOD's EVM Implementation Guide emphasizes the importance of identifying the effects of significant variances on immediate tasks, downstream milestones, and the total contract.[25] Detailed variance analysis

[23]GAO, *Defense Acquisitions: Realistic Business Cases Needed to Execute Navy Shipbuilding Programs*, GAO-07-943T (Washington, D.C.: July 24, 2007).

[24]Department of Defense, Office of the Under Secretary of Defense for Acquisition and Sustainment, *Integrated Program Management Report*, DI-MGMT-81861A (Sept. 16, 2015).

[25]Department of Defense, Office of the Under Secretary of Defense for Acquisition and Sustainment, *Department of Defense Earned Value Management Implementation Guide (EVMIG)* (Jan. 18, 2019). See also Department of the Navy, *Earned Value Management Implementation Guide* (Aug. 8, 2017).

offers valuable insights into progress and accomplishment of schedule milestones and tasks as well as potential delays that may affect the critical path and EAC.

SUPSHIP Groton officials stated that Electric Boat's current reporting methods are sufficient for them to understand the immediate causes of data variances. They also stated that the SUPSHIP offices and the program address issues and root causes through routine discussions with shipbuilder representatives, including during monthly briefings. However, SUPSHIP Groton has identified similar types of EVM reporting issues, including variances, as those we identified above since at least 2021. The number and size of these variances can affect the accuracy of the shipbuilder's EAC because they over- or underestimate performance.

Without realistic estimates that reflect past performance and analysis that better identifies the sources and impacts of cost and schedule variance, the program cannot effectively use projected cost and schedule information to inform decisions to mitigate future problems. As a result, the program may not be identifying or implementing efforts that would best slow ongoing cost growth and schedule delays as well as potentially avoid construction challenges. Moreover, budget requests based on unrealistic EACs may not fully reflect the funding needed to complete the program, and additional costs to complete construction will increase costs to the government. If the Navy fails to plan for realistic cost overruns, this could ultimately slow *Columbia* class submarine development, production, and entry into the fleet for operations.

Program Has Not Sufficiently Ensured That Actions to Address Construction Challenges Are Supporting Production or Quality Goals

The Navy and shipbuilders have taken actions intended to address construction challenges by increasing awards of SDF and outsourcing work to strategic suppliers. However, the program has not sufficiently ensured that supplier investments support construction goals or that outsourced work meets quality expectations. Specifically, the program has yet to consistently identify the information it needs to determine whether suppliers that receive SDF awards are demonstrating intended production improvements or cost savings. Further, despite the rapid growth of outsourced work, the cognizant SUPSHIP offices are not currently well positioned to conduct quality assurance oversight at strategic suppliers.

Some Investments Have Enhanced Production, but the Program Does Not Consistently Identify Improvement Information

The Navy and shipbuilders have awarded SDF to help achieve *Columbia* class construction goals by increasing some suppliers' production capabilities and capacity. According to the Navy and shipbuilders, some suppliers are required to report on projects' expected return on investment and benefits using various metrics. However, the program has not consistently identified the production improvements or cost savings information that it needs to sufficiently determine whether SDF outcomes support *Columbia* class construction goals.

Reported SDF funding and budget requests—some of which is not included in the *Columbia* program's total costs—have grown over the last few years. Total annual SDF the Navy has reported receiving increased from $225 million in fiscal year 2018 to more than $450 million in fiscal year 2023. Moreover, the Navy has reported

receiving nearly $1 billion in SDF in fiscal year 2024.[26] See table 1 for a summary of SDF amounts the Navy reported receiving in past years and has requested for fiscal year 2025.

Table 1: Navy Reported Supplier Development Funding (SDF) for 2018 to 2024 and Requested Funding for 2025 (by Fiscal Year)

Dollars in millions

	2018	2019	2020	2021	2022	2023	2024	2025
Supplier development[a]	0.0	0.0	0.0	0.0	0.0	280.0	189.0[b]	726.0
Supplier projects	0.0	127.3	145.4	101.4	145.0	0.0	0.0	0.0
Specialized purchases	225.0	97.7	81.2	93.1	181.0	172.6	801.2	536.6
Total funding	225.0	225.0	226.6	194.5	326.0	452.6	990.2	1,262.6

Source: GAO analysis of *Columbia* class program budget information and Navy documentation. | GAO-24-107732

Note: From fiscal years 2018 through 2022, the Navy received most SDF over and above the Navy's budget request.

