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Report to the Committee on Armed Services, House of Representatives

February 2022

NAVY SHIP MAINTENANCE

Actions Needed to Monitor and Address the Performance of Intermediate Maintenance Periods

Accessible Version

GAO-22-104510

GAO Highlights

Highlights of GAO-22-104510, a report to the Committee on Armed Services, House of Representatives

February 2022

NAVY SHIP MAINTENANCE

Actions Needed to Monitor and Address the Performance of Intermediate Maintenance Periods

Why GAO Did This Study

During fiscal years 2015 through 2020, the Navy spent an average of $2.1 billion per year performing high priority maintenance on submarines, surface ships, and aircraft carriers. The Navy's ships' crews and shore-based maintenance providers, located at homeports throughout the world, generally performed this maintenance—referred to by GAO as "intermediate maintenance periods"—to prepare the ships to get underway to execute their next missions.

The House Armed Services Committee, in a report accompanying a bill for the National Defense Authorization Act for Fiscal Year 2021, included a provision for GAO to review Navy ship intermediate maintenance periods. GAO evaluated the extent to which the Navy (1) collected and used data regarding the performance of intermediate maintenance periods for submarines, surface ships, and aircraft carriers during fiscal years 2015 through 2020, and (2) has addressed challenges affecting the performance of intermediate maintenance periods. GAO analyzed data related to Navy intermediate maintenance periods during fiscal years 2015 through 2020, reviewed key documents, and met with Navy crews and officials.

What GAO Recommends

GAO is making four recommendations to the Navy, including to establish and implement procedures to collect and analyze reliable maintenance data; share best practices and lessons learned; and include the performance of intermediate maintenance periods in strategic planning efforts. The Navy concurred with all four recommendations.

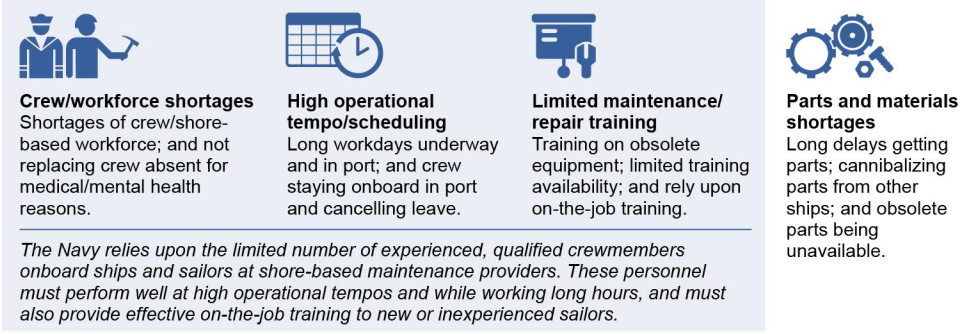
View GAO-22-104510. For more information, contact Diana Maurer at (202) 512-9627 or maurerd@gao.gov.

What GAO Found

The Navy collected, but did not analyze, limited data on the performance of intermediate maintenance periods—work often occurring while a ship is pier-side and capable of getting underway within 96 hours. Based on these data, GAO found that the Navy completed 191 of 414 (46 percent) submarine intermediate maintenance periods late from fiscal years 2015 through 2020, totaling 2,525 days of maintenance delay. The Navy did not collect several categories of data for submarines, surface ships, and aircraft carriers, including the planned and actual maintenance period costs. Without establishing and implementing procedures to collect and analyze these data, the Navy cannot effectively track and improve the performance of intermediate maintenance periods.

GAO identified four main challenges affecting the performance of intermediate maintenance periods for submarines, surface ships, and aircraft carriers based on discussions with ships' crews and officials from Navy organizations (see fig.).

Four Main Challenges Affecting the Performance of Intermediate Maintenance Periods



Source: GAO analysis of discussions with Navy ships' crews and officials. | GAO-22-104510

Ships' crews and shore-based maintenance providers have taken steps to address these challenges, but have had limited success because the Navy's efforts have been fragmented, have not generally included the sharing of best practices and lessons learned, and have not included the performance of intermediate maintenance periods in its strategic planning. For example:

- The Navy's aircraft carrier community independently created a working group to address some aspects of parts shortages, but has not shared this effort across the fleet. Implementing a mechanism to share best practices and lessons learned will better enable the Navy to address challenges affecting the performance of these maintenance periods.
- The Navy has not included the performance of intermediate maintenance periods for submarines, surface ships, and aircraft carriers in strategic planning efforts. Without including consideration of the performance of intermediate maintenance periods in its strategic planning and related initiatives, the Navy risks negatively affecting the readiness of the fleet.

Addressing these issues will better position the Navy to increase the readiness of submarines, surface ships, and aircraft carriers needed to perform their missions.

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February 8, 2022

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

The Navy's ability to maintain and repair its ships, while ensuring their availability to get underway quickly to perform missions, plays a critical role in sustaining readiness. The Navy spent an average of $9.1 billion per year to maintain its fleet of ships from fiscal years 2015 through 2020. Of this spending, on average, about $2.1 billion per year was used to perform high-priority planned and unplanned maintenance needed on submarines, surface ships, and aircraft carriers while they were in port preparing to get underway to execute their next missions. This high-priority planned maintenance, which we have defined as "intermediate maintenance periods," is work generally occurring while a ship is pier-side and on tether, meaning that the ship is capable of ending the maintenance period at any point and getting underway within 4 days.[1]

The Navy's ships' crews and shore-based maintenance providers, located at homeports throughout the world, perform these intermediate maintenance periods.[2] These maintenance periods generally include three levels of work: (1) organizational-level work, which ships' crews perform during planned maintenance periods both pier-side and while

[1]The Navy refers to this maintenance in several ways: scheduled continuous maintenance availability (CMAV); pre-overseas movement; and planned window of opportunity maintenance periods. In this report, we use the term "intermediate maintenance period" to refer to these concepts.

[2]Shore-based maintenance providers are what the Navy defines as Fleet Maintenance Activities, which include tenders, Regional Maintenance Centers, Naval Ship Repair Facilities, Naval Submarine Support Facilities, Naval Intermediate Maintenance Facilities, and Trident Refit Facilities, among other entities that perform intermediate maintenance periods on submarines, surface ships, and aircraft carriers. This work can be supplemented by contractors as well as maintenance providers from the Navy's four shipyards: the Portsmouth Naval Shipyard in Kittery, Maine; the Norfolk Naval Shipyard in Norfolk, Virginia; the Puget Sound Naval Shipyard & Intermediate Maintenance Facility in Bremerton, Washington; and the Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility in Honolulu, Hawaii.

underway;[3] (2) intermediate-level work that exceeds the capabilities of the crew and requires additional support such as the use of shore-based maintenance providers; and (3) depot-level work that exceeds the capabilities of both ships' crews and shore-based maintenance providers and may be performed by contractors or personnel assigned to the Navy's four shipyards, or at private shipyards.

Delays in completing maintenance can reduce the amount of time during which these ships are available for operations and training. Since 2015, we have issued more than 20 reports and testimonies regarding Navy ship maintenance challenges, shipyard workforce and capital investment, ship crewing, scheduling, and force structure. Many of these reports and testimonies have focused on delays and other issues associated with the less frequent, but longer duration, Chief of Naval Operations (CNO), or depot-level, maintenance periods.[4]

In July 2020, a committee report accompanying a bill for the National Defense Authorization Act for Fiscal Year 2021 included a provision for us to review the Navy's field-level maintenance for ships.[5] This review of intermediate maintenance periods complements our prior work on CNO maintenance periods and focuses on the high-priority maintenance that occurs between CNO maintenance periods, specifically focusing upon intermediate maintenance periods and organizational-level maintenance. Planned intermediate maintenance periods occur more frequently and on a more flexible basis than CNO maintenance periods. The Navy plans specific maintenance tasks during an intermediate maintenance period to help ensure that its submarines, surface ships, and aircraft carriers can

[3]Ships' crews perform organizational-level maintenance and also play a role in both intermediate and depot-level work to help ensure systems and equipment are readied to be safely maintained by other maintenance providers including shore-based maintenance providers and contractors, among others.

[4]For lists of some of the reports and testimonies related to CNO-maintenance periods, see GAO, *Navy Ship Maintenance: Actions Needed to Address Maintenance Delays for Surface Ships Based Overseas,* GAO-20-86 (Washington, D.C.: Feb. 26, 2020) and GAO, *Navy Shipyards: Actions Needed to Address the Main Factors Causing Maintenance Delays for Aircraft Carriers and Submarines,* GAO-20-588 (Washington, D.C.: Aug. 20, 2020). In our previous reports, we have described CNO maintenance periods as depot-level maintenance periods.

[5]H.R. Rep. No. 116-442, at 90-91 (2020). DOD defines field-level maintenance as intermediate-work and organizational-level work without reference to the planned maintenance periods themselves, which incorporate both levels of work and can include depot-level work as well.

meet their expected service lives, while also ensuring that these ships can get underway quickly if called upon to perform operations or training.

In this report, we examine the extent to which the Navy (1) collected and used data regarding the performance of intermediate maintenance periods for submarines, surface ships, and aircraft carriers during fiscal years 2015 through 2020, and (2) has addressed challenges affecting the performance of intermediate maintenance periods. In appendix I, we describe the challenges related to the performance of organizational-level maintenance.

The scope of our review included intermediate maintenance periods performed during fiscal years 2015 through 2020, on submarines, surface ships, and aircraft carriers, which account for about 200 of the Navy's 260 active warships.[6] Our scope included 12 homeports in which these ships were located as of October 2021.

For objective one, we analyzed the Navy's available data for intermediate maintenance periods completed during fiscal years 2015 through 2020 for submarines, surface ships, and aircraft carriers. We asked for data on planned and actual start and completion dates; actual number of jobs completed; the number of jobs and associated actual days of labor deferred to another planned maintenance period; and planned and actual

[6]We generally excluded classes of ships with three or fewer operational submarines or ships, such as the *America*-class amphibious assault ships and *Seawolf*-class attack submarines. We also excluded both classes of Littoral Combat Ships—due to related, recently completed GAO work and their limited deployment history—coastal patrol boats; and mine countermeasures ships. For more information on the Littoral Combat Ships see GAO, *Littoral Combat Ship: Unplanned Work on Maintenance Contracts Creates Schedule Risk as Ships Begin Operations,* GAO-21-172 (Washington, D.C.: Apr. 29, 2021).

costs for submarines and surface ships.[7] For aircraft carriers, we asked the Navy for data only on planned and actual start and completion dates.[8]

To assess the reliability of the data, we reviewed the data for anomalies, such as whether the start date for a maintenance period occurred later than the completion date, and asked Navy officials to explain any discrepancies or outliers that we encountered. We also asked the Navy officials questions about the reliability of the data and received responses from them during meetings and in writing. We found one dataset—data on submarine planned and actual start and completion dates for intermediate maintenance periods—to be sufficiently reliable for the purpose of our report. This allowed us to analyze and report on the days of maintenance delay for each intermediate maintenance period, and the average number of days for each period.

