



November 2018

NAVY READINESS

Actions Needed to Address Costly Maintenance Delays Facing the Attack Submarine Fleet

Accessible Version

GAO Highlights

Highlights of [GAO-19-229](#), a report to Subcommittee on Readiness, Committee on Armed Services, House of Representatives

Why GAO Did This Study

According to the Navy, its 51 attack submarines provide the United States an asymmetric advantage to gather intelligence undetected, attack enemy targets, and insert special forces, among others. These capabilities make attack submarines some of the most-requested assets by the global combatant commanders.

GAO was asked to review the readiness of the Navy's attack submarine force. This report discusses the extent to which the Navy (1) has experienced maintenance delays in its attack submarine fleet and costs associated with any delays; and (2) has addressed any challenges and developed mitigation plans for any maintenance delays. GAO analyzed readiness information from fiscal years 2008-2018, operating and support costs, maintenance performance, and other data; visited attack submarines and squadrons; and interviewed public and private shipyard and fleet officials.

This is a public version of a classified report issued in October 2018. Information the Department of Defense deemed classified or sensitive, such as attack submarine force structure requirements and detailed data on attack submarine maintenance delays, has been omitted.

What GAO Recommends

GAO recommends that the Navy conduct a business case analysis to inform maintenance workload allocation across public and private shipyards. The Department of Defense concurred with GAO's recommendation.

View [GAO-19-229](#). For more information, contact John Pendleton at (202) 512-3489 or pendletonj@gao.gov.

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Actions Needed to Address Costly Maintenance Delays Facing the Attack Submarine Fleet

What GAO Found

The Navy has been unable to begin or complete the vast majority of its attack submarine maintenance periods on time resulting in significant maintenance delays and operating and support cost expenditures. GAO's analysis of Navy maintenance data shows that between fiscal year 2008 and 2018, attack submarines have incurred 10,363 days of idle time and maintenance delays as a result of delays in getting into and out of the shipyards. For example, the Navy originally scheduled the USS *Boise* to enter a shipyard for an extended maintenance period in 2013 but, due to heavy shipyard workload, the Navy delayed the start of the maintenance period. In June 2016, the USS *Boise* could no longer conduct normal operations and the boat has remained idle, pierside for over two years since then waiting to enter a shipyard (see figure). GAO estimated that since fiscal year 2008 the Navy has spent more than \$1.5 billion in fiscal year 2018 constant dollars to support attack submarines that provide no operational capability—those sitting idle while waiting to enter the shipyards, and those delayed in completing their maintenance at the shipyards.

USS *Boise* Idle Pierside



Source: U.S. Navy. | GAO-19-229

The Navy has started to address challenges related to workforce shortages and facilities needs at the public shipyards. However, it has not effectively allocated maintenance periods among public shipyards and private shipyards that may also be available to help minimize attack submarine idle time. GAO's analysis found that while the public shipyards have operated above capacity for the past several years, attack submarine maintenance delays are getting longer and idle time is increasing. The Navy may have options to mitigate this idle time and maintenance delays by leveraging private shipyard capacity for repair work. But the Navy has not completed a comprehensive business case analysis as recommended by Department of Defense guidelines to inform maintenance workload allocation across public and private shipyards. Navy leadership has acknowledged that they need to be more proactive in leveraging potential private shipyard repair capacity. Without addressing this challenge, the Navy risks continued expenditure of operating and support funding to crew, maintain, and support attack submarines that provide no operational capability because they are delayed in getting into and out of maintenance.

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Abbreviation

DOD Department of Defense

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November 19, 2018

The Honorable Joe Wilson
Chairman
The Honorable Madeleine Z. Bordallo
Ranking Member
Subcommittee on Readiness
Committee on Armed Services
House of Representatives

The Navy spends over \$9 billion annually to operate and sustain its fleet of 51 attack submarines—consisting of 33 *Los Angeles* class, 3 *Seawolf* class, and 15 *Virginia* class submarines—that vary in age, size, and capability. These submarines are responsible for attacking enemy surface ships and submarines, intelligence collection and surveillance, striking land targets, and special operations force insertion. According to Navy documentation, attack submarines’ stealthy nature provides an asymmetric advantage for gathering intelligence undetected and, due to their nuclear power, allows for prolonged underwater operations with few practical limits. These capabilities make attack submarines some of the most-requested assets by the geographic combatant commanders.

Providing the military forces needed to deter war and to protect the security of the United States is a fundamental mission of the Department of Defense (DOD), and DOD has made the sustainment of ready forces a priority for meeting mission needs. Each of the military services is generally smaller and less combat-ready today than it has been in many years. We reported in May 2016 that the Navy faced significant challenges in rebuilding readiness, with maintenance delays limiting the ability of Navy forces to surge to respond to unforeseen crises or contingencies.¹ In August 2018, we reported that as the military services take steps to rebuild the readiness of their forces, they continue to be challenged by a demand for forces that, at times, outpaces the available supply.² DOD has recognized the challenges associated with low

¹GAO, *Navy and Marine Corps: Services Face Challenges to Rebuilding Readiness*, GAO-16-481RC (Washington, D.C.: May 25, 2016).

²GAO, *Military Readiness: Update on DOD’s Progress in Developing a Readiness Rebuilding Plan*, GAO-18-441RC (Washington, D.C.: August 10, 2018).

readiness and has made rebuilding the readiness of the military forces a priority.