[a]In fiscal years 2018 through 2022, the Navy and Department of Defense requested and received SDF for supplier projects (also referred to as direct investments) and specialized purchases. Beginning in fiscal year 2023, the Navy and Department of Defense began requesting amounts for supplier development within a larger category of funding for the submarine industrial base, in addition to specialized purchases as reflected in the annual budget request. The Navy has requested SDF as part of submarine industrial base funding through *Columbia* class advance procurement and *Virginia* class procurement.

[b]Fiscal year 2024 funding does not include additional amounts the Navy planned to use for supplier development if funding was made available following the President's 2023 emergency supplemental request. According to Navy documentation, if emergency supplemental funding were provided, the Navy planned on using $502 million for supplier development. Subsequently, the Indo-Pacific Security Supplemental Appropriations Act, 2024, was enacted. Pub. L. No. 118-50, div. C.

As of December 2023, the program reported that 193 suppliers had received SDF awards. The awards have supported projects to expand production capabilities and capacity and to develop alternate suppliers. The awards also supported preparations at selected suppliers to take on outsourced work from the shipbuilders. Suppliers have used SDF to purchase new equipment, improve facilities, implement training, and acquire new production capabilities. For example:

- One supplier used SDF to purchase equipment, including new cranes to lift heavier items. Before these purchases, the supplier could only produce items weighing 5 to 10 tons, but it can now produce 150-ton items. Supplier representatives stated that the increased capability helps the supplier produce large structures that form parts of *Columbia* class modules.
- Another supplier used SDF to support training, purchase new equipment and tooling, and improve facilities. The supplier's purchases included welding machines, storage, cable management, and rigging needed to execute *Columbia* class module decks and outfitting.

The Navy and shipbuilders have yet to consistently define the information they need to determine whether SDF investments have resulted in production improvements or cost savings that support *Columbia* class construction goals. According to the Standards for Internal Control in the Federal Government, management should define the information, such as operational information, that it needs to achieve its objectives and

[26]This does not include additional amounts the Navy planned for supplier development in fiscal year 2024 if funding was made available following the President's emergency supplemental funding request submitted in October 2023. Congress subsequently appropriated nearly $2.5 billion in additional procurement funding to support improvements to the submarine industrial base and for related expenses in April 2024. Indo-Pacific Security Supplemental Appropriations Act, 2024, Pub. L. No. 118-50, div. C.

address related risks. Management should collect this information from relevant and reliable sources on a timely basis.[27]

According to the shipbuilders, suppliers have sometimes agreed to a return on investment that will be measured at the end of each project. These metrics, however, have varied. For recent awards, BlueForge Alliance officials stated that they work with the suppliers and shipbuilders to define one or two types of specific metrics for each project, such as for capacity, quality, and capability. For example, they told us that metrics could include an increase in the production rate of specific items or a reduction in the time between when the shipbuilder orders and takes delivery of an item. While the shipbuilders may consider anticipated benefits when reviewing SDF proposals, they have not always defined the information needed to sufficiently understand these benefits.

Program officials stated that they are still in the process of identifying what metrics would best help them determine whether SDF investments are helping to support *Columbia* class construction goals. Navy officials stated that it sometimes takes years—typically longer than it takes to complete SDF projects—for suppliers to fully realize production improvements and cost savings. They added that this can result from the time needed for suppliers to acquire and qualify new machinery, among other reasons. Further, shipbuilder representatives also told us that it is difficult to measure suppliers' short-term production improvements resulting from SDF investments. Specifically, Newport News representatives stated that it is difficult to quantify short-term return on investment for SDF projects, and they do not have information on such short-term outcomes.

Suppliers that are ultimately unable to demonstrate production improvements or cost savings despite receiving large amounts of SDF will not help mitigate *Columbia* class construction risks. Some suppliers have struggled to achieve expected production improvements in the years after receiving SDF. For example:

- One supplier received SDF beginning in fiscal year 2019 to purchase fabrication equipment that would allow the supplier to perform more operations internally instead of relying on vendors. The Navy and Newport News expected to increase the supplier's production rate by more than 35 percent. Four years later, however, the supplier was not ready to meet future construction demand.
- Starting in fiscal year 2019, a supplier received SDF, in large part, to develop a new facility to fabricate large components. The Navy and Electric Boat expected to add capacity and capability for large structural fabrication and to train and certify personnel for welding. According to supplier representatives and the Navy, a combination of staffing challenges and quality defects, including deficiencies caused by welding problems, have caused persistent delays to deliveries.