However, we found the remainder of the requested data that the Navy provided unreliable for our purposes because of inaccurate or missing data, as described later in this report. We compared the reliability of these data against the Navy's ship maintenance policy, which requires fleet/type commanders (TYCOMs) and shore-based maintenance providers such as Regional Maintenance Centers (RMCs) to obtain maintenance completion and cost data to help refine maintenance actions through the development of lessons learned.[9] The *Joint Fleet Maintenance Manual*

[7]Although the Navy uses the industrial term "manday" when referring to ship maintenance, for the purposes of this report we use the term "days of labor." Both refer to the industrial unit of production equal to the work one person can produce in a day. See GAO, *Defense Infrastructure: Navy's Analysis of Costs and Benefits Regarding Naval Station Mayport Demonstrated Some Best Practices and Minimally Addressed Other Requirements,* GAO-13-501 (Washington, D.C.: May 23, 2013). See Federal Accounting Standards Advisory Board, *Definitional Changes Related to Deferred Maintenance and Repairs: Amending Statement of Federal Financial Accounts Standards 6, Accounting for Property, Plant and Equipment* (May 11, 2011). "Deferred" maintenance is maintenance not performed when required or scheduled and that is subsequently delayed to a future maintenance period. The term "job" refers to the maintenance or repair task the Navy has scheduled for completion.

[8]Initially, Navy officials told us that there were no planned intermediate maintenance periods for aircraft carriers; however, they later stated that aircraft carriers' planned windows of opportunity maintenance periods met our definition of intermediate maintenance periods. After receiving this information, we then focused our requests for information about intermediate maintenance periods for aircraft carriers on planned and actual start and completion dates.

[9]Chief of Naval Operations Instruction (OPNAVINST) 4700.7M, *Maintenance Policy for Navy Ships* (May 8, 2019).

states that Fleet commanders and TYCOMs plan and monitor availability execution and monitor corrective maintenance actions taken, respectively.[10] We also compared the reliability of these data against the quality information principle of federal internal control standards—that is, that management should use quality information to achieve the agency's objectives.[11]

For our second objective, we engaged ships' crews in discussion groups about challenges to ship maintenance and efforts to address those challenges. Specifically, we held 12 discussion groups with a non-generalizable selection of 16 ships' crews from 10 classes of submarines, surface ships (including amphibious ships, destroyers, and a cruiser), and aircraft carriers. We selected the crews to represent each type and class of submarine, surface ship, and aircraft carrier in the scope of this review while also including representation from 8 of the 12 domestic and overseas homeports to which they had been assigned. We performed a content analysis of these discussions to identify challenges affecting the performance of intermediate maintenance periods.

We corroborated what we heard during the discussion groups by having independent analysts review notes from the meetings and written responses to questions we sent headquarters level officials and officials from shore-based maintenance providers. These officials included representatives from Naval Sea Systems Command (NAVSEA); United States Fleet Forces and Pacific Fleet and their TYCOMs for submarines, surface ships, and aircraft carriers; Submarine Maintenance Engineering, Planning and Procurement and Surface Maintenance Engineering Planning Program; Director for Surface Ship Maintenance and Modernization; Commander, Navy Regional Maintenance Centers (CNRMC)—including Mid-Atlantic, Southeast, and Southwest RMCs; Pearl Harbor Naval Shipyard & Intermediate Maintenance Facility; Portsmouth Naval Shipyard; Puget Sound Naval Shipyard & Intermediate Maintenance Facility; and shore-based maintenance providers at various homeports such as Naval Submarine Base New London, Connecticut.

[10]Commander, U.S. Fleet Forces Command Instruction (COMUSFLTFORCOMINST) 4790.3, *Joint Fleet Maintenance Manual* (Jan. 15, 2021) (incorporating revision D, Change 1).

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

Based on the challenges we identified, we analyzed Navy maintenance strategies—such as the Navy's *Maintenance Policy for Navy Ships*, the *Joint Fleet Maintenance Manual*, the CNO *Navigation Plan 2021*, NAVSEA *Campaign Plan to Expand the Advantage 3.0*, and the Shipyard Infrastructure Optimization Program, among other things—to determine what efforts the Navy had undertaken to address these challenges.[12] We reviewed the CNO's *Transforming Naval Logistics for Great Power Competition* strategy that states the Navy should formally establish the structure, governance, and authorities to provide a single voice for naval logistics and a mechanism for strategic coordination among logistics stakeholders.[13]

In addition, we identified *Standards for Internal Control in the Federal Government* that state that management should establish an organizational structure, assign responsibility, and delegate authority to achieve an entity's objectives. To the extent that the Navy's strategic plans and related initiatives considered Navy ship maintenance, we determined that these efforts primarily focused on the performance of CNO maintenance periods. A more detailed explanation of our scope and methodology can be found in appendix II.

We conducted this performance audit from September 2020 to February 2022 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.

[12]Documents we reviewed include the following: DOD Directive 4151.18, *Maintenance of Military Materiel* (Mar. 31, 2004) (incorporating change 1, Aug. 31, 2018); DOD Instruction 1336.07, *Management of Personnel Tempo* (Dec. 28, 2020); CNO, *Navigation Plan 2021* (Jan. 2021); OPNAVINST 4700.7M; COMUSFLTFORCOMINST 4790.3; NAVSEA, *Campaign Plan to Expand the Advantage 3.0* (Jan. 2021); and Department of the Navy, *The Shipyard Infrastructure Optimization Program (SIOP): President's Fiscal Year 22 Budget 5-Year Plan* (Sept. 2021). See also GAO-14-704G. We used the following seven principles from the *Standards for Internal Control in the Federal Government* as applicable: (1) Establish Structure, Responsibility, and Authority; (2) Demonstrate Commitment to Competence; (3) Identify, Analyze, and Respond to Risk; (4) Identify, Analyze, and Respond to Change; (5) Design Control Activity; (6) Design Activities for the Information System; and (7) Evaluate Issues and Remediate Deficiencies.

[13]CNO, *Transforming Naval Logistics for Great Power Competition* (January 2021).

Background

Roles and Responsibilities for Intermediate Maintenance Periods

A number of Navy organizations and commands share responsibilities for setting maintenance policies and planning, scheduling, and executing ship maintenance. Key organizations include:

NAVSEA. Among other functions, NAVSEA offices maintain submarines, surface ships, and aircraft carriers to meet fleet requirements within defined cost and schedule parameters. These offices perform contract administration, program management, and planning for future maintenance periods informed by the historical maintenance needs of Navy ships. The following NAVSEA offices have certain responsibilities for the execution of intermediate maintenance periods:

- **NAVSEA's Director for Surface Ship Maintenance and Modernization.** This office, known as NAVSEA21, provides life-cycle management for surface ships and manages critical modernization, maintenance, training, and inactivation programs.
- **CNRMC.** This office oversees the regional maintenance centers in the United States, including the Mid-Atlantic RMC in Norfolk, VA; Southeast RMC in Mayport, FL; and the Southwest RMC in San Diego, CA. CNRMC is also responsible for the coordination of maintenance activities related to intermediate maintenance periods at the Northwest RMC at Puget Sound Naval Shipyard and Intermediate Maintenance Facility in Bremerton, WA and the Hawaii RMC embedded in the Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility in Pearl Harbor, HA. It also manages overseas locations such as the Forward Deployed Regional Maintenance Center headquartered in Italy, and a related detachment in Rota, Spain, among others.
- **NAVSEA's Logistics, Maintenance, and Industrial Operations.** This office, also known as NAVSEA 04, manages and oversees the Navy's shipyards and the Ship Repair Facility and Japan Regional Maintenance Center in Yokosuka, Japan, and its detachment in Sasebo, Japan, both of which serve as homeports for Navy warships in the scope of this review.
- **Submarine Maintenance Engineering, Planning and Procurement.** This office provides engineering, program

management, and information technology support throughout the entire life-cycle maintenance process for submarines. This office, among other things, facilitates, manages, or distributes various fleet and TYCOM maintenance manuals and documents including the *Joint Fleet Maintenance Manual* and the *Tag-Out Users Manual* used by a ship's crew to safely perform maintenance, among other things, while preventing damage to equipment.[14]

TYCOM. The Navy's TYCOMs are responsible for maintaining, training, and ensuring the readiness of the ships assigned to each fleet. All ships are organized into categories—e.g., submarine, surface ship, and aircraft carrier. The TYCOMs for these ships have a critical role developing and updating the *Joint Fleet Maintenance Manual*, which establishes a unified set of maintenance requirements across all three categories of ships, though different types and classes of ships have different maintenance requirements.[15] The following TYCOMs are responsible for the submarines, surface ships, and aircraft carriers described in this report:

- Commander, Naval Air Force, U.S. Atlantic Fleet; Commander, Naval Air Force, U.S. Pacific Fleet;
- Commander, Naval Surface Force, U.S. Atlantic Fleet; Commander, Naval Surface Force, U.S. Pacific Fleet; and
- Commander, Submarine Force, U.S. Atlantic Fleet; Commander, Submarine Force, U.S. Pacific Fleet.

Chief of Naval Operations Maintenance Periods and Intermediate Maintenance Periods

The Navy has different durations and frequency for its CNO and intermediate maintenance periods. The Navy's four shipyards, along with privately owned shipyards, perform CNO maintenance periods. These maintenance periods can include major repair, overhaul, or the complete rebuilding of systems needed for ships to reach their expected service lives, and involve complex structural, mechanical, and electrical repairs. The Navy generally schedules CNO maintenance periods every 4 to 6 years for submarines and every 2 to 3 years for surface ships and aircraft carriers. The level of complexity of ship repair, maintenance, and

[14]COMUSFLTFORCOMINST 4790.3; NAVSEA 0400-AD-URM-010, *Tag-Out Users Manual* (Oct. 28, 2020) (incorporating revision 8).

[15]COMUSFLTFORCOMINST 4790.3.

modernization can affect the length of a maintenance period, which can range from 6 months to about 3 years for more complex and involved maintenance. According to Navy officials, the Navy considers ships undergoing CNO maintenance periods to be "untethered," meaning these ships are unavailable to stop maintenance and quickly get underway to perform a mission.

Intermediate maintenance periods occur between CNO maintenance periods and have a higher frequency and much shorter duration. Shore-based maintenance providers perform special maintenance processes and have technical proficiency for equipment or instrumentation not available to ships' crews. This maintenance normally consists of calibration, repair, refurbishment or replacement of damaged or unserviceable parts or components, the emergency manufacture of unavailable parts, and the provision of technical assistance to ships' crews. Because the Navy schedules intermediate maintenance periods more frequently and for much shorter durations than CNO maintenance periods, maintenance providers tend to complete fewer and less complex jobs during these maintenance periods. The Navy also considers intermediate maintenance periods' scheduling and duration to be more flexible than CNO maintenance periods. Specifically, according to Navy officials, the Navy considers a submarine or ship undergoing an intermediate maintenance period to be "tethered," what the Navy describes as capable of stopping maintenance work and getting underway within 4 days (96 hours) to perform a mission.