You asked us to complete a review of the readiness of the Navy's attack submarine force. This report is a public version of a classified report that we issued on October 31, 2018. This report discusses the extent to which the Navy (1) has experienced maintenance delays in its attack submarine fleet and costs associated with any delays; and (2) has addressed any challenges and developed mitigation plans for any maintenance delays. The classified report included an objective discussing attack submarine readiness goals and wartime requirements. DOD deemed this information to be classified, which must be protected from loss, compromise, or inadvertent disclosure. Consequently, this public version excludes that information.

Further, this public report omits certain information that DOD deemed to be sensitive related to (1) attack submarine force structure requirements, (2) detailed data on attack submarine maintenance delays, (3) attack submarine cannibalization rates, (4) maintenance prioritization at the Navy's public shipyards, (5) maintenance duration forecasting, and (6) additional recommendations we made to address these issues. Although the information provided in this report is more limited, it uses the same methodology as the classified report.

For our first objective, we reviewed data from Naval Sea Systems Command on maintenance schedule performance for all attack submarine depot-level maintenance periods for fiscal years 2008—2018 and any idle periods (that is, time awaiting maintenance and unable to conduct normal operations) during that time period.³ We determined maintenance delays by identifying the elapsed time between the expected completion date⁴ and the actual completion date; and we determined idle periods by identifying the length of time during which a submarine

³Maintenance availabilities are scheduled periods of ship maintenance and modernization. For the purposes of this report, we refer to maintenance availabilities as "maintenance periods."

⁴The number of submarines unavailable on any given day or other time period due to expected maintenance reflects the start and completion dates that may have been revised by the Navy at the time the submarine began its maintenance period, and not the expected dates as set in the original maintenance schedule.

awaiting maintenance was unable to conduct normal operations. We also determined the total amount of time for which a submarine was unavailable due to actual maintenance and idle time. To estimate costs associated with maintenance delays and idle time, we calculated average daily cost factors using data from the Navy's Visibility and Management of Operating and Support Costs system. We also interviewed Navy fleet and squadron officials, submarine crews, and shipyard officials to understand factors affecting operational availability.

For our second objective, we reviewed the Navy's plans to mitigate any maintenance delay challenges and interviewed Navy headquarters, fleet, and squadron officials, as well as public and private shipyard officials, to discuss these plans. We visited the three public shipyards—Portsmouth Naval Shipyard, Norfolk Naval Shipyard, and Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility—that perform the majority of attack submarine maintenance; the two private shipyards that conduct attack submarine maintenance; and Navy facilities in Connecticut, Virginia, Hawaii, and Guam. We evaluated the Navy's plans to address any challenges against criteria in federal standards for internal control, the Department of Defense's business case analysis guidebook, *A Guide to the Project Management Body of Knowledge*, and guidance in the Secretary of the Navy's December 2017 *Strategic Readiness Review* on assessing risks to fleet readiness.⁵

To assess the reliability of the data sources used in conducting our analysis, we reviewed systems documentation and interviewed officials to understand system operating procedures, organizational roles and responsibilities, and error-checking mechanisms. We selected the time frames for each of the data series above after assessing their availability and reliability to maximize the amount of data available for us to make meaningful comparisons. We assessed the reliability of each of the data sources based on Navy documentation and interviews with Navy officials. We also conducted our own error checks to identify potentially inaccurate

⁵See GAO, *Standards for Internal Control in the Federal Government*, [GAO-14-704G](#) (Washington, D.C.: September 2014); Department of Defense, *DOD Product Support Business Case Analysis Guidebook* (April 2011); Project Management Institute, Inc., *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, Sixth Edition, 2017. *PMBOK®* is a trademark of Project Management Institute, Inc.; and Secretary of the Navy, *Strategic Readiness Review*. December 2017.

or questionable data, and we discussed with officials any data irregularities we found. We determined that the data series were sufficiently reliable for the purposes of summarizing attack submarine readiness trends and related information. Our scope and methodology are discussed in greater detail in appendix I.

The performance audit upon which this report is based was conducted from August 2017 to October 2018 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 to prepare this unclassified version of the report for public release. This public version was also prepared in accordance with these standards.

Background

The Navy currently has 51 attack submarines—comprising 33 *Los Angeles* class, 3 *Seawolf* class, and 15 *Virginia* class submarines (see fig. 1).⁶ Attack submarines are homeported at bases in the United States: in New London, Connecticut; Pearl Harbor, Hawaii; Norfolk, Virginia; San Diego, California; and Bangor, Washington; 4 are homeported overseas, in the U.S. territory of Guam.

⁶This count includes all Navy commissioned attack submarines, as of June 2018, including two submarines undergoing inactivation—a process in which a submarine is defueled in preparation for its decommissioning. Submarines undergoing inactivation are crewed, and they are still commissioned Navy vessels, but they are no longer capable of undertaking operations.

Figure 1: U.S. Navy Attack Submarines



Virginia class: USS Illinois (SSN 786)



Seawolf class: USS Jimmy Carter (SSN 23)



Los Angeles class: USS Buffalo (SSN 715)

Source: Defense Visual Information Distribution Service. | GAO-19-229

The four public naval shipyards—Portsmouth Naval Shipyard, Norfolk Naval Shipyard, Puget Sound Naval Shipyard and Intermediate Maintenance Facility, and Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility—provide depot-level maintenance, which the Navy describes as the most involved and time-consuming maintenance work, such as overhauls, alterations, refits, restorations, nuclear refueling, and deactivations.⁷ As we reported in 2016, these activities are crucial to supporting attack submarine readiness.⁸ Two private shipyards—General Dynamics Electric Boat and Huntington Ingalls Industries-Newport News Shipbuilding—build the Navy’s nuclear-powered ships, including attack submarines, and in some cases provide depot-level maintenance for attack submarines. Depot-level maintenance is performed during designated periods in the Navy’s attack submarine life cycle, through a schedule of planned maintenance, training, and deployment periods. We reported in 2016 that successful implementation of the Navy’s operational schedules depends, in part, on the shipyards’ completing maintenance on

⁷The Navy classifies ship maintenance at three levels: organizational maintenance, which is conducted by crews as part of their duties; intermediate maintenance, which exceeds the capacity of the crew and requires the use of certain fleet maintenance activities such as intermediate maintenance facilities; and depot-level maintenance, which exceeds the capacity of an intermediate maintenance facility and requires the use of a public or private shipyard. Office of the Chief of Naval Operations Instruction 4700.7L, *Maintenance Policy for United States Navy Ships* (May 25, 2010).