Without consistently identifying the information needed to determine whether suppliers have achieved production improvements or cost savings, the Navy and shipbuilders are not well positioned to ensure that future SDF investments will effectively spur their intended benefits for the *Columbia* class program. Determining progress towards specific metrics could also help ensure that the Navy and shipbuilders pursue courses of action that effectively support *Columbia* class construction goals as well as overall industrial base demand.

[27]GAO, *Standards for Internal Control in the Federal Government*, GAO-14-704G (Washington, D.C.: Sept. 10, 2014).

We have ongoing work looking more broadly at how the Navy tracks and assesses its investments in the shipbuilding industrial base.

SUPSHIP Is Not Well Positioned to Conduct Quality Assurance Oversight of Outsourced Work

SUPSHIPs Groton and Newport News are not well positioned to conduct the quality assurance oversight needed to monitor the significant amount of *Columbia* class work that the shipbuilders are outsourcing. While the SUPSHIP offices and SUPSHIP Management have taken steps to request additional funding and increase staffing, peak levels of outsourcing are already straining available resources. Moreover, as Electric Boat considers additional changes to the amount of work it is outsourcing, SUPSHIP offices may continue to face challenges monitoring quality assurance oversight.

As *Columbia* class construction increased from 2020 through 2023, the shipbuilders—primarily Electric Boat—significantly ramped up the amount of work they were outsourcing. Since 2021, Electric Boat has also substantially increased the amount of total submarine work—for *Columbia* class and *Virginia* class—that it plans to outsource through 2026. This increase may require Electric Boat to identify additional components to outsource and strategic suppliers to conduct the work.

The SUPSHIP Operations Manual states that the SUPSHIP offices must develop and implement risk-based oversight plans that focus on shipbuilding activities posing the greatest risk to program cost, schedule, and performance.[28] The SUPSHIP offices' quality assurance planning must also identify the most effective use of quality assurance resources. Further, the SUPSHIP offices must ensure that staffing needs accurately reflect quality assurance requirements. According to SUPSHIP Management leadership, outsourcing is a significant challenge to quality assurance because the construction work takes place at facilities where SUPSHIPs Groton and Newport News do not have a permanent presence.

SUPSHIP Groton officials stated that, in general, they prioritize the oversight of high-risk work, such as the production of items critical to submarine safety. However, SUPSHIP Groton does not have a full-time presence at strategic suppliers taking on that type of work. According to SUPSHIP Groton officials, planning and staffing to adequately supervise construction at multiple sites has been a challenge, and SUPSHIP Groton is still determining the resources needed for oversight of outsourced work. According to the program, oversight by SUPSHIP office staff at supplier locations is an expansion of SUPSHIP's mission, and the associated labor hours and travel have not previously been accounted for in SUPSHIP's budget.

For fiscal years 2023 through 2028, the Navy added $16 million to its planned budget requests for increased SUPSHIP office oversight, including more staffing to help ramp up oversight of supplier capability, capacity, and quality. As of April 2024, the Navy planned to set aside $2 million for government oversight if emergency supplemental funding was provided in fiscal year 2024. The program's fiscal year 2025 budget request included an additional $4 million for this purpose. Nevertheless, the funding may not keep pace with planned outsourcing. We previously reported that the Navy completed an assessment of its supply chain oversight approach and quality assurance for outsourcing for nuclear shipbuilding in 2021. The Navy then conducted

[28]Department of the Navy, Naval Sea Systems Command, *Supervisor of Shipbuilding, Conversion, and Repair Operations Manual*, S0300-B2-MAN-010 Revision 3 (Washington, D.C.: Dec. 1, 2023).

additional planning with DOD for more resources in 2021 and 2022.[29] As described above, Electric Boat has conducted significantly more outsourcing than previously expected. As a result, the additional funding planned through fiscal year 2027 for SUPSHIP oversight and staffing may not be in line with actual increases in outsourcing.

The Navy assessed the need for additional full-time equivalents at SUPSHIPs Groton and Newport News to execute oversight of the submarine supplier base. SUPSHIP Management officials stated that SUPSHIPs Groton and Newport News increased each of their staffs in fiscal year 2023 and plan to increase staffing for supplier oversight through 2027. SUPSHIP Gulf Coast also plans to increase its staffing to conduct supplier oversight. Still, high levels of outsourcing are likely to continue to strain quality assurance staffing in the near future. According to SUPSHIP officials, one office's new strategic outsourcing branch had yet to be fully staffed, and another office's quality assurance department was still establishing and refining roles and responsibilities and updating its staffing models.