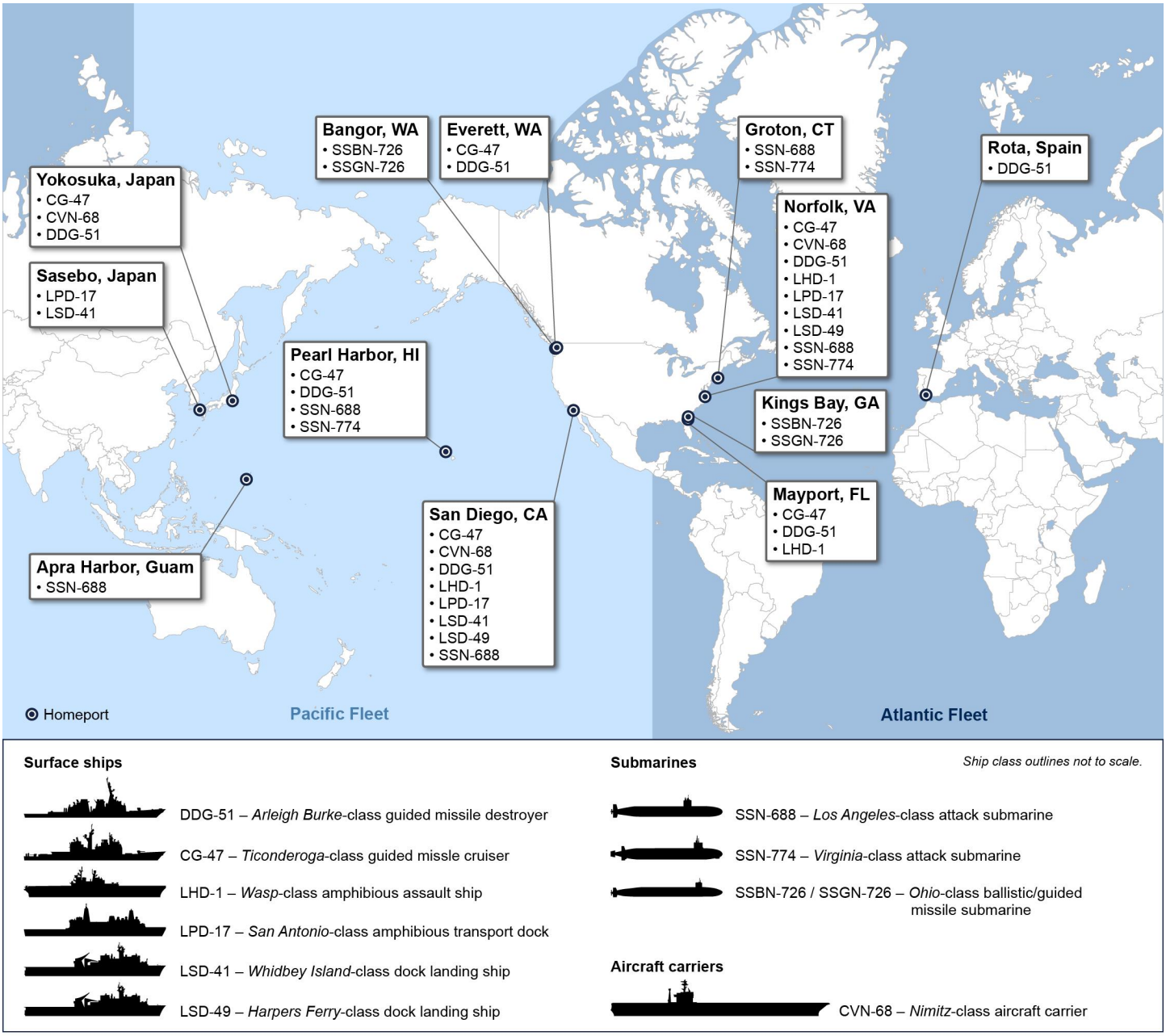
The scheduled frequency and duration of intermediate maintenance periods can vary based on whether the maintenance periods apply to submarines, surface ships, or aircraft carriers. Specifically, the Navy schedules intermediate maintenance periods every 3 to 5 months for submarines; the periods have an estimated duration of 21 to 35 days. Planned submarine intermediate maintenance periods are mandatory and cannot be deferred, deleted, or shortened without concurrence from the TYCOM. The Navy typically schedules intermediate maintenance periods for surface ships each quarter a surface ship is not deployed, for a minimum of 3 weeks. Further, the Navy's planned intermediate maintenance periods for aircraft carriers are "as scheduled" per the *Joint Fleet Maintenance Manual*.[16]

[16]COMUSFLTFORCOMINST 4790.3.

Intermediate Maintenance Periods Performed at the Navy's Homeports

Shore-based maintenance providers and ships' crews generally perform their work during intermediate maintenance periods, which includes work performed at regional maintenance centers that usually work on surface ships and naval submarine support facilities that work on submarines located at the Navy's homeports (see fig.1).

Figure 1: Locations of Homeports and Classes of Navy Submarines, Surface Ships, and Aircraft Carriers in the Scope of This Review



Source: GAO analysis of Department of Defense data. | GAO-22-104510

In addition, contractors and shipyard workers from the Navy's four shipyards support and augment work performed by the shore-based

maintenance providers. For example, a detachment from Portsmouth Naval Shipyard provides support to submarines homeported at Naval Station San Diego, and shipyard workers from Norfolk Naval Shipyard provide support to aircraft carriers at Naval Station Norfolk as well as for submarines stationed at Naval Submarine Base Kings Bay, among others.

The Navy Lacks Complete and Reliable Data to Monitor Intermediate Maintenance Periods

During fiscal years 2015 through 2020, the Navy collected limited data but did not analyze the data it collected on the performance of intermediate maintenance periods for submarines. The Navy did not collect several categories of data for intermediate maintenance periods for submarines, surface ships, and aircraft carriers, including the actual number of jobs deferred to other maintenance periods and the planned and actual costs.

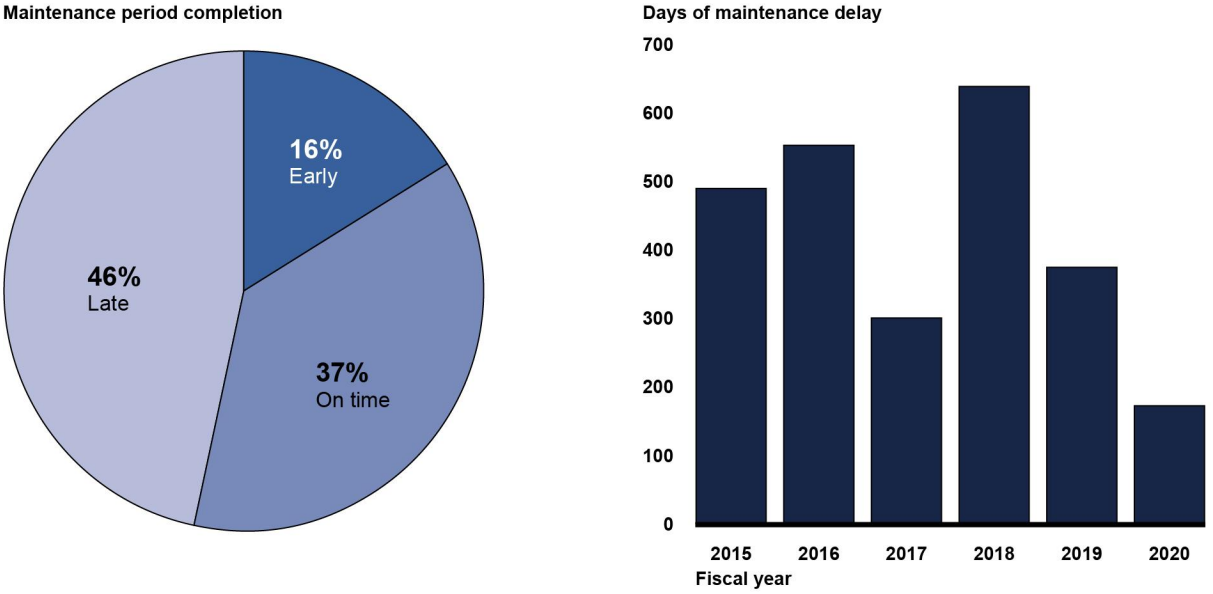
The Navy Collected Limited Reliable Data for Intermediate Maintenance Periods for Submarines, but Did Not Analyze the Data

For submarines, the Navy collected limited data on the intermediate maintenance periods' planned and actual start and completion dates. However, the Navy did not use these data for analysis and compiled the data after we requested the information. Using the Navy's data on the timely performance of submarines' intermediate maintenance periods, we analyzed the timeliness of the intermediate maintenance periods. We found that of the 414 intermediate maintenance periods for submarines completed during fiscal years 2015 through 2020, the Navy completed 223 (54 percent) on time or early and 191 (46 percent) late.[17] Further, we found that during fiscal years 2015 through 2020, submarines

[17]We based our analysis of days of maintenance delay on the number of days planned for completion at the start of the maintenance period compared to the actual results. Our analysis of days of maintenance delay was independent of whether the Navy used the flexibility of intermediate maintenance periods to shift the entirety of the maintenance period to start sooner or later due to the needs of the Navy.

- accumulated 2,525 days of maintenance delay for completed intermediate maintenance periods with a 13-day average delay for late intermediate maintenance periods;[18] and
- experienced a decrease in days of maintenance delay per year from 638 days in fiscal year 2018, to 374 days in fiscal year 2019, and then to 172 days in fiscal year 2020 (see fig. 2 for this decrease juxtaposed with intermediate maintenance period completion percentages).

Figure 2: Intermediate Maintenance Period Completion Percentages and Days of Maintenance Delay for Submarines during Fiscal Years 2015 through 2020



Source: GAO analysis of Navy data. | GAO-22-104510

[18]This analysis applies to intermediate maintenance periods for submarines with at least 1 day of maintenance delay. The days of maintenance delay ranged from 1 to 152. Of the 191 intermediate maintenance periods ending late, for 98 percent of these maintenance periods completed late, we found that delays ranged from 1 to 51 days. Four intermediate maintenance periods reported delays lasting more than 52 days with two instances lasting over 100 days, according to our analysis of Navy data.

Accessible Data for Figure 2: Intermediate Maintenance Period Completion Percentages and Days of Maintenance Delay for Submarines during Fiscal Years 2015 through 2020

Maintenance period completion	
Early	16%
On time	37%
Late	46%

Days of maintenance delay	
2015	489
2016	552
2017	300
2018	638
2019	374
2020	172

Note: The numbers do not total 100 percent in the pie chart due to rounding. The Navy completed 414 intermediate maintenance periods for submarines during fiscal years 2015 through 2020 at six shore-based maintenance providers that were part of the scope of this report.