⁸GAO, *Military Readiness: Progress and Challenges in Implementing the Navy’s Optimized Fleet Response Plan*, [GAO-16-466R](#) (Washington, D.C.: May 2, 2016).

Submarine Safety Controls and Culture

On April 10, 1963, the USS *Thresher* (SSN 593) sank during deep submergence tests off the coast of New England. One hundred and twelve officers and enlisted sailors and 17 civilians perished in the tragedy. The accident investigation concluded that the Navy did not have adequate procedures in place to prevent and respond to a catastrophic flooding incident.



The loss of the USS *Thresher* and its crew spurred the Navy to establish stringent safety requirements for submarines to prevent another loss at sea. Following the accident, the Navy established submarine safety certification criteria to provide maximum reasonable assurance that critical systems would protect the crew from flooding and allow the submarine to conduct an emergency surfacing should flooding occur. This program, known as SUBSAFE, is still in use today, to ensure that these critical systems receive a high quality of work and that all work is properly documented. According to the Navy, the SUBSAFE certification status of a submarine is fundamental to its mission capability, as it provides a thorough and systematic approach to quality, and to a culture that permeates the entire submarine community. According to Navy officials, since the SUBSAFE program was established in 1963, no SUBSAFE-certified submarine has ever been lost.

Source: GAO review of Navy documentation and discussion with Navy officials; Naval History and Heritage Command (photos). | GAO-19-229

time, and that maintenance delays reduce the amount of time during which ships and submarines are available for training and operations.⁹

Submarine fleet and squadron officials emphasized the strict safety culture that permeates the submarine community. This emphasis on meeting safety certification criteria means that the Navy operates a supply-based submarine force that does not compromise on adherence to training and maintenance standards to meet combatant commander demands, according to these officials (see sidebar). Officials added that the Navy will delay deployment dates if necessary to ensure that these standards are met. As a result, deployed readiness is high and attack submarines are in excellent materiel condition as compared with the rest of the Navy fleet.

Attack Submarine Fleet Has Experienced Maintenance Delays and Navy Is Incurring Large Operating and Support Costs for Delayed Submarines

The Navy has been unable to begin or complete the vast majority of its attack submarine maintenance periods on time resulting in significant maintenance delays and operating and support cost expenditures. Our analysis of Navy maintenance data shows that between fiscal year 2008 and the end of fiscal year 2018, attack submarines will have incurred

⁹GAO, *Military Readiness: Progress and Challenges in Implementing the Navy's Optimized Fleet Response Plan*, [GAO-16-466R](#) (Washington, D.C.: May 2, 2016). According to Navy officials, some of the attack submarines currently in extended maintenance periods may be candidates for service life extensions in the future since their hulls may be subjected to fewer stresses associated with submerging and other operations over their service lives.

10,363 days of idle time and maintenance delays as a result of delays in getting into and out of the shipyards.¹⁰

Our analysis found that the primary driver affecting attack submarines are delays in completing depot maintenance. For example, of the 10,363 total days of lost time since fiscal year 2008, 8,472 (82 percent) were due to depot maintenance delays. As we previously reported, completing ship and submarine maintenance on time is essential to Navy readiness, as maintenance periods lasting longer than planned could reduce the number of days during which ships and crews are available for training or operations.¹¹

Attack submarines also face delays in beginning maintenance when the public shipyards have no available capacity, in some cases forcing submarines to idle pierside because they are no longer certified to conduct normal operations. According to Navy officials, the SUBSAFE program—its program to ensure and certify submarine safety—requires submarines to adhere to strict maintenance schedules and pass materiel condition assessments before they are allowed to submerge. Attack submarines that go too long without receiving required maintenance are at risk of having their materiel certification expire. Should this certification expire, these submarines are restricted to sitting idle, pierside, while they wait until a shipyard has the capacity to begin their maintenance period (see fig. 2).

¹⁰The Navy's aircraft carriers and surface fleet have also had significant maintenance delays over this time period. For example, we reported in September 2017 that between fiscal year 2000 and fiscal year 2016, the Navy's 11 aircraft carriers incurred 1,354 lost operational days due to maintenance delays at the Navy's public shipyards. See GAO, *Naval Shipyards: Actions Needed to Improve Poor Conditions That Affect Operations*, [GAO-17-548](#) (Washington, D.C.: Sept. 12, 2017).

¹¹GAO, *Military Readiness: Progress and Challenges in Implementing the Navy's Optimized Fleet Response Plan*, [GAO-16-466R](#) (Washington, D.C.: May 2, 2016).

Figure 2: Extended Idle Time for USS *Boise*



The USS *Boise* was originally scheduled to enter Norfolk Naval Shipyard for depot-level maintenance in 2013. The Navy delayed the start of the maintenance period because the shipyard was unable to meet its original schedule. Naval Sea Systems Command officials said the delay was due to the heavy workload at Norfolk Naval Shipyard. In June 2016, the *Boise*'s certification for normal operations expired, pulling the boat out of service and leaving the *Boise* to idle pierside at Norfolk Naval Station.