SUPSHIP Groton has also started to coordinate quality assurance oversight with another SUPSHIP office, and both SUPSHIPs Groton and Newport News plan to coordinate with the Defense Contract Management Agency (DCMA).[30] According to Navy officials, however, SUPSHIPs Groton and Newport News will still supplement the oversight activities that they are delegating to SUPSHIP Gulf Coast and DCMA where there are gaps in capabilities, certifications, or training. For example, SUPSHIP Groton personnel will still conduct certain types of inspections when they involve selected materials and components.

While outsourcing has significantly increased over the last 3 years, SUPSHIP office resources and staffing have not kept pace, leaving it challenged to provide effective quality assurance oversight at strategic suppliers. Arrangements with other oversight offices and agencies are limited, and Electric Boat continues to make changes to its outsourcing plans. These changes, in turn, could further affect the steps that SUPSHIP is planning to take to ensure the shipbuilders are adequately monitoring supplier quality performance at outsourcing locations.

SUPSHIP Groton officials stated that they have yet to develop a final plan for quality assurance oversight at strategic suppliers because Electric Boat is still deciding where outsourced work will be executed. We have also previously reported that the total annual hours that Electric Boat planned to outsource has changed over time.[31] Moreover, Electric Boat has not updated its formal outsourcing plan since 2021. Instead, Electric Boat now maintains a quarterly working plan. However, without more specific information in these plans, for example about where the shipbuilders plan to outsource work and how the number of outsourced hours will change in the coming years, SUPSHIP Groton and SUPSHIP Management cannot appropriately plan for quality assurance oversight.

[29]GAO, *Navy Shipbuilding: Increasing Supervisors of Shipbuilding Responsibility Could Help Improve Program Outcomes*, GAO-22-104655 (Washington, D.C.: Apr. 12, 2022).

[30]DCMA conducts quality assurance oversight activities for Navy programs when SUPSHIP and the contracting office delegate the responsibility for oversight at the supplier level, including government source inspections of supplier processes and products to ensure they meet contract requirements. See Federal Acquisition Regulation 46.401-402; GAO-21-257.

[31]GAO-21-257.

Conclusions

Without improvements to current construction performance, the Navy estimates the lead *Columbia* class submarine will be delivered at least 1 year after the current contract delivery date. The program will need to demonstrate unprecedented levels of performance to overcome persistent challenges and recover from existing schedule and cost growth while confronting, at this point in construction, risks that threaten to cause additional delays and overruns that materialize through delivery. Successfully mitigating the causes of poor *Columbia* class construction performance—many of which are long-standing—will be difficult. If the *Columbia* class program does not effectively learn from its performance problems to date, future mitigation efforts will likely require more funding and significant replanning. Delays to the delivery of *Columbia* class submarines will affect how the nation plans to meet its nuclear deterrence requirements, a national security imperative. In addition, cost growth on this priority program, absent additional funding, could force critical trade-offs for the Navy's planned fleet.

While the Navy has started to assess the implications of late *Columbia* class deliveries, it is doing so without a complete picture of the lead submarine's costs or progress. A realistic EAC that more closely reflects historical trends and thorough analysis of key elements of cost and schedule variance would better position the program to anticipate funding needs and respond to challenges in the future. These actions will take on increasing importance as the program progresses, since risks towards the end of construction will likely add to existing schedule delays, making the lead submarine's aggressive delivery date even less achievable.

Moreover, if the Navy and the shipbuilders do not better address ongoing production and quality issues in the submarine supplier base, they cannot sufficiently ensure that that the billions of dollars the Navy is investing in this area will adequately mitigate *Columbia* class construction problems. Defining the information that the program needs to determine whether suppliers receiving SDF are achieving increased production or cost savings would help the Navy decide whether to pursue other courses of action to meet *Columbia* class construction goals. Updated planning for outsourcing and the corresponding quality assurance oversight at strategic suppliers, including more SUPSHIP oversight staffing, would also help ensure that those products are delivered without defects, saving valuable time and resources.