We determined that the six Navy shore-based maintenance providers that performed intermediate maintenance periods for submarines had average days of maintenance delay ranging from 8 to 22 days for maintenance periods that ended late (see table 1). For example, Naval Submarine Base New London had a total of 286 days of maintenance delay—with an average of 8 days of maintenance delay for those intermediate maintenance periods it completed late. Meanwhile, Portsmouth Naval Shipyard – San Diego Detachment had a total of 599 days of maintenance delay with an average of 22 days of delay for those intermediate maintenance periods it completed late over the same period.[19]

[19]Portsmouth Naval Shipyard, located in Kittery, ME, has a detachment in San Diego, CA to provide maintenance support to visiting and homeported ships and submarines in San Diego, according to officials from the detachment. Other shipyards also send personnel to shore-based maintenance providers to support maintenance work. For example, Puget Sound Naval Shipyard and Intermediate Maintenance Facility has detachments located in San Diego; Everett, WA; and Yokosuka, Japan.

Table 1: Navy Shore-based Maintenance Providers and Associated Days of Maintenance Delay for Submarines during Fiscal Years 2015 through 2020

n/a	Days of maintenance delay (for maintenance periods completed late)		Number of maintenance periods
Maintenance provider	**Average**	**Total**	**Total/Completed late (percent late)**
Portsmouth Naval Shipyard – San Diego Detachment	22	**599**	**35/27** (77%)
Norfolk Naval Shipyard	18	**214**	**28/12** (43%)
Trident Refit Facility Bangor	14	**658**	**75/48** (64%)
Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility	12	**539**	**109/46** (42%)
Trident Refit Facility, Kings Bay	11	**229**	**70/21** (30%)
Naval Submarine Base New London	8	**286**	**97/37** (38%)

Source: GAO analysis of Navy data. | GAO-22-104510

Note: We included these six Navy shore-based maintenance providers because they completed intermediate maintenance periods for submarines during fiscal years 2015 through 2020.

In addition, our analysis found that these intermediate maintenance periods averaged 53 days during fiscal years 2015 through 2020. This average length of intermediate maintenance periods for submarines was nearly 2 weeks longer than what the *Joint Fleet Maintenance Manual* considers as ideal and what Navy officials we interviewed described as typical.[20]

The Navy Generally Did Not Collect or Use Several Types of Data on the Performance of Intermediate Maintenance Periods

In addition, the Navy could not provide reliable data for the remaining types of data we requested for submarines and could not provide any reliable data for surface ships and aircraft carriers. The Navy has not collected or used data to effectively monitor the performance of intermediate maintenance periods for submarines, surface ships, and aircraft carriers. Specifically, the Navy provided limited reliable data as shown in table 2.

[20]COMUSFLTFORCOMINST 4790.3.

Table 2: The Reliability of Data Received from the Navy for the Performance of Intermediate Maintenance Periods

Requested data fields	Were the data the Navy provided reliable?		
n/a	Submarines	Surface ships	Aircraft carriers
Planned and actual start and completion dates	Yes	No	No
Actual number of jobs	Yes	No	N/A[a]
Planned and actual number of days of labor	No	No	N/A
Actual number of deferred jobs	No	No	N/A
Actual days of labor associated with deferred jobs	No	No	N/A
Planned and actual costs	No	No	N/A

Legend: N/A = not applicable

Source: GAO analysis of Navy data. | GAO-22-104510

[a]We did not request this information from the Navy. During the course of this review, we received conflicting information about what types of maintenance periods constituted intermediate maintenance periods for aircraft carriers. Initially, Navy officials told us that there were no planned intermediate maintenance periods for aircraft carriers. In July 2021, TYCOM officials confirmed that aircraft carriers' planned windows of opportunity maintenance periods met our definition of intermediate maintenance periods. We then focused our requests for information about planned and actual start and completion dates for aircraft carrier intermediate maintenance periods.

For submarines, data on intermediate maintenance periods were incomplete. For example, the Navy provided us a spreadsheet listing some causes (e.g., work execution) for why it completed intermediate maintenance periods late during fiscal years 2019 through 2020. However, the spreadsheet did not include causes for delays for intermediate maintenance periods completed during fiscal years 2015 through 2018. In addition, some of the causes listed, such as work execution, were incomplete or vague because they did not offer detailed explanations as to why the delays occurred.

For surface ships, the Navy could not reliably identify the number of intermediate maintenance periods it completed during fiscal years 2015 through 2020. The data from Naval Surface Force Atlantic—which included U.S. Atlantic Fleet surface ships, but excluded data from U.S. Pacific Fleet—reported that the Navy completed approximately 400 intermediate maintenance periods for surface ships during this period. However, CNRMC's data—which included data from three domestic RMCs, but excluded data from Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility, Naval Station Everett, and the Ship Repair Facility and Japan Regional Maintenance Center—reported that the Navy probably completed at least 600 intermediate maintenance periods for surface ships during the same period. Further, some of the maintenance periods reported actual completion dates that preceded the actual start dates for the maintenance periods, while others were missing

planned start and completion dates, and others included matching planned and actual start and completion dates.

For aircraft carriers, Navy officials stated that the data they provided were unreliable. To determine whether there had been any days of maintenance delay, we attempted to compare the actual start and completion dates and planned start and completion dates to determine whether delays occurred in the completion of each intermediate maintenance period. The Navy provided us the planned start and end dates for the intermediate maintenance periods, but was unable to provide us with the actual start and completion dates to perform the analysis on maintenance delays. Further, for the data on planned start and completion dates provided by the Navy, officials noted that the data were unreliable because the two sources of these data did not contain the same results. Specifically, these Navy officials explained that the data were stored in a database and non-centralized paper files and that the dates were not the same. Finally, Navy officials stated that they did not usually collect these data and had only collected these data in response to our request.

Navy guidance requires that the data on the performance of intermediate maintenance periods be collected by both the shore-based maintenance providers and fleet/TYCOMs. We estimated that, except for the limited submarine timeliness data provided by the Navy, it has not collected or used reliable data for at least 1,000 planned intermediate maintenance periods during fiscal years 2015 through 2020.[21] The Navy's *Maintenance Policy for Navy Ships* requires that the Navy obtain maintenance completion and cost data to help refine maintenance actions through the development of lessons learned.[22] Further, the *Joint Fleet Maintenance*

[21]The Navy reported that 414 intermediate maintenance periods occurred during fiscal years 2015 through 2020 for submarines. We found the number of maintenance periods that occurred to be reliable for submarines. The Navy provided multiple sets of unreliable data for surface ships that indicated anywhere from 427 to 561 intermediate maintenance periods occurred during this time. However, neither set of data was reliable and neither included information from all shore-based maintenance providers that perform intermediate maintenance periods such as Pearl Harbor Naval Shipyard & Intermediate Maintenance Facility or Naval Station Everett. Finally, the Navy reported completing at least 120 intermediate maintenance periods for aircraft carriers, but Navy officials stated the data were unreliable as personnel only included the planned maintenance period completion dates as placeholders, not as a way to track the end of each maintenance period.

[22]OPNAVINST 4700.7M.

Manual states that fleet commander and TYCOMs plan and monitor availability execution and monitor corrective maintenance actions taken, respectively.[23] In addition, *Standards for Internal Control in the Federal Government* states that management should use quality information to achieve the entity's objectives by identifying information requirements, obtaining relevant data from reliable sources, and processing the obtained data into quality information that supports the internal control system.[24]

However, the Navy has not collected or used the required data on intermediate maintenance periods because the Navy has not established and implemented procedures to collect and analyze these data related to the performance of intermediate maintenance periods. Further, Navy officials stated they believed the intermediate maintenance periods were being performed on time and in full. For example, submarine fleet/TYCOM officials stated that completing intermediate maintenance periods was not a problem and that the maintenance periods generally ended on time. In addition, Navy officials from Naval Air Forces told us that they could not recall any time when personnel completed an intermediate maintenance period late due to the performance of planned work, but did not provide reliable data to support this assertion. These officials also acknowledged they did sometimes complete intermediate maintenance periods late due to unplanned work or other unexpected systems failures that might have occurred before an aircraft carrier departed for a mission.

Without establishing and implementing procedures to collect and analyze data, the Navy does not have the ability to track and monitor the performance of intermediate maintenance periods. This also limits the Navy's ability to provide effective oversight of maintenance for submarines, surface ships, and aircraft carriers. Further, the Navy cannot effectively institute any needed measures to improve the performance of intermediate maintenance periods so that the fleet is available for training crews and supporting U.S. military and national security goals.

[23]COMUSFLTFORCOMINST 4790.3.

[24]GAO-14-704G.

The Navy Has Not Effectively Addressed Challenges Affecting Intermediate Maintenance Periods

Based on our analyses of meetings with 16 ships' crews, Navy officials from headquarters-level entities, and various shore-based maintenance providers, we identified four main challenges affecting the performance of intermediate maintenance periods: (1) shortages of crew serving on board ships as well as shortages of the workforce at shore-based maintenance providers, (2) high operational tempo, (3) limitations in maintenance training, and (4) parts and materials shortages. Specifically, we identified the four main challenges based on our discussions with ships' crews and confirmed these four challenges during interviews with Navy officials from 18 different Navy headquarters and shore-based maintenance providers. Ships' crews and shore-based maintenance providers have undertaken some efforts to improve the performance of intermediate maintenance periods, but we identified aspects that may limit the effectiveness of their efforts.

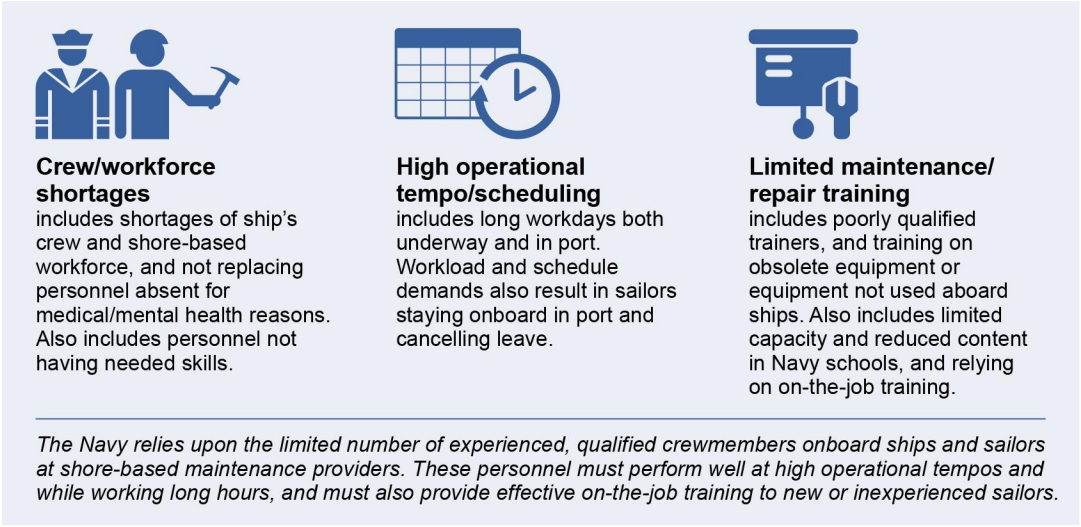
Four Main Challenges Identified by Ships' Crews and Maintenance Providers Affect the Performance of Intermediate Maintenance Periods

Based on meetings with 12 groups of 6 to 12 junior and senior enlisted personnel responsible for maintenance from 16 submarines and ships, we identified four main challenges that affect the performance of

intermediate maintenance periods for submarines, surface ships, and aircraft carriers (see fig. 3).[25]

[25]We engaged ships' crews in discussions about challenges to ship maintenance and efforts to address those challenges, and asked officials responsible for shore-based intermediate maintenance corroborative questions related to the discussions. Independent analysts then reviewed notes from the discussion groups to identify common challenges identified by ship's crews, and reviewed interviews and written responses from officials to determine if they corroborated challenges identified by ships' crews. The perspectives provided by crews from 16 ships regarding challenges to maintenance are not generalizable across the fleet of Navy warships, but corroboration by officials and examples provided in the meetings with ships' crews provided important insights into actual conditions in the fleet. Based on their unanimous identification, we determined the four main challenges and confirmed these four via our analysis of the interviews and written information provided by headquarters-level officials. See Appendix I for more detailed examples from the ships' crews regarding these challenges, and appendix II for a detailed explanation of our scope and methodology.