In 2017, Congress pointed to the harmful effects of the idling on crew morale and training, and called for the Navy to take action to address the situation. In October 2017, the Navy awarded a contract to Huntington Ingalls Industries-Newport News Shipbuilding for depot maintenance on the *Boise* in fiscal year 2019. By October 1, 2018, the first day that work could begin, the *Boise* will have idled for a total of 852 days—more than 2 years—since 2016. However, because of the time required to prepare for such a major maintenance period, work will not begin on the *Boise* until January 2019 after 960 days of idle time.

Source: GAO review of Navy documentation, direct observation, and discussions with crew and Navy officials; U.S. Navy (photos). | GAO-19-229

We found that since fiscal year 2008, 14 attack submarines have spent a combined 61 months (1,891 days) idling while waiting to enter shipyards for maintenance. Idle time incurred while waiting to begin a maintenance period is often coupled with maintenance delays while at the shipyards, thus compounding total delays.

We also found that the Navy incurs significant costs in operating and supporting submarines that are experiencing maintenance delays and idle time. We analyzed the operating and support costs the Navy incurs on average to estimate the costs of crewing, maintaining, and supporting attack submarines that are delayed in getting into and out of the shipyards. Using historical daily cost data the Navy adjusted for inflation, we estimated that since fiscal year 2008 the Navy has spent more than \$1.5 billion in fiscal year 2018 constant dollars on attack submarines

sitting idle while waiting to enter the shipyards, and on those delayed in completing their maintenance at the shipyards (see table 1).¹² While the Navy would incur these costs regardless of whether the submarine was delayed, idled, or deployed, our estimate of \$1.5 billion represents costs incurred from fiscal year 2008 through fiscal year 2018 for attack submarines without receiving any operational capability in return. While acknowledging the magnitude of these costs, Navy officials stated that there may be some benefits that could be realized from these operating and support costs since crews on idle attack submarines can conduct some limited training.

Table 1: Estimated Operating and Support Costs Incurred for Delayed and Idle Attack Submarines, Fiscal Years 2008—2018

| Submarine class | Average daily cost | Days of maintenance delays | Days of idle periods | Total estimated operating and support costs |
|-----------------------------|--------------------|----------------------------|----------------------|---|
| <i>Los Angeles</i> | \$135,974 | 6,289 | 1,488 | \$1,057,466,569 |
| <i>Seawolf</i> | \$205,705 | 1,625 | 79 | \$350,521,112 |
| <i>Virginia</i> (block one) | \$153,149 | 558 | 195 | \$115,321,495 |
| <i>Virginia</i> (block two) | \$86,133 | 0 | 129 | \$11,111,220 |
| Total | - | 8,472 | 1,891 | \$1,534,420,396 |

Source: GAO analysis of Navy data. | GAO-19-229

Operating and support costs include payment of crew salaries, purchasing of spare parts, and conducting of maintenance, among other things, but they do not represent the full operational impact incurred by

¹²Naval Sea Systems Command adjusted the historical operating and support costs for inflation to fiscal year 2018 constant dollars, using Navy inflation factors. We analyzed annual data from fiscal years 2011 through 2017 from the Navy's Visibility and Management of Operating and Support Costs system. The Navy calculates total operating and support expenditures for each attack submarine on an annual basis, as well as the yearly average expenditure for each attack submarine class, including *Los Angeles* class, *Seawolf* class, and *Virginia* class block one and two. For each class, we converted the Navy's annual class averages into daily average costs by adding the annual class averages together for each year that data were available, fiscal years 2011 through 2017, then dividing that number by the total number of days. We then multiplied the daily class average by the total number of days of maintenance delays and idle time incurred by submarines within that class, according to our calculations outlined above, between fiscal year 2008 and fiscal year 2018, and added these totals together to produce the total estimated operating and support cost for maintenance delays and idle time incurred during this period.

the Navy from the idle time and maintenance delays. For example, attack submarine depot-level maintenance requires the use of a drydock, and officials from the three public shipyards we visited told us that their drydock capacity was limited. A delayed attack submarine maintenance period can restrict the use of a drydock for much longer than originally anticipated, thereby preventing the shipyard from using that drydock to maintain other vessels, including other types of ships, or to conduct necessary repairs on the facilities.

Navy Has Begun to Address Some Challenges Associated with Attack Submarine Maintenance Delays but Has Not Effectively Allocated Maintenance Periods to Limit Idle Time

Navy Is Addressing Some Challenges at the Public Shipyards

The Navy has started to address workforce shortages and facilities needs at the public shipyards. These efforts to address the Navy's maintenance challenges are important steps, but they will require several years of sustained management attention to reach fruition. As we reported in September 2017, maintenance on ships and submarines may be delayed for numerous reasons, including workforce gaps and inexperience, the poor condition of facilities and equipment, parts shortages, changes in planned maintenance work, and weather.¹³ According to Navy officials, all of these issues continue to affect the Navy's ability to complete attack submarine maintenance on time. According to officials, the Navy has begun to address some of these challenges. For example:

- **The public shipyards have been hiring to address workforce shortages.** The number of civilian full-time employees at the shipyards increased from 25,087 in 2007 to 34,160 in 2017, with a goal to reach 36,100 by 2020. Navy officials cautioned that this newly

¹³GAO, *Naval Shipyards: Actions Needed to Improve Poor Conditions That Affect Operations*, [GAO-17-548](#) (Washington, D.C.: Sept. 12, 2017).

hired workforce is largely inexperienced and will require time to attain full proficiency.¹⁴