Recommendations for Executive Action

We are making the following five recommendations to the Department of the Navy:

The Secretary of the Navy should ensure that the Deputy Commander for SUPSHIP has Electric Boat revise its cost estimate at completion to incorporate all remaining identified program risks and reflect likely levels of program performance based on historical trends. (Recommendation 1)

The Secretary of the Navy should ensure that the Deputy Commander for SUPSHIP, in conjunction with the *Columbia* class submarine program office, has Electric Boat produce EVM reporting that includes key elements of variance analysis needed to better address future risks, such as an explanation of root cause, impacts to cost and schedule, and corrective actions. (Recommendation 2)

The Secretary of the Navy should ensure that the *Columbia* class submarine program, in conjunction with Electric Boat and Newport News, consistently identifies the information needed to determine whether

production improvements and cost savings from supplier development funding are sufficiently supporting *Columbia* class construction goals. (Recommendation 3)

The Secretary of the Navy should ensure that the Deputy Commander for SUPSHIP has the SUPSHIPs Groton and Newport News update planning to ensure they have adequate resources and staffing needed to conduct quality assurance oversight of outsourced work at Electric Boat and Newport News strategic supplier facilities. (Recommendation 4)

The Secretary of the Navy should ensure that the *Columbia* class submarine program, in conjunction with the Deputy Commander for SUPSHIP, has Electric Boat update planning for submarine outsourcing, including expected hours and locations of outsourced work, to help SUPSHIP identify quality assurance oversight risks and request necessary resources. (Recommendation 5)

Agency Comments

We provided a draft of the sensitive version of this report to DOD for review and comment in April 2024. Its response to the sensitive report, provided in July 2024, is reprinted in appendix III. DOD concurred with the recommendations and cited actions that it will take to address them. DOD also provided technical comments, which we incorporated as appropriate.

We are providing copies of this report to the appropriate congressional committees, the Secretary of the Navy, the Secretary of Defense, and other interested parties. In addition, the report is available at no charge on the GAO website at http://www.gao.gov.

Should you or your staff have questions, please contact me 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 report. GAO staff who made key contributions to this report are listed in appendix IV.

Shelby S. Oakley
Director, Contracting and National Security Acquisitions

List of Committees

The Honorable Jack Reed
Chairman
The Honorable Roger Wicker
Ranking Member
Committee on Armed Services
United States Senate

The Honorable Jon Tester
Chair
The Honorable Susan Collins
Ranking Member
Subcommittee on Defense
Committee on Appropriations
United States Senate

The Honorable Mike Rogers
Chairman
The Honorable Adam Smith
Ranking Member
Committee on Armed Services
House of Representatives

The Honorable Ken Calvert
Chairman
The Honorable Betty McCollum
Ranking Member
Subcommittee on Defense
Committee on Appropriations
House of Representatives

Appendix I: Objectives, Scope, and Methodology

This report assesses the *Columbia* class submarine program. Specifically, we assessed (1) the extent to which the *Columbia* class submarines are on track to meet cost and schedule targets and how risks could affect construction progress; and (2) the extent to which the Navy's and shipbuilders' actions regarding the *Columbia* class supplier base are helping to achieve construction goals and mitigate risks.

This report is a public version of a sensitive report that we issued in July 2024. The Department of Defense (DOD) deemed some of the information in our July 2024 report to be sensitive, which must be protected from public disclosure. Therefore, this report omits sensitive information about the program's efforts to assess and address construction challenges, *Columbia* class supplier performance and supplier development funding (SDF) investments, and Navy oversight of the supplier base. Although the information is more limited, the report addresses the same objectives as the sensitive report and uses the same methodology.

To assess the extent to which *Columbia* class submarines are on track to meet cost and schedule targets and the extent to which risks could affect construction progress, we reviewed Navy and shipbuilder documents, including program briefings, schedules, contract documents, and management reports. The reports we reviewed included Integrated Program Management Reports, integrated baseline reviews, annual budget requests and briefings, business systems surveillance reports, and quarterly construction cost and schedule metrics.[1] To gain further context about the status of the construction effort, associated challenges, and future risks to the program's cost and schedule, we visited shipbuilder facilities and observed construction efforts at General Dynamics Electric Boat (Electric Boat) at Groton, Connecticut and Quonset Point, Rhode Island as well as Huntington Ingalls Industries Newport News Shipbuilding (Newport News) at Newport News, Virginia.

We also assessed the documentation and Navy and shipbuilder processes against best practices in the GAO cost guide associated with comprehensive, accurate, and informative earned value management (EVM).[2] Specifically, we analyzed shipbuilder data and reporting from January 2022 through May 2023 using generally accepted formulas printed in our cost guide to determine progress towards program completion and to show trends in cost and schedule performance. Ranges in the estimates at completion (EAC) are driven by using different efficiency indexes based on the program's past cost and schedule performance to forecast the cost of the remaining work and adding that cost to the actual costs to date.[3] To assess the cost data, we electronically tested the data for significant variances and anomalies and reviewed relevant documentation.