Figure 3: Four Main Challenges Affecting the Performance of Intermediate Maintenance Periods



Source: GAO analysis of discussions with Navy ships' crews and officials. | GAO-22-104510

Note: We identified challenges to the performance of maintenance from our discussions with groups of 6 to 12 junior and senior enlisted personnel responsible for maintenance on 16 different ships and corroborated these challenges in discussions with, or written responses from, officials responsible for shore-based maintenance for submarines, surface ships, and aircraft carriers. We identified challenges mentioned by every discussion group as main challenges.

Crew/workforce shortages. All 16 ships' crews we met with stated that the shortage of sailors was a challenge affecting the completion of maintenance. A few ships' crews stated that crewing shortages are the biggest challenge, and another crew added that there are not enough qualified, available crew assigned to ships to complete the planned maintenance.[26] For example, members of the crew on one surface ship told us that six of 13 positions in its electronics division remained unfilled as of April 2021. Similarly, crew aboard a different surface ship told us their electronics division decreased from 28 to 11 sailors and that the ship had eight crewmembers left onboard with the qualifications to perform the maintenance required for that division. In addition, crewmembers told us that crew shortages placed additional burdens on sailors executing maintenance, often adversely affecting the timely completion of maintenance. Sailors from surface ships described specific crew shortages that severely hampered the completion of maintenance both at

[26]We previously reported on crew shortages. Specifically, between October 2016 and September 2020 crew shortfalls nearly doubled, increasing from 8 percent to 15 percent. *See* GAO, *Navy Readiness: Additional Efforts Are Needed to Manage Fatigue, Reduce Crewing Shortfalls, and Implement Training*, GAO-21-366 (Washington, D.C.: May 27, 2021).

sea and while in port. Similarly, sailors from all seven submarines we met with told us that crew shortages resulted in the deferral of preventive maintenance for their submarines.

According to 10 of the 16 ships' crews, crew shortages and additional demands to perform maintenance lead to mental health and morale issues that may result in sailors taking leave for medical reasons such as to receive mental health evaluations, which further increases crew shortages. In addition, several of the ships' crews said that personnel slots might remain unfilled for months while affected individuals receive mental health evaluations or until replacement personnel can be assigned. Members of one ship's crew stated that they lost one person to suicide and a dozen other personnel experienced mental health issues over a period of 7 months.

Navy officials confirmed that workforce shortages also exist at the shore-based maintenance providers. Specifically, 15 of the 18 organizations with responsibility for various aspects of intermediate maintenance periods, including shore-based maintenance providers, identified shortfalls in the workforce available to perform intermediate maintenance periods. According to Navy officials, over the last several years the Navy has consistently filled positions open to enlisted personnel at shore-based maintenance providers 20 percent or more below authorized levels. In addition, these officials said that only a portion of personnel assigned could perform work during intermediate maintenance periods due to competing priorities, such as training or reassignments, to help other ships get underway.

According to Navy officials, having too few personnel available to complete maintenance has resulted in the Navy deferring work from intermediate maintenance periods that might otherwise be completed. For example, one RMC stated that they had deferred about 15 percent of their work prior to the onset of the COVID-19 pandemic, but that amount has increased to 50 or 60 percent.[27] The officials said that, if the Navy determines the work cannot be deferred to another maintenance period,

[27]Though Navy officials referred to these percentages, earlier in this report we determined that the Navy is collecting limited data and not performing oversight of intermediate maintenance periods, including the amount of work deferred from intermediate maintenance periods as well as the amount of days of labor associated with that deferred maintenance.

the work may be assigned to contractors or Navy shipyard workers at additional expense.[28]

High operational tempo/scheduling. All 16 ships' crews we met with stated high operational tempo and scheduling challenged their ability to complete maintenance. Ships' crews described operating in unsafe conditions, with safety measures circumvented or disregarded, and working 12 to 20 hours while in port, cancelling leave, and also working long shifts in order to get maintenance done while underway. For example, one surface ship's crew told us they may only have 2 or 3 days to complete maintenance tasks in port, but if challenges prevent completion of maintenance it may be deferred in order to get the ship underway again. Further, they said high operational tempo and schedule is a challenge while underway because sailors may work 12 to 14 hours per day, in addition to performing other duties. Another ship's crew stated that, at times, sailors might average 80 hours of work per week while in port, and that sometimes that number increases to over 100 hours of work per week to prepare for deployment.[29]

Submarine crewmembers told us that departures from specifications—that is, changes from the approved maintenance procedures—are increasing in frequency. Navy guidance requires compliance with maintenance technical specifications, but allows departures from specifications if approved by the proper authority.[30] Our analysis found that submarine departures from specifications as a percentage of all maintenance jobs completed averaged 10 percent from fiscal years 2015 through 2020. Specifically, departures from specification have generally

[28]We reported in October 2020 that private contractors and U.S. Naval shipyards have had difficulty completing maintenance on time, resulting in reduced time for training and operations and additional costs in a resource-constrained environment. For more information see GAO, *Navy Maintenance: Navy Report Did Not Fully Address Causes of Delays or Results-Oriented Elements,* GAO-21-66 (Washington, D.C.: Oct. 29, 2020) and GAO-20-588.

[29]We reported in May 2021 about overburdened Navy crews working long hours, among other things. See GAO, *Navy Readiness: Additional Efforts Are Needed to Manage Fatigue, Reduce Crewing Shortfalls, and Implement Training,* GAO-21-366 (Washington, D.C.: May 27, 2021). In that report we made eight recommendations to the Secretary of the Navy to take actions to address the factors causing sailor fatigue and inadequate sleep, establish crewing targets that are based on analysis and assessment of risk, and use crew requirements to project future personnel needs, among other things. DOD concurred with our recommendations.

[30]OPNAVINST 4700.7M.

grown during this period rising from 9 percent of all maintenance jobs started in fiscal year 2015 to 15 percent for jobs starting in fiscal year 2020.[31] Additionally, crewmembers from six of seven submarines stated that high operational tempo resulted in deferring maintenance because much of the preventive maintenance cannot be performed while submarines are underway.[32]

Officials from 11 out of 18 shore-based maintenance providers and other Navy officials we interviewed agreed with ships' crews, stating that high operational tempo and scheduling create a challenge for maintenance. Officials at one RMC stated that if they did not have enough capacity to complete work in a timely fashion, they may defer work or send the work to a shipyard or contractor. Officials from another RMC stated that the operational tempo within the fleet means that more ships need maintenance and repairs than they can realistically address. Specifically, officials said that the amount of work to be done exceeds the capacity of the personnel available to do it in the time allotted before ships are required to get underway.

Limited maintenance/repair training. All 16 ships' crews that we met with identified limited maintenance/repair training as being a challenge affecting their abilities to complete maintenance. Ships' crews also said that a mismatch existed between the skills needed to perform maintenance and the training provided by the Navy. For example, ships' crews stated that the Navy has significantly reduced the availability of formal training in recent years leading to too few seats for personnel and the absence of instruction on basic troubleshooting skills and procedures, among other things. Some crews also said that the Navy is teaching maintenance for systems and technology no longer in use onboard ships. Ships' crews described sailors arriving from Navy schools with little to no practical maintenance training and a few ships' crews said they sometimes had to rely on social media to help solve maintenance problems.

[31]Due to the unreliable data we described above, we were not able to calculate the number of departures from specifications for intermediate maintenance periods for surface ships or aircraft carriers.

[32]GAO, *Navy Maintenance: Persistent and Substantial Ship and Submarine Maintenance Delays Hinder Efforts to Rebuild Readiness,* GAO-20-257T (Washington, D.C.: Dec. 4, 2019). We reported that the Navy may defer needed maintenance so that its ships can sustain a high operational tempo.

Ships' crews also provided examples of the Navy discontinuing some training that could provide them with critical skills. For example, crewmembers from one submarine stated basic soldering courses existed 15 years ago, but were discontinued because the Navy deemed the courses unbeneficial to the fleet. In addition, some ships' crews indicated the Navy has relied too heavily on on-the-job training in an already understaffed work environment. Specifically, they stated that the limited number of experienced and qualified personnel aboard the ships that are relied upon to perform well at high operational tempos while working long hours are the same personnel relied upon to provide effective on-the-job training. Finally, some ships' crews and shore-based maintenance providers stated that insufficient training has contributed to sailors damaging or breaking systems while performing maintenance.

Officials from shore-based maintenance providers and other Navy officials confirmed that limited maintenance/repair training is one of their challenges in performing intermediate maintenance periods. Specifically, 15 out of 18 organizations we contacted reported challenges associated with limited maintenance training for sailors similar to those reported by ships' crews. For example, RMC officials stated that formal maintenance training provided to sailors by the Navy is "watered down." Specifically, in 2017, the Navy shortened the length of its job training schools to get sailors to the fleet faster, according to Navy officials. According to sailors, some schools that previously dedicated 6 months to teaching maintenance skills now dedicated 3 weeks. The Navy began making significant changes to training in 2000, reducing the amount of instructor-led and hands-on training as crew sizes aboard Navy ships were being reduced while increasing reliance on on-the-job training.[33]

Navy officials also stated that frequent changes in personnel assignments, limited experience, and insufficient formalized or on-the-job training made it difficult to maintain skill levels among military personnel at some shore-based maintenance providers. Officials also stated that the Navy may also assign personnel to RMCs that do not have a background in maintenance, or whose previous assignments may have been in a position not related to ship maintenance, such as food service. According

[33]GAO, *Military Readiness: Navy Needs to Reassess Its Metrics and Assumptions for Ship Crewing Requirements*, GAO-10-592 (Washington, D.C.: June 9, 2010).

to Navy officials, maintenance training limitations may result in additional work for ships' crews to correct changes made in error.[34]

Parts and materials shortages. All 16 ships' crews that we met with identified challenges obtaining parts and materials. Some crewmembers provided examples of parts such as electrical safety equipment being on backorder for up to 2 years and described difficulties locating consumable materials such as filters, specific types of oil, and protective clothing for themselves. Ten of the 16 ships' crews we met with stated that they resorted to cannibalizing parts—that is, taking functional parts away from other ships, in turn leaving them less-than-operational—so their respective ships could remain operational. For example, one surface ship crew described taking parts off two other ships of the same class, leaving them less-than-operational, so their ship could remain operational.