- **The Navy has released a plan to guide public shipyard capital investments.** In September 2017 we reported that the Navy projected an inability to support 50 planned submarine maintenance periods over the ensuing 23 years, due to capacity and capability shortfalls at the public shipyards. We recommended that the Navy develop a comprehensive plan for shipyard capital investment.¹⁵ In February 2018 the Navy published its shipyard optimization plan, outlining an estimated \$21 billion investment needed to address shipyard facility and equipment needs over 20 years to meet the operational needs of the current Navy fleet, but not the larger fleet size planned for the future.¹⁶

Navy Has Not Effectively Allocated Maintenance Periods among the Public and Private Shipyards to Limit Attack Submarine Idle Time

While the public shipyards have operated above capacity for the past several years, attack submarine maintenance delays are getting longer and idle time is increasing. The Navy expects the maintenance backlogs at the public shipyards to continue. We estimate that, as a result of these backlogs, the Navy will incur approximately \$266 million in operating and support costs in fiscal year 2018 constant dollars for idle submarines from fiscal year 2018 through fiscal year 2023, as well as additional depot maintenance delays.

The Navy may have options to mitigate idle time and maintenance delays. For example, officials at the private shipyards—General Dynamics

¹⁴GAO has an ongoing engagement examining workforce skill gaps at DOD depots, including the public shipyards.

¹⁵GAO, *Naval Shipyards: Actions Needed to Improve Poor Conditions That Affect Operations*, [GAO-17-548](#) (Washington, D.C.: Sept. 12, 2017).

¹⁶As we reported in September 2017, the Navy's 2016 Force Structure Assessment calls for increasing the number of planned aircraft carriers from 11 to 12 and the number of attack submarines from 48 to 66 (a 38 percent increase). This proposed increase in fleet size will aggravate shortfalls in drydock capacity, since an increase in the number of ships will lead to an increase in the volume of maintenance the shipyards must perform.

Electric Boat and Huntington Ingalls Industries-Newport News Shipbuilding—told us that they will have available capacity for repair work for at least the next 5 years.¹⁷ Although the Navy has shifted about 8 million man-hours in attack submarine maintenance to private shipyards over the past 5 years, it has done so sporadically, having decided to do so in some cases only after experiencing lengthy periods of idle time. According to private shipyard officials, the sporadic shifts in workload have resulted in repair workload gaps that have disrupted private shipyard workforce, performance, and capital investment—creating costs that are ultimately borne in part by the Navy.

We believe that the Navy has not fully mitigated this challenge because it has not completed a comprehensive business case analysis to inform maintenance workload allocation across public and private shipyards, and to proactively minimize attack submarine idle time and maintenance delays. Such an analysis would help the Navy better assess private shipyard capacity to perform attack submarine maintenance and would help it incorporate a complete accounting of all costs, benefits, and risks, including:

- the large operating and support costs of having attack submarines sitting idle;
- the qualitative benefits associated with providing additional availability to the combatant commanders; and

¹⁷General Dynamics Electric Boat and Huntington Ingalls Industries-Newport News Shipbuilding build all of the Navy's nuclear-powered ships and, in some cases, provide depot-level maintenance for attack submarines.

-
- the potential for additional work at private shipyards to reduce schedule risk to submarine construction programs by allowing the yards to build and maintain a stable shipyard workforce.¹⁸

The April 2011 *DOD Product Support Business Case Analysis Guidebook* provides standards for DOD's process for conducting analyses of costs, benefits, and risks.¹⁹ It states that data sources used to conduct a business case analysis should be comprehensive and should include both quantitative and qualitative values. It notes that benefits, such as the availability of a weapon system, may be qualitative in nature, and that DOD should evaluate all possible support options, to include government- and contractor-provided maintenance. Navy leadership has acknowledged that they need to be more proactive in leveraging private shipyard repair capacity,²⁰ but officials cautioned that maintenance could

¹⁸Vice Admiral Thomas Moore, Commander of Naval Sea Systems Command, testified in April 2018 that additional attack submarine maintenance work at private shipyards could reduce schedule risk to new submarine construction programs by allowing the private shipyards to begin the lengthy process of hiring and developing skilled workers. The Navy is currently building *Virginia* class attack submarines and will soon begin construction on *Columbia* class nuclear ballistic missile submarines designed to replace the *Ohio* class submarines that currently maintain the Navy's arm of the nuclear strategic triad. In December 2017 we found that the *Columbia* class program was at risk due to several critical technologies that are currently untested, and we warned that any unexpected delays could result in the delay of the deployment of the lead submarine. See GAO, *Columbia Class Submarine: Immature Technologies Present Risks to Achieving Cost, Schedule, and Performance Goals*, [GAO-18-158](#) (Washington, D.C.: Dec. 21, 2017). Similar to the public shipyards, newly hired workers at the private shipyards will require time to attain full proficiency. The private shipyards have delivered the last three *Virginia* class attack submarines behind schedule.

¹⁹Department of Defense, *DOD Product Support Business Case Analysis Guidebook* (April 2011).