[1]The Integrated Program Management Report is a critical tool for DOD program management, providing comprehensive insights into the progress and performance of major defense acquisition programs, including the cost, schedule, and performance status. It serves as a primary means of communicating the program's status between contractors and the government, facilitating effective oversight, decision-making, and risk management.

[2]GAO, *Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Program Costs*, GAO-20-195G (Washington, D.C.: Mar. 20, 2020).

[3]Our total cost performance index and EAC analyses are based on total contract cost. We included management reserve—funds intended to account for "known unknowns" in a contract's scope—in the analyses because the *Columbia* class program has consistently had in-scope, unplanned work requiring the use of management reserve funds. Future in-scope, unplanned work is expected to use the remainder of the management reserve funds at a similar cost efficiency.

We provided the Navy with a draft version of our detailed analysis of the *Columbia* class program's EVM so that officials could verify the information on which we based our findings. The Navy provided additional information in response to our analysis, which we incorporated as appropriate. We determined that the EVM information that we assessed was sufficiently reliable for the purposes of our reporting.

To assess actions that the Navy and shipbuilders have taken in the *Columbia* class supplier base to help achieve construction goals and the extent to which the Navy's and shipbuilder's actions with regard to the supplier base are mitigating risks, we reviewed Navy, shipbuilder, and DOD information related to submarine supplier base investments and outsourcing. The documents that we reviewed included SDF agreement documentation provided by the Navy, *Columbia* class program supplier briefings, Submarine Industrial Base program reports, and the shipbuilders' contract reporting and strategic enterprise planning. We compared Navy and shipbuilder actions against federal standards for internal controls related to the use of quality information and the Supervisors of Shipbuilding, Conversion, and Repair (SUPSHIP) Operations Manual.

We also reviewed program and shipbuilder reporting to identify SDF awards made to critical suppliers from fiscal years 2018 to 2020 that totaled $1 million or more and examined the shipbuilders' evaluations of critical suppliers that received these awards over subsequent years to assess changes in supplier performance. In addition, we reviewed program and Navy documentation to evaluate the growth of outsourcing work at suppliers and SUPSHIP's plans for conducting quality assurance oversight at supplier facilities. We also met with representatives from BlueForge Alliance and four strategic suppliers and visited one of those supplier's facilities. We selected the strategic suppliers because all four had received SDF and three of them had implemented Electric Boat's Focus Factory model.

To obtain additional information for both objectives, we met with Navy officials from the *Columbia* class submarine program office; Navy Strategic Systems Programs; Naval Sea Systems Command SUPSHIP Management, SUPSHIP Groton, and SUPSHIP Newport News; Naval Reactors; Submarine Industrial Base program; and the Office of the Chief of Naval Operations, Undersea Warfare Division. We met with DOD officials from the office of Cost Assessment and Program Evaluation and obtained information from the office of the Director, Operational Test and Evaluation and Office of the Undersecretary of Defense for Acquisition and Sustainment. We also met with shipbuilder representatives from Electric Boat and Newport News to discuss construction progress and risks, EVM practices and reporting, and actions in the supplier base.

We conducted this performance audit from January 2023 to July 2024 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.

We worked with DOD from June 2024 to September 2024 to prepare this unclassified version of the original sensitive report for public release. This public version was also prepared in accordance with these standards.

Appendix II: Supplier Development Funding

Since fiscal year 2018, the Navy has received supplier development funding (SDF) to support second- and third-tier suppliers in the submarine industrial base and ensure they have the capability and capacity to support increased construction demand. In general, the Navy has divided its use of SDF into two categories:

1. Direct investments in suppliers: funding awarded to suppliers to address validated shortfalls in their facilities, machinery, and skilled workers to reduce risk;[1] and
2. Specialized purchases to signal demand: purchases of materials designed to help the supplier base better predict and manage their work and optimize use of their facilities.[2]

According to Navy documentation, suppliers have used direct investments to purchase equipment, improve facilities, and conduct training. The shipbuilders have also awarded SDF to develop alternative suppliers to reduce risks from single- and sole-source suppliers.