Eleven ships' crews also told us about the difficulty obtaining parts and materials for old and obsolete systems and equipment. Crewmembers also stated that parts or materials they did receive were at times incorrect, expired, or did not fit or function properly. For example, six out of seven submarine crews told us about difficulty obtaining parts for their oxygen generation systems, and that attempts to cannibalize parts from other submarines had not provided an adequate solution. According to five of 16 ships' crews, challenges obtaining parts and materials led them to resort to using work-arounds, which several crewmembers characterized as unorthodox engineering or using "duct-tape" and "bubble-gum" approaches to get systems and equipment in "good enough" condition to function and get underway.

Shore-based maintenance providers and other Navy officials we contacted confirmed the observations made by the ships' crews. Specifically, 14 out of 18 organizations reported similar challenges, with some describing them as a major issue. Maintenance providers we interviewed stated they often had difficulty obtaining parts and materials for old or obsolete systems as well as equipment used on almost every type of ship, including submarines, surface ships, and aircraft carriers.

[34]We previously reported on similar challenges providing inexperienced maintenance depot personnel with training for skilled occupations that generally use industrial facilities, specialized tools and equipment, and uniquely experienced and trained personnel. For more information see GAO, *DOD Depot Workforce: Services Need to Assess the Effectiveness of Their Initiatives to Maintain Critical Skills,* GAO-19-51 (Washington, D.C.: Dec. 14, 2018).

The Navy, Ships' Crews, and Shore-based Maintenance Providers Use Various Efforts to Address Maintenance Challenges

The Navy has taken a variety of approaches to improve the performance of intermediate maintenance periods.

Efforts to address crew/workforce shortages. The Navy has taken some steps to address workforce shortages Navy-wide by filling available positions with recruits and apprentices. For example, according to the Navy, the Commander of Naval Submarine Forces sent a letter to the Chief of Naval Personnel in May 2020 raising concerns that the Navy was having difficulty filling positions for non-nuclear apprentices. By February 2021, the Navy had managed to meet only 70 percent of its goals for these positions, according to the Navy. By May 2021, the Navy had improved this rate to 74 percent; however, it may take 2 more years to restore non-nuclear apprentice levels to 95 percent, according to Navy officials.

Members of ships' crews told us they use every means available to address workforce shortages, but their principal solution is to work longer hours. For example, 15 of the ships' crews reported working long hours. Specifically, submarine, surface ship, and aircraft carrier personnel described working days of 10 to 20 hours. Sailors performing maintenance described adapting schedules to work on tasks through the night while in port, and forgoing sleep.[35] According to submarine crewmembers, the Navy has extended personnel's assignments involuntarily because it had not found replacements.

Submarines and ships also borrow personnel to complete maintenance, according to ships' crews. For example, a submarine crew we met with stated that about a dozen shore-based sailors went to sea with the submarine to supplement the short-handed crew and help complete maintenance while they were underway. Also, sailors from one surface ship described seeing memorandums requesting "riders" from shore-based maintenance providers to supplement the ship's crew when it went underway. Further, both submarines and ships under construction or undergoing a CNO maintenance period have crew assigned to them. Sailors from one submarine crew told us about borrowing sailors from

[35]A lack of adequate rest has been cited as a contributor to accidents at sea. See GAO-21-366.

submarines under construction to help alleviate crew shortages on their submarine and training them while underway. However, once back in port, the newly trained sailors return to the submarine under construction leaving the active submarine short of crew.

Shore-based maintenance providers also sometimes borrow personnel. For example, personnel from RMCs sometimes lend personnel to forward-deployed locations such as Rota, Spain, or Guam. If a shore-based maintenance provider does not have enough personnel to do the work needed, they may also borrow personnel from Navy shipyards. For example, during fiscal year 2019, Norfolk Naval Shipyard provided resources to 21 other maintenance projects outside the shipyard. Navy officials stated that if they cannot locate enough qualified personnel to compete maintenance work, they may assign the work to contractors or not complete the work. Specifically, the Navy sometimes defers work until it has personnel that can perform the work or completes it later during another planned maintenance period. As we stated previously, the Navy could not provide data regarding how much work is deferred from intermediate maintenance periods into another intermediate or CNO maintenance period.

Efforts to address high operational tempo/scheduling. The Navy holds an annual conference with 45 to 60 officials representing Navy fleets—including the surface ship and aircraft carrier communities—to manage maintenance workloads and schedules so that maintenance can be reasonably completed, according to Navy officials.[36] Within the submarine community, officials stated they use procedures in accordance with policy to manage how the personnel and their units, such as specific submarines or maintenance providers, are used. Navy officials stated they do this to ensure that the Navy does not exceed established limits for deployment without advance awareness and approval by affected individuals.[37] According to the Navy, this allows officials to evaluate the effects on individuals' quality of life due to deployments and non-deployment events, including off-duty time away from home.

[36]Ship schedules may depend upon a combination of factors, such as goals for a number of specific vessel types to be deployed at all times, assignments to maintain an overseas presence by using standard deployments, and the need to include time for training and ship maintenance.

[37]We have an ongoing review of the Navy's ability to meet these deployment limits, as set out in the Navy's Optimized Fleet Response Plan.

All 16 ships' crews we met with aboard submarines and surface ships discussed working long hours at sea and in port to perform maintenance, but Navy officials responsible for aircraft carrier maintenance stated military personnel completing maintenance on aircraft carriers are rarely required to work excessive hours. Navy officials acknowledged that sailors work long hours to complete maintenance.

Efforts to address limited maintenance/repair training. In addition to filling positions on ships' crews and at maintenance providers, the Navy is working to improve the training provided to these crews. According to Navy officials, the Navy is attempting to address training issues through Ready Relevant Learning, computer-based training, and the use of the Navy Afloat Maintenance Training System established in 1998 to provide sailors with additional maintenance skills. Ready Relevant Learning is a program that focuses, in part, on accession training, or "A school," where junior sailors receive technical training in their selected occupations prior to their first sea tours.

In addition, the Navy has not accounted for the time that sailors will spend on modernized training, leading to the possibility that the modernized training will exacerbate overwork and fatigue among ships' crews. RMC officials stated their workforce provided on-the-job training to crews while performing some maintenance onboard ships. According to RMC officials, the specific nature of maintenance for each ship class requires on-the-job training provided by Navy personnel assigned to ships and shore-based maintenance activities, but without a sufficient number of personnel available to perform maintenance, the time they can devote to on-the-job training in addition to other priorities decreases.

Ten of the ships' crews we met with stated that they provide on-the-job training to less experienced sailors when possible. Some ships' crews also said they assist other ships with training, but crewmembers pointed out that when ships borrow crew from other ships and provide these sailors with on-the-job training, the borrowing ship remains short-handed when the sailors return to their own ships. Crewmembers also told us they engaged in their own efforts to equip personnel with practical skills. For example, crewmembers from a surface ship told us they try to find newly assigned crewmembers while the latter are still in training to advise these new personnel on specific skills to learn in school before they report to the ship.

Sailors have stated that the training is not as relevant to their maintenance needs as it might be and officials from shore-based

maintenance providers acknowledged this concern. For example, the Navy used Consolidated Afloat Networks and Enterprise Services by 2012, but the version taught in Navy schools is no longer used aboard aircraft carriers, according to officials. In September 2020, the Commander, U.S. Fleet Forces Command, acknowledged that the Navy's current training is not sufficient, that its training model needs to be improved, and that readiness cannot be built "just-in-time for the next deployment."[38] We reported in May 2021 that delivering modernized training using Ready Relevant Learning would require significant upgrades to the Navy's information technology infrastructure, for which it has recently begun planning.[39]

Efforts to address parts and materials shortages. The Navy has undertaken some class-specific efforts to address parts and materials challenges. For example, according to Navy officials the aircraft carrier community created an obsolete parts working group to address the inability to obtain parts and equipment for old or obsolete systems, such as hatches for *Nimitz*-class aircraft carriers that are no longer manufactured. The submarine community uses a construct within the Performance to Plan (P2P) initiative to identify and resolve parts and material issues relevant to planned maintenance.[40] In addition, management in the submarine community focuses on parts issues at twice-yearly meetings. When parts and materials issues cannot be resolved, ships may resort to cannibalization. The Navy tracks cannibalization through an electronic system to determine which parts are cannibalized the most, and then attempts to address the issue with the Navy supply system by improving forecasts for the number of parts needed and locating supply sources.

[38]Just-in-time is a private sector logistics philosophy. Private sector firms have learned to cut costs by moving to just-in-time inventory concepts that help keep inventories low, turn stock frequently, and fill orders quickly. The just-in-time philosophy may not be suited to providing personnel with skills necessary for maintaining complex weapon systems that may require more time and experience to acquire.

[39]GAO-21-366.

[40]In fiscal year 2019, the Navy began an initiative to improve Navy surface ship, submarine, and aviation readiness. This initiative, called Performance to Plan (P2P), designates Commander, Naval Surface Forces, and Commander, NAVSEA, is responsible for improving the performance of ship maintenance in private and public shipyards. NAVSEA refers to this initiative as the Shipyard P2P initiative that includes efforts related to aircraft carriers and submarines, and separately for surface ships. See GAO-20-588.

Personnel from RMCs and forward deployed locations that work on surface ships reported that parts on order are needed more urgently than the supply system usually allows for (some parts must be ordered months in advance) may be expedited through the supply process, or bought on the open market. Similarly, according to ships' crews, when they cannot locate inexpensive parts or consumable items through standard channels, they might purchase the items themselves, adapt available materials to address their needs, or adapt parts from other ships to their own. For example, one crew we met with said that they drove from their homeport to a Navy shipyard to remove a part from another submarine, drove back, and installed it on their own submarine to get underway. Finally, crews on submarine tenders can at times make parts for forward-deployed ships as needed to address equipment shortfalls.

Navy Efforts Are Fragmented and Lack Sharing of Best Practices and a Strategic Approach

Navy efforts to address challenges. Although the Navy engages in a variety of activities to improve the execution of intermediate maintenance periods, these activities may have limited effectiveness because the oversight of intermediate maintenance periods is fragmented across NAVSEA and the TYCOMS and varies by ship type.[41] Specifically, according to Navy officials, the Navy has not designated a single entity to address challenges affecting intermediate maintenance periods for submarines, surface ships, and aircraft carriers.