²⁰See, for example, Vice Admiral Thomas Moore, Commander of Naval Sea Systems Command, *On a 355 Ship Navy*, testimony before the House Armed Services Subcommittee on Seapower and Projection Forces, 115th Cong., 2nd sess. (Apr. 12, 2018). The Navy reported that it has considered the effect of moving additional maintenance to private shipyards on their compliance with 10 U.S.C. § 2464 and 10 U.S.C. § 2466. Section 2464 of title 10, United States Code, requires that DOD maintain a core logistics capability that is government-owned and government-operated to ensure a ready and controlled source of technical competence and resources necessary to ensure effective and timely response to a mobilization, national defense contingency situations, and other emergency requirements. Section 2466 of title 10, United States Code, requires that not more than 50 percent of annual funds made available to a military department for depot-level maintenance and repair workload be used to contract for the performance of such workload by non-federal government personnel (private-sector contractors).

cost more at a private shipyard than at a public shipyard.²¹ However, without a complete accounting of all costs, benefits, and risks, the Navy will remain unable to determine whether the cost of performing a maintenance period at a private shipyard would outweigh the mission benefits of having reduced idle time, additional operational availability, and the potential for reduced risk to submarine construction programs.

Conclusions

The nation's investment in attack submarines provides the United States an asymmetric advantage to gather intelligence undetected, attack enemy targets, and insert special forces, among other capabilities. However, the Navy's attack submarine fleet has suffered from persistent and costly maintenance delays. Although the Navy has several activities underway to reduce maintenance delays for the attack submarine fleet, it has not yet taken additional steps to maximize attack submarine readiness that fully address challenges such as the allocation of maintenance periods between public and private shipyards. Without addressing this challenge, the Navy will not achieve the full benefit of the nation's investment in its attack submarines, and it risks continued expenditure of operating and support funding to crew, maintain, and support attack submarines that provide no operational capability because they are delayed in getting into and out of maintenance.

Recommendation for Executive Action

The Secretary of the Navy should ensure that the Chief of Naval Operations conducts a business case analysis to inform maintenance workload allocation across public and private shipyards; this analysis should include an assessment of private shipyard capacity to perform attack submarine maintenance, and should incorporate a complete accounting of both (a) the costs and risks associated with attack submarines sitting idle, and (b) the qualitative benefits associated with having the potential to both mitigate risk in new submarine construction and provide additional availability to the combatant commanders.

²¹The Congressional Budget Office is currently studying the cost differences between maintenance conducted at the public and private shipyards.

Agency Comments

We provided a draft of the classified version of the report to DOD for review and comment. That draft contained the same recommendation as this unclassified version as well as three additional recommendations DOD deemed sensitive. In written comments provided by DOD (reprinted in appendix II), DOD concurred with our recommendation stating that it has taken the first steps to take a more holistic view of submarine maintenance requirements and impacts across both the public and private shipyards.

The Navy also provided technical comments, which we incorporated as appropriate.

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

If you or your staff have any questions about this report, please contact me at (202) 512-3489 or pendletonj@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.



John H. Pendleton
Director
Defense Capabilities and Management

Appendix I: Scope and Methodology

To assess the extent to which the Navy has experienced maintenance delays in its attack submarine fleet, we analyzed attack submarine maintenance delay and idle time data from Naval Sea Systems Command, and we reviewed prior GAO work on shipyard maintenance delays.¹ The Navy determines depot maintenance delays by counting each day in which a submarine maintenance period extends beyond the planned completion date. Two Navy offices within Naval Sea Systems Command—that is, the Logistics, Maintenance, and Industrial Operations office and Program Executive Office Submarines—track days incurred from depot-level maintenance delays and idle time. To determine the total number of days of maintenance delays for each fiscal year within our scope, we subtracted the planned completion date from the actual completion date to produce the number of days of maintenance delays for each maintenance period for each submarine.² We added together the days of maintenance delays across all attack submarines for each fiscal year, and then added the fiscal year totals to produce the overall total. Although the data included some maintenance periods that began before fiscal year 2008, we counted days of maintenance delays only from periods that were incurred in fiscal years 2008 through 2018. We also tracked the total number of days that the Navy completed maintenance periods ahead of schedule—that is, 153—but we noted these separately instead of subtracting them from the total number of days of maintenance delays.

To estimate costs associated with these delays, we analyzed annual data from fiscal years 2011 through 2017 (the most current data available at the time of our review) from the Navy's Visibility and Management of

¹GAO, *Naval Shipyards: Actions Needed to Improve Poor Conditions That Affect Operations*, [GAO-17-458](#) (Washington, D.C.: Sept. 12, 2017).

²For some maintenance periods, this resulted in 0 days, indicating that the maintenance was completed on time. For other periods, this resulted in a negative number, indicating that the maintenance was completed ahead of schedule. We did not subtract days completed ahead of schedule from the total number of days of maintenance delays.

Operating and Support Costs system.³ We also reviewed prior work on determining the operating and support costs of Navy ships.⁴ The Navy calculates total operating and support expenditures for each attack submarine on an annual basis, as well as the yearly average expenditure for each attack submarine class, including *Los Angeles* class, *Seawolf* class, and *Virginia* class blocks one and two.⁵ For each class, we converted the Navy's annual class averages into daily average costs by adding the annual class averages together for each year that data were available, fiscal years 2011 through 2017, then dividing that number by the total number of days. We then multiplied the daily class average by the total number of days of maintenance delays and idle time incurred by submarines within that class, according to our calculations outlined above, between fiscal year 2008 and fiscal year 2018, and we added these totals together to produce the total estimated operating and support cost for days of maintenance delays and idle time incurred during this period.⁶ The data did not include annual class average costs for fiscal years 2008, 2009, 2010, or 2018. However, the annual class averages for fiscal years 2011 through 2017 did not show significant variation, so we applied these averages to 2008, 2009, 2010, and 2018.

To assess the extent to which the Navy has addressed any challenges and developed mitigation plans for any maintenance delays, we reviewed the Navy's plans to address attack submarine maintenance delays and interviewed Navy headquarters, fleet, and squadron officials, attack

³Naval Sea Systems Command adjusted the historical operating and support costs for inflation to fiscal year 2018 constant dollars, using the appropriate Navy inflation factors.