In contrast to direct investments in suppliers that the Navy has used to target risks faced by individual suppliers, purchases to signal demand are intended to assist the supplier base writ large by assuring that demand for materials is consistent. Through expanded acquisition authorities, the Navy has used special purchases to send a steady demand signal and pursue potential cost savings through the following types of specialized purchases:[3]

- Continuous production funding is intended to help avoid supplier challenges caused by gaps in demand, including problems related to staffing and year-to-year spikes in funding. Shipbuilder documentation identifies ideal products for continuous production as being high value, manufactured in large quantities, and critical to maintaining the construction schedule. These products include spherical air flasks, hull valves, and items for outfitting missile tubes.
- Multi-program material purchases are intended to stabilize demand by coordinating purchases across shipbuilding programs when they use the same suppliers. By leveraging the combined production volume required for common items for submarine and aircraft carrier construction, the shipbuilders planned to engage in joint negotiations and coordinate purchases with suppliers. Items include pipe fittings and fasteners.
- Production back-up units are a subset of multi-program material purchase components that require long-lead production times and materials that need to be procured early and kept in reserve to reduce schedule risk. These early purchases are meant to ensure that materials are available when needed.

[1]Beginning in fiscal year 2023, the Navy and Department of Defense began requesting amounts for supplier development direct investments within a larger category of funding for the submarine industrial base. We have not included other elements of the submarine industrial base category in our reporting.

[2]In fiscal years 2018 through 2022, the Navy referred to this category of supplier development as material purchases. Although the Navy continues to make these types of purchases, the Navy stopped categorizing SDF in this way in fiscal year 2023.

[3]See 10 U.S.C. § 2218a (establishing and governing the use of the National Sea-Based Deterrence Fund).

Appendix III: Comments from the Department of Defense

The Department of Defense provided comments on a sensitive version of this report, which are reprinted below.

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
3600 DEFENSE PENTAGON
WASHINGTON, DC 20301-3600

ACQUISITION

JUL 11 2024

Ms. Shelby Oakley
Director, Contracting and National Security Acquisitions
U.S. Government Accountability Office
441 G Street, N.W.
Washington, DC 20548

Dear Ms. Oakley:

This is the Department of Defense (DoD) response to the Government Accountability Office (GAO) Draft Report GAO-24-106555SU, "COLUMBIA CLASS SUBMARINE: Overcoming Persistent Challenges Requires Yet Undemonstrated Performance and Better-Informed Supplier Investments," dated April 2024 (GAO Code 106555).

The Department has completed the security review and finds the Draft Report cleared for public release pending removal of DoD Controlled Unclassified Information, as marked, by the GAO prior to release. Additionally, within the Draft Report, the GAO provided five recommendations to the DoD. The Department concurs with the recommendations and detailed responses to each recommendation are enclosed.

The Department appreciates the opportunity to comment on the draft report. For further questions concerning this matter, please contact Ms. Sorahi Azarbarzin at 703-614-6485 or via email at sorahi.a.azarbarzin.civ@mail.mil.

Sincerely,

Gary A. Ashworth
Performing the Duties of the Assistant Secretary
of Defense for Acquisition

Enclosures:
As stated

GAO DRAFT REPORT DATED APRIL 25, 2024
GAO-24-106555SU (GAO CODE 106555)

"COLUMBIA CLASS SUBMARINE: OVERCOMING PERSISTENT CHALLENGES REQUIRES YET UNDEMONSTRATED PERFORMANCE AND BETTER-INFORMED SUPPLIER INVESTMENTS"

DEPARTMENT OF DEFENSE COMMENTS
TO THE GAO RECOMMENDATION

RECOMMENDATION 1: The Secretary of the Navy should ensure that the Deputy Commander for Supervisor of Shipbuilding, Conversion and Repair (SUPSHIP) has Electric Boat revise its cost estimate at completion to incorporate all remaining identified program risks and reflect likely levels of program performance based on historical trends.

DoD RESPONSE: Concur. The Columbia class submarine program office will ensure the cost estimate at completion incorporates all remaining identified program risks and reflect likely levels of program performance based on historical trends. The Deputy Commander for SUPSHIP will ensure that SUPSHIP Groton continues to independently develop cost estimates at completion that incorporate all remaining identified program risks and reflect likely levels of program performance based on historical trends.

RECOMMENDATION 2: The Secretary of the Navy should ensure that the Deputy Commander for SUPSHIP, in conjunction with the Columbia class submarine program office, has Electric Boat produce Earned Value Management (EVM) reporting that includes key elements of variance analysis needed to better address future risks, such as an explanation of root cause, impacts to cost and schedule, and corrective actions.