Both NAVSEA and the TYCOMs have roles in overseeing intermediate maintenance periods, and although they may collaborate for specific purposes such as scheduling, they do not engage in a Navy-wide approach to improve the performance of intermediate maintenance periods, according to Navy officials. NAVSEA is responsible for maintaining submarines, surface ships, and aircraft carriers to meet fleet requirements within defined cost and schedule parameters. However, several different entities within NAVSEA manage intermediate maintenance periods separately for submarine, surface ships, and aircraft carriers, along with their respective program executive offices, which focus on modernization and acquisition.

[41]For the purposes of our analysis, we used the term "fragmentation" to refer to circumstances in which more than one federal agency (or more than one organization within an agency) is involved in the same broad area of national need.

Meanwhile, fleet/TYCOMs have competing responsibilities to (1) maintain, train, and ensure the readiness of the ships and (2) assign and complete missions necessary to provide national security. We found that these competing responsibilities may result in TYCOMs treating intermediate maintenance periods as a lower priority than the operational needs of the Navy to have ships deployed at sea. When we asked fleet/TYCOM officials about these competing priorities they agreed that the operational and maintenance needs did at times conflict with each other, but that they worked together to resolve any conflicts. Ships' crews indicated the TYCOMs do not prioritize performing maintenance ahead of getting underway, which they said can result in increased risks to personnel and ships. For example, a few submarine crews we met with expressed concerns about commanders avoiding going into port to continue operating and defer maintenance and testing.[42] Senior Navy officials stated they were aware of efforts to avoid assessments that might prevent detection of deficiencies.

In addition, the Navy manages intermediate maintenance periods differently for submarines, surface ships, and aircraft carriers, according to officials. For example, surface ships may complete maintenance during intermediate maintenance periods that the Navy refers to as continuous maintenance availabilities that last 2 to 6 weeks, or longer. Aircraft carrier officials stated they consider continuous maintenance availabilities to be CNO maintenance periods and refer to aircraft carrier intermediate maintenance periods as "windows of opportunity" availabilities of limited duration that may be planned or unplanned. Submarine officials stated that submarines have intermediate maintenance periods they refer to as continuous maintenance availabilities, and another type referred to as pre-operational movement while ballistic missile submarines have a third category of planned intermediate maintenance periods.

According to the Chief of Naval Operations' *Transforming Naval Logistics for Great Power Competition* strategy, the Navy should formally establish the structure, governance, and authorities to provide a single voice for naval logistics and a mechanism for strategic coordination among logistics stakeholders.[43] In addition, according to *Standards for Internal*

[42]According to sailors we met with and Navy officials, ships may use Temporary Standing Orders as well as work-arounds performed by ships' crew to allow them to get or remain underway despite known deficiencies.

[43]CNO, *Transforming Naval Logistics for Great Power Competition* (Jan. 2021).

Control in the Federal Government, management should establish an organizational structure, assign responsibility, and delegate authority to achieve the entity's objectives.[44] Ships' crews and shore-based maintenance providers also stated that solving challenges related to intermediate maintenance periods merit a Navy-wide response.

NAVSEA and the TYCOMs are responsible for submarine, surface ship, and aircraft carrier maintenance planning and execution. Navy officials said responsibilities for, and focus upon, the performance of intermediate maintenance periods have become more disjointed over time and that they have not effectively balanced the operational demands for ships and the challenges associated with maintaining those ships. Senior Navy officials stated the Navy has not provided central oversight of intermediate maintenance periods for some time and has not considered standardizing intermediate maintenance processes. Identifying a single entity to oversee the performance of intermediate maintenance periods with authority across the spectrum of submarines, surface ships, and aircraft carriers would better position the Navy to address challenges affecting the performance of intermediate maintenance periods.

Navy efforts to share best practices and lessons learned. In addition, we found that the Navy does not have a mechanism for shore-based maintenance providers to share best practices and lessons learned regarding intermediate maintenance periods with fleet/TYCOMs. We found that Navy efforts to share best practices and lessons learned for performing intermediate maintenance periods are generally limited to those within each submarine, surface ship, and aircraft carrier community, and not across these communities. One Navy-wide effort, the Common Maintenance Planning Working Group, is intended to serve as the primary Navy organization tasked with developing, issuing, and sustaining, the tools and services used by those responsible for improving maintenance requirements for all ships that are in service, regardless of type.[45] However, shore-based maintenance providers, such as RMCs, and aircraft carrier officials stated they have no significant involvement with the working group.

Further, the fleet/TYCOMs generally do not work to share tools and practices that could improve the performance of intermediate

[44]GAO-14-704G.

[45]NAVSEA Instruction 4790.26A, *Common Maintenance Planning Working Group* (Mar. 6, 2019).

maintenance periods. For example, the surface ship and aircraft carrier communities have not adopted tools used by the submarine community to identify and locate parts that may contribute to intermediate maintenance delays. Similarly, the aircraft carrier community provides forward-reaching live technical assistance to assist personnel aboard ship in some circumstances, but, according to ship crews we met with, the surface ship community has not adopted this practice in part due to limited connectivity. In another example, aircraft carrier officials told us they have an obsolete parts working group to help address the challenge of obtaining obsolete parts, though this working group does not appear across submarines and surface ships, according to submarine and surface community officials.

In addition, efforts by shore-based maintenance providers and fleet/TYCOMs to share best practices and lessons learned for intermediate maintenance periods are not always effective. For example, parts management practices at one RMC that have reduced challenges to performing intermediate maintenance periods have not been adopted at other RMCs. NAVSEA shares maintenance best practices formally across the fleet through advisory messages and notices with technical input, according to Navy officials. However, formal messages and notices may not be sufficient to support implementation of best practices to address challenges. For example, the Southwest RMC maintains an inventory of parts and supplies that are difficult to obtain, but the other RMCs use different approaches, according to Navy officials.

Our prior work has shown that maintenance organizations benefit from sharing best practices and lessons learned, even when the type of systems they maintain are substantially different (e.g., aircraft, ground vehicles, or ships).[46] For example, we previously reported that the Navy shipyards, which primarily perform CNO maintenance periods on submarines and aircraft carriers, have a “One Shipyard” concept. The “One Shipyard” concept is a Navy workforce initiative in which shipyards exchange maintainers to ensure that the shipyards will have the necessary number of workers and skill sets to meet current and planned maintenance requirements resulting in better sharing of best practices. DOD depots sharing best practices and lessons learned between and

[46]GAO, *Military Depots: DOD Can Benefit from Further Sharing of Best Practices and Lessons Learned*, GAO-20-116 (Washington, D.C.: Jan. 30, 2020).

across military services has also led to benefits, including time and cost savings.[47]

The *Navy Lessons Learned Program* establishes policy that Navy organizations will incorporate lessons learned and best practices into their planning and operations to the maximum extent possible in order to enhance fleet learning, change behavior, and improve readiness.[48] Further, DOD's *Maintenance of Military Materiel* directive states that DOD materiel maintenance programs should adopt business practices and quality management processes to continuously improve maintenance operations and maintenance production, achieve cost savings and avoidance, and realize process cycle time reduction.[49] While the Navy has efforts to share best practices and lessons learned for CNO maintenance periods, shore-based maintenance providers and the fleet/TYCOMs have not fully shared their best practices and lessons learned for intermediate maintenance periods. By ensuring a mechanism exists for shore-based maintenance providers and the fleet/TYCOMs to share their best practices and lessons learned for intermediate maintenance periods, the Navy will better position them to share important information that could lead to efficiencies, improve the performance of intermediate maintenance periods, and address ongoing maintenance challenges.

Navy inclusion of intermediate maintenance periods in strategic planning efforts. Since at least 2014, several Navy strategic planning documents and related initiatives have described, to varying extent, the need to improve CNO maintenance periods at Navy shipyards, but the Navy's strategic planning and related initiatives do not identify the need to improve the performance of intermediate maintenance periods. According to Navy policy, intermediate maintenance periods are a higher priority than CNO maintenance performed at shipyards because submarines, surface ships, and aircraft carriers receiving pier-side maintenance need

[47]GAO-20-116.

[48]OPNAV Instruction 3500.37D, *Navy Lessons Learned Program* (June 20, 2018).

[49]DOD Directive 4151.18, *Maintenance of Military Materiel* (Mar. 31, 2004) (incorporating change 1, Aug. 31, 2018).

to be able to get underway to perform their missions.[50] Further, past strategic decisions may have adversely affected the performance of intermediate maintenance periods. For example, officials said that when the Navy closed its Shore Intermediate Maintenance Activities in the 1990s, it lost physical infrastructure and maintenance personnel, which affected the Navy's capability to perform intermediate maintenance periods.

In January 2021, the CNO *Navigation Plan 2021* reported that nearly 70 percent of the fleet planned by the Navy to exist in 2030 is in service today and stated that sustaining ships is absolutely critical to meeting future demands.[51] However, the Navy has not included the performance of intermediate maintenance periods in its strategic maintenance planning documents and related initiatives. For example, the Navy's *Depot Maintenance Strategic Plan 2014-2019* primarily focused on CNO maintenance periods and mentioned intermediate maintenance once in a discussion on future capital investments.[52] Similarly, other strategic efforts such as the Shipyard Infrastructure Optimization Program focus upon modernizing facilities and equipment at public shipyards that perform CNO-level maintenance, and do not address challenges to performing intermediate maintenance periods. According to NAVSEA and CNRMC officials, NAVSEA may begin efforts to incorporate shore-based maintenance providers into the Shipyard Infrastructure Optimization Program during fiscal year 2022; however, the Navy did not include this effort in its September 2021 update to the Shipyard Infrastructure Optimization Program's 5-year plan.[53]

The CNO *Navigation Plan 2021* stated that the Navy will scale P2P initiatives across the force to improve readiness. Further, the CNO *Navigation Plan 2021* reported that leveraging a data-driven, P2P

[50]According to OPNAVINST 4700.7M, to ensure flexible yet consistent applications of priorities for intermediate and depot-level work, (1) emergent and re-fit work for ballistic missile submarines, (2) voyage repair work on deployed or deploying units, and (3) work on ships being prepared for deployment are all higher priority than CNO depot maintenance availabilities and other work.

[51]Chief of Naval Operations, *Navigation Plan 2021* (Jan. 2021).

[52]U.S. Navy, *Depot Maintenance Strategic Plan 2014-2019* (Oct. 2013). As of November 2021, this is the Navy's most recent strategic plan for Navy ship maintenance.