⁴See, for example, GAO, *Navy Force Structure: Actions Needed to Ensure Proper Size and Composition of Ship Crews*, [GAO-17-413](#) (Washington, D.C.: May 18, 2017).

⁵*Virginia* class submarines are procured in blocks. Four *Virginia* class submarines were purchased in the first block and commissioned between 2004 and 2008, while the second block comprises six submarines commissioned between 2008 and 2013. Block three *Virginia* class submarines are currently in production, including the most recently commissioned attack submarine, the USS *Colorado* (SSN 788), but as of April 2018, Navy data indicated that no block three submarine had reached its first scheduled depot-level maintenance period, nor incurred any maintenance delays or idling.

⁶A financial cost not captured by our analysis of operating and support costs is that of shore-side power. Submarines docked pierside, such as during an idle period, use a shore-side electrical connection for power—shore side power costs are not included in the Navy's operating and support cost database.

submarine crews, and public and private shipyard officials to understand any plans to address attack submarine maintenance delays and idle time. We analyzed data on factors contributing to attack submarine maintenance delays, such as cannibalization rates.⁷ We visited three of the four public shipyards, including Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility, Portsmouth Naval Shipyard, and Norfolk Naval Shipyard, to observe operations, training, and the condition of the facilities and equipment, and to interview officials about challenges affecting operational efficiency and performance. We also met with Navy maintainers at Naval Station Norfolk and Naval Submarine Base New London, and with the crew of the submarine tenders USS *Frank Cable* (AS-40) and USS *Emory S. Land* (AS-39) in Guam. We toured the two private shipyards that conduct attack submarine repair work—General Dynamics Electric Boat and Huntington Ingalls Industries-Newport News Shipbuilding—and interviewed executives at both locations. We also toured attack submarines and met with crew leadership, selected according to which submarines and crews were available for tours at each of the sites we visited. We visited the USS *Boise* (SSN 764) at Naval Station Norfolk and four attack submarines in depot-level maintenance: the USS *Albany* (SSN 753), the USS *Jefferson City* (SSN 759), the USS *New Mexico* (SSN 779), and the USS *Springfield* (SSN 761). We met with the crews of two attack submarines assigned to the operating forces at the time of our visit, the USS *Missouri* (SSN 780) and the USS *North Dakota* (SSN 784). We evaluated the Navy's plans to address any challenges against criteria in federal standards for internal control, which state that agencies should evaluate performance in achieving key objectives and addressing risks; the Department of Defense's business case analysis guidebook, which provides standards for the process used to conduct analyses of costs, benefits, and risks; the *Project Management Book of Knowledge*, which provides best practices for project management; and the Secretary of the Navy's December 2017

⁷Cannibalization refers to removal of a part from one operating asset and installing that part on another operating asset.

Strategic Readiness Review, which calls for the early identification of systemic risks before problems occur.⁸

To assess the reliability of the data sources for conducting analyses to address all of the objectives in this report, we reviewed systems documentation and interviewed officials to understand system operating procedures, organizational roles and responsibilities, and error-checking mechanisms. We selected the time frames for each of the data series above after assessing their availability and reliability, to maximize the amount of data available for us to make meaningful comparisons. We assessed the reliability of each of the data sources. The Navy provided information based on our questions regarding data reliability, including information on an overview of the data, data-collection processes and procedures, data quality controls, and overall perceptions of data quality. The Navy provided documentation of how the systems are structured and what written procedures are in place to help ensure that the appropriate information is collected and properly categorized. Additionally, we interviewed Navy officials to obtain further clarification on data reliability, discuss how the data were collected and reported, and explain how we planned to use the data. We also conducted our own error checks to look for inaccurate or questionable data, and we discussed with officials any data irregularities we found. We conducted these assessments on the following data for attack submarines: Navy deployed and surge-ready submarines from fiscal years 2011 through 2018; maintenance timeliness from fiscal years 2000 through 2018; idle time from fiscal years 2008 through 2018; operating and support costs from fiscal years 2011 through 2017; and cannibalization rates from 2012 through 2017. Some of these data were used in prior reports, and their reliability had previously been assessed. After further assessing any data that we had not recently used, we determined that they were sufficiently reliable for the purposes of summarizing attack submarine readiness trends and related information.

⁸See GAO, *Standards for Internal Control in the Federal Government*, [GAO-14-704G](#) (Washington, D.C.: September 2014); Department of Defense, *DOD Product Support Business Case Analysis Guidebook* (April 2011); Project Management Institute, Inc., *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, Sixth Edition, 2017. *PMBOK®* is a trademark of Project Management Institute, Inc.; and Secretary of the Navy, *Strategic Readiness Review*, December 2017.

We interviewed officials, and where appropriate obtained documentation, at the following locations:

Department of the Navy

- Office of the Chief of Naval Operations
 - Undersea Warfare Division (N97)
 - Warfare Integration Division (N83)
- U.S. Fleet Forces Command
 - Commander, Submarine Force, U.S. Atlantic Fleet
 - Commander, Submarine Squadron 4
 - Commander, Regional Support Group Groton
- U.S. Pacific Fleet
 - Commander, Submarine Force, U.S. Pacific Fleet
 - Commander, Submarine Squadron 1
 - Commander, Submarine Squadron 7
 - Commander, Submarine Squadron 15
- Naval Sea Systems Command (NAVSEA)
 - Logistics, Maintenance, and Industrial Operations (NAVSEA 04)
 - Program Executive Office, Submarines
 - Attack Submarine Program Office (PMS 392)
 - Submarine Maintenance Engineering, Planning, and Procurement (SUBMEPP)
 - Supervisor of Shipbuilding, Conversion, and Repair (SUPSHIP)
 - Groton, Connecticut
 - Newport News, Virginia
- Navy Education and Training Command
 - Submarine Learning Facility Norfolk
- Navy Board of Inspection and Survey
- Public Shipyards
 - Norfolk Naval Shipyard, Norfolk, Virginia

- Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility, Pearl Harbor, Hawaii
- Portsmouth Naval Shipyard, Kittery, Maine

Combatant Commands

- U.S. Pacific Command
- U.S. European Command
 - Naval Forces Europe

Other Organizations

- Congressional Budget Office
- Private Shipyards
 - Newport News Shipbuilding, Virginia, operated by Huntington Ingalls Industries
 - Electric Boat, Groton, Connecticut, operated by General Dynamics Electric Boat

The performance audit upon which this report is based was conducted from August 2017 to October 2018 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 to prepare this unclassified version of the report for public release. This public version was also prepared in accordance with these standards.

Appendix II: Comments from the Department of Defense



READINESS

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-4000

Mr. John Pendleton,
Director, Defense Capabilities and Management
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

NOV 14 2018

Dear Mr. Pendleton,

Attached is the Department of Defense (DoD) response to the Government Accountability Office (GAO) Draft Report GAO-19-229, "Navy Readiness: Actions Needed to Address Costly Maintenance Delays Affecting the Attack Submarine Fleet," dated November 9, 2018 (GAO Code 103111).

Thank you for the opportunity to comment on the draft report. Many of the issues raised and the recommendation made align with current efforts in the Department of the Navy, and the GAO's independent evaluation confirms that the Department has effectively identified and bounded the issues that are affecting submarine maintenance.

If questions should arise, please have your action officers contact CAPT Steve Bury at (703) 693-6263.

Sincerely,

A handwritten signature in black ink, appearing to read "M. Shipton".

Matthew B. Shipton
Deputy Assistant Secretary of Defense
Force Readiness

Attachment:
As stated.

**GAO DRAFT REPORT DATED NOVEMBER 9, 2018
GAO-19-229 (GAO CODE 103111)**

**“NAVY READINESS: ACTIONS NEEDED TO ADDRESS COSTLY MAINTENANCE
DELAYS AFFECTING THE ATTACK SUBMARINE FLEET”**

**DEPARTMENT OF DEFENSE COMMENTS
TO THE GAO RECOMMENDATION**

(U) RECOMMENDATION: The GAO recommends that the Secretary of the Navy should ensure that the Chief of Naval Operations conducts a business case analysis to inform maintenance workload allocation across public and private shipyards; this analysis should include an assessment of private shipyard capacity to perform attack submarine maintenance and should incorporate a complete accounting of both (a) the costs and risks associated with submarines sitting idle, and (b) the qualitative benefits associated with having the potential to both mitigate risk in new submarine construction and provide additional availability to the combatant commanders.

(U) DoD RESPONSE: The Department of Defense concurs with this recommendation and has taken the first steps to take a more holistic view of submarine maintenance requirements and impacts across both the public and private shipyards.

Appendix III: Related GAO Products

Report numbers with a C or RC suffix are Classified. Classified reports are available to personnel with the proper clearances and need to know, upon request.

Columbia Class Submarine: Immature Technologies Present Risks to Achieving Cost Schedule and Performance Goals. [GAO-18-158](#). Washington, D.C.: Dec. 21, 2017.

Navy Readiness: Actions Needed to Address Persistent Maintenance, Training, and Other Challenges Affecting the Fleet. [GAO-17-809T](#). Washington, D.C.: Sept. 19, 2017.

Naval Shipyards: Actions Needed to Improve Poor Conditions that Affect Operations. [GAO-17-548](#). Washington, D.C.: Sept. 12, 2017.

Navy Readiness: Actions Needed to Address Persistent Maintenance, Training, and Other Challenges Facing the Fleet. [GAO-17-798T](#). Washington, D.C.: Sept. 7, 2017.

Military Readiness: DOD's Readiness Rebuilding Efforts May Be at Risk without a Comprehensive Plan. [GAO-16-841](#). Washington, D.C.: Sept. 7, 2016.

Navy and Marine Corps: Services Face Challenges to Rebuilding Readiness. [GAO-16-481RC](#). Washington, D.C.: May 25, 2016.
(SECRET//NOFORN)

Military Readiness: Progress and Challenges in Implementing the Navy's Optimized Fleet Response Plan. [GAO-16-466R](#). Washington, D.C.: May 2, 2016.

Navy Force Structure: Sustainable Plan and Comprehensive Assessment Needed to Mitigate Long-Term Risks to Ships Assigned to Overseas Homeports. [GAO-15-329](#). Washington, D.C.: May 29, 2015.

Appendix IV: GAO Contact and Staff Acknowledgments

GAO Contact

John Pendleton, (202) 512-3489 or pendletonj@gao.gov

Acknowledgments

In addition to the contact named above, Suzanne Wren, Assistant Director; Chris Watson, Analyst in Charge; Herb Bowsher; Chris Cronin; Ally Gonzalez; Cynthia Grant; Carol Petersen; Amber Sinclair; and Cheryl Weissman made key contributions to this report.

Appendix V: Accessible Data

Agency Comment Letter

Accessible Text for Appendix II Comments from the Department of Defense

Page 1

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Director, Defense Capabilities and Management
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

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NOV 14 2018

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Matthew B. Shipley

Deputy Assistant Secretary of Defense Force Readiness

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Page 2

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