DoD RESPONSE: Concur. The Deputy Commander for SUPSHIP/SUPSHIP Groton, in conjunction with the Columbia class submarine program office, will continue to work with Electric Boat to develop improved EVM reporting that includes explanations and root causes.

RECOMMENDATION 3: The Secretary of the Navy should ensure that the Columbia class submarine program, in conjunction with Electric Boat and Newport News, consistently identifies the information needed to determine whether production improvements and cost savings from supplier development funding are sufficiently supporting Columbia class construction goals.

DoD RESPONSE: Concur. The Columbia class submarine program will work with both prime submarine shipyards as well as other stakeholders and activities to ensure supplier development funding contracts continue to require recipients to provide specific targets for cost savings, cost avoidance, and/or performance improvement as part of the proposal phase, and report realized results following project completion to support analysis of return on investment (ROI) and project impact.

RECOMMENDATION 4: The Secretary of the Navy should ensure that the Deputy Commander for SUPSHIP has SUPSHIPs Groton and Newport News update planning to ensure they have the adequate resources and staffing needed to conduct quality assurance oversight of outsourced work at Electric Boat and Newport News strategic supplier facilities.

DoD RESPONSE: Concur. The Deputy Commander for SUPSHIP will ensure SUPSHIPs Groton and Newport News update planning to ensure they have the adequate resources and staffing needed to conduct quality assurance oversight of outsourced work at Electric Boat and Newport News strategic supplier facilities.

RECOMMENDATION 5: The Secretary of the Navy should ensure that the Columbia class submarine program, in conjunction with the Deputy Commander for SUPSHIP, has Electric Boat update planning for submarine outsourcing, including expected hours and locations of outsourced work, to help SUPSHIP identify quality assurance oversight risks and request necessary resources.

DoD RESPONSE: Concur. TEAM SUBMARINE, the overarching organization for the Columbia class submarine program, in coordination with Deputy Commander SUPSHIP and Electric Boat, will continue quarterly updates to the outsourcing plan, including expected hours and locations of outsourced work, to help SUPSHIP identify quality assurance oversight risks and request necessary resources.

Accessible Text for Appendix III: Comments from the Department of Defense

JUL 11 2024

Ms. Shelby Oakley
Director, Contracting and National Security Acquisitions
U.S. Government Accountability Office 441 G Street, N.W.
Washington, DC 20548

Dear Ms. Oakley:

This is the Department of Defense (DoD) response to the Government Accountability Office (GAO) Draft Report GAO-24-106555SU, “COLUMBIA CLASS SUBMARINE: Overcoming Persistent Challenges Requires Yet Undemonstrated Performance and Better-Informed Supplier Investments,” dated April 2024 (GAO Code 106555).

The Department has completed the security review and finds the Draft Report cleared for public release pending removal of DoD Controlled Unclassified Information, as marked, by the GAO prior to release. Additionally, within the Draft Report, the GAO provided five recommendations to the DoD. The Department concurs with the recommendations and detailed responses to each recommendation are enclosed.

The Department appreciates the opportunity to comment on the draft report. For further questions concerning this matter, please contact Ms. Sorahi Azarbarzin at 703-614-6485 or via email at sorahi.a.azarbarzin.civ@mail.mil.

Sincerely,

Gary A. Ashworth

Performing the Duties of the Assistant Secretary
of Defense for Acquisition

Enclosures:
As stated

GAO DRAFT REPORT DATED APRIL 25, 2024
GAO-24-106555SU (GAO CODE 106555)

“COLUMBIA CLASS SUBMARINE: OVERCOMING PERSISTENT CHALLENGES REQUIRES YET UNDEMONSTRATED PERFORMANCE AND BETTER-INFORMED SUPPLIER INVESTMENTS”

DEPARTMENT OF DEFENSE COMMENTS TO THE GAO RECOMMENDATION

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Appendix IV: GAO Contact and Staff Acknowledgments

GAO Contact

Shelby S. Oakley at (202) 512-4841 or oakleys@gao.gov.

Staff Acknowledgments

In addition to the contact named above, the following staff members made key contributions to this report: Diana Moldafsky, Assistant Director; Anne McDonough, Assistant Director; Brendan K. Orino, Analyst-in-Charge; William Callahan; Eric Inumerable; Daniel R. Singleton; Benjamin Wilder; and Tiayé Wooten. Other contributors were Cassidy Cramton, Lori Fields, Stephanie Gustafson, and Min-Hei (Michelle) Kim.

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