[53]Department of the Navy, *The Shipyard Infrastructure Optimization Program (SIOP): President's Fiscal Year 2022 Budget 5-Year Plan* (Sept. 2021).

approach has been crucial to the gains the Navy has made to date regarding CNO maintenance periods. However, the CNO *Navigation Plan 2021* did not provide specific goals related to the performance of intermediate maintenance periods. We reported in August 2020 that NAVSEA's P2P Navy Shipyard effort focused upon developing metrics and factors, or drivers, affecting the timely completion of CNO maintenance periods at the Navy's four shipyards.[54] To date, P2P has been a Navy strategic effort focused on CNO maintenance periods rather than intermediate maintenance periods. For example, an earlier P2P Surface effort analyzed CNO maintenance periods for the Navy's DDG-51 *Arleigh Burke*-class guided missile destroyers. The P2P Surface effort, much like the P2P Navy Shipyard effort, did not take into consideration challenges affecting the timely completion of intermediate maintenance periods. Officials from NAVSEA and CNRMC stated that it would be helpful if the Navy considered intermediate maintenance periods during its strategic planning efforts and adopted P2P across the fleet, although they stated such efforts are notional and may take years to complete.

According to *Standards for Internal Control in the Federal Government*, an entity sets a strategic plan to achieve its objectives.[55] Officials from the TYCOMs and RMCs stated they generally did not believe timeliness issues existed regarding the performance of intermediate maintenance periods and that is why they had not focused on strategic planning for intermediate maintenance periods. They also stated that they did not think intermediate maintenance could be significantly late based on the assumption that intermediate maintenance periods are designed to allow ships and submarines to get underway within 96 hours to perform missions if needed. However, as discussed earlier, the Navy does not have sufficient data to determine whether intermediate maintenance periods are completed on time, and the reasons for any delays that may occur.

By not including the performance of intermediate maintenance periods in its strategic planning, the Navy risks negatively affecting the readiness of the fleet. Intermediate maintenance periods may continue to incur thousands of days of maintenance delay for the Navy's submarines, surface ships, and aircraft carriers. Further, neglecting maintenance deteriorates the material condition of ships and leads to increasing maintenance and operating costs. These costs, along with the need to

[54]GAO-20-588.

[55]GAO-14-704G.

modernize ships and their warfighting capability, may contribute to early decommissioning decisions, according to officials. Decommissioning decisions alter the number of ships in the fleet—a frequent topic of Navy strategic planning documents such as the CNO *Navigation Plan 2021*. By not including the significant amount of maintenance work accomplished at its homeports in its strategic planning, the Navy risks not realizing the longest useful lives possible for submarines, surface ships, and aircraft carriers across its entire fleet.

Conclusions

The ability of the Navy's shore-based maintenance providers to maintain and repair submarines, surface ships, and aircraft carriers is critical to sustaining readiness and ensuring that ships are available to perform their missions. Intermediate maintenance periods for submarines have incurred 2,525 days of maintenance delay during fiscal years 2015 through 2020. The Navy does not know to what extent delays exist in the performance of these maintenance periods for its surface ships and aircraft carriers because it does not have procedures to collect and analyze complete and reliable data regarding the performance of intermediate maintenance periods. Effective oversight based on the collection of complete and reliable data on the performance of intermediate maintenance periods is critical for the Navy's ability to make any needed improvements to the performance of intermediate maintenance periods and help ensure that the fleet is available to train crews, complete missions, and support U.S. military and national security goals.

Ships' crews and organizations conducting intermediate maintenance periods described challenges primarily associated with a shortage of crew, a high operational tempo and schedule that are forcing sailors to work long hours both at sea and while in port, limited maintenance training for new sailors, and obtaining the right parts in a timely manner. The Navy's efforts to mitigate these challenges are negatively affected by responsibility for oversight of these maintenance periods being fragmented across Navy organizations and shore-based maintenance providers, best practices and lessons learned not being shared across the fleet, and strategic planning not including the performance of intermediate maintenance periods. Addressing these issues will better position the Navy to improve the performance of its intermediate maintenance periods and would increase the overall availability of submarine, surface ship, and aircraft carriers needed for training and operations.

Recommendations for Executive Actions

We are making four recommendations to the Secretary of the Navy.

The Secretary of the Navy should ensure that the shore-based maintenance providers and the fleet/type commanders establish and implement procedures to collect and analyze complete and reliable data on the performance of intermediate maintenance periods for submarines, surface ships, and aircraft carriers. These data should include the planned and actual start and completion dates, costs, and the causes of any delays in the completion of maintenance periods, among other things. (Recommendation 1)

The Secretary of the Navy should ensure that a single entity is designated to address challenges affecting intermediate maintenance periods for submarines, surface ships, and aircraft carriers.
(Recommendation 2)

The Secretary of the Navy should ensure that shore-based maintenance providers and fleet/type commanders implement a mechanism to share best practices and lessons learned regarding the performance of intermediate maintenance periods across submarines, surface ships, and aircraft carriers.
(Recommendation 3)

The Secretary of the Navy should ensure that the Navy's maintenance-related strategic planning and initiatives, such as the Navy's Performance to Plan efforts, include issues associated with the performance of intermediate maintenance periods.
(Recommendation 4)

Agency Comments

We provided a draft of this report to DOD for review and comment. In written comments provided by the Navy (reproduced in appendix III), DOD concurred with our recommendations. The Navy also provided technical comments, which we have incorporated as appropriate.

We are sending copies of this report to the appropriate 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) 512-9627 or maurerd@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 that made key contributions to this report are listed in appendix IV.

Diana Maurer
Director, Defense Capabilities and Management

Appendix I: Maintenance Discussions with Navy Crews

Navy Crewmembers Identified Challenges Affecting Ship Maintenance

We met with crews representing 16 various submarines, surface ships, and aircraft carriers to discuss challenges affecting the completion of organizational-level maintenance, whether pier-side or underway, including organizational-level maintenance performed during intermediate maintenance periods. Specifically, we met with 107 junior and senior enlisted sailors from the following types and classes of ships:

- three *Los Angeles*-class and one *Virginia*-class fast attack submarines
- three *Ohio*-class ballistic missile submarines
- two *Arleigh Burke*-class guided missile destroyers
- one *Ticonderoga*-class guided missile cruiser
- one *Whidbey Island*-class and one *Harpers Ferry*-class dock landing ship
- one *Wasp*-class amphibious assault ship
- one *San Antonio*-class amphibious transport dock
- two *Nimitz*-class aircraft carriers

These crews represented ships from a variety of the Navy's homeports around the world. These homeports included the following:

- Naval Submarine Base New London (Groton, Connecticut)
- Naval Station Norfolk (Norfolk, Virginia)/(Joint Expeditionary Base Little Creek-Fort Story (Virginia Beach, Virginia)
- Naval Station Mayport (Mayport, Florida)
- Naval Base Coronado (San Diego, California)
- Naval Station Kitsap-Bangor (Bangor, Washington)
- Joint Base Pearl Harbor-Hickam (Pearl Harbor, Hawaii)
- Naval Station Rota (Rota, Spain)
- Commander Fleet Activities, Yokosuka (Yokosuka, Japan)

Four Main Challenges and Two Additional Challenges to Performing Maintenance

We identified four main challenges to the performance of maintenance from our discussions with shipss crews including crew shortages, high operational tempo/scheduling, limited maintenance/repair training, and parts and material shortages. These challenges were identified in every discussion we held with ships' crews. We also identified two other challenges in 10 of the 12 discussions we had with ships' crews associated with the performance of maintenance and the low prioritization of maintenance.

We engaged ships' crews in collaborative discussions about challenges to ship maintenance and efforts to address those challenges. The perspectives provided by the ships' crews regarding challenges to maintenance may not be generalizable across the fleet of Navy warships, but the examples provided below from the discussions with the ships' crews provide important insights into actual conditions in the fleet at the time of the discussions. The following ships' crews' perspectives were edited for clarity and length.

MAIN CHALLENGE: Crew Shortages

What Sailors Had to Say

Crew Shortages

Includes a lack of capacity (not having enough people), capability (not having people with the right skills), and experience among ships' crews. All ships' crew meetings identified workforce shortages as a critical challenge affecting the crews' abilities to complete maintenance. This challenge affects the completion of maintenance. There are not enough qualified, available crew assigned to vessels to complete maintenance. Crew shortages are exacerbated by medical/mental health absences, and can have a negative impact on the operational tempo and scheduling as well as upon training.

Source: GAO analysis of discussions with Navy personnel. | GAO-22-104510

- Normal staffing for a ship's sonar maintenance crew is 16 to 21. The crew is essentially operating with 13 people. The crew does not have the personnel to teach the new sailors and do maintenance and assessments.
- The ship's biggest problem is being understaffed resulting in maintenance taking longer than it should.
- Ship crews are overwhelmed with maintenance work. On one surface ship, a large work center that required many crew had only three sailors available to complete weekly maintenance checks.
- A surface ship's maintenance division is at 40 percent of its optimal crewing levels. Thus, ship's maintenance is often delayed.
- Crew shortages of sailors with the right skills resulted in deferring preventative maintenance until the crew arrived in port.
- A submarine may borrow 10 to 12 personnel from other ships for deployment. Afterward, a huge vacuum occurs when qualified maintenance personnel leave to support a deploying submarine.

MAIN CHALLENGE: High Operational Tempo/Scheduling

What Sailors Had to Say

High Operational Tempo/Scheduling

Includes "overspending" the force in terms of unit and individual activity; reduction in time available for training and maintenance; and potential adverse impacts on readiness, force structure, and quality of life, amongst other things. Ships' crews described working long hours both while in port and underway to perform maintenance.

Source: GAO analysis of discussions with Navy personnel. | GAO-22-104510

- The operational tempo has increased over the last 2 years. Because of this, junior personnel do not receive proper training, which in turn

leads to junior personnel gaining senior status and still not knowing what they are doing.

- The Navy at times shortens maintenance periods and doubles the workload for submarines, resulting in submarines “breaking” as they start deployment because equipment was not properly fixed and/or it was fixed in a rushed manner.
- Workforce shortages at sea result in work days that regularly exceed 16 hours. Further, additional demands to perform maintenance in port can result in longer workdays than at sea.
- The operational tempo adds to the stress levels among the crew because it affects how they actually accomplish their work. It is really hard and causes high levels of stress. There is no down time; the work seems to be non-stop.
- Ships’ crews are really only working with a handful of personnel to accomplish everything they are responsible for. The hours of required maintenance exceed the hours in a day.

MAIN CHALLENGE: Limited Maintenance/Repair Training

What Sailors Had to Say

Limited Maintenance/Repair Training

Ships' crews described sailors arriving from A-school training with little to no practical maintenance training and sometimes relying on internet videos to help them solve maintenance problems aboard their respective ships. Further, ships' crews described limitations in the number of seats available for formal training, poor quality of formal training, or schools, and the heavy reliance upon on-the-job training to teach new sailors maintenance and repair.

Ships' crews stated that they received training on equipment that does not match what exists onboard the submarines and ships sailors are assigned, such as obsolete systems and equipment. Also, ships' crews said they received only limited training for essential skills such as soldering, basic troubleshooting, and maintenance.

Source: GAO analysis of discussions with Navy personnel. | GAO-22-104510

- Training and school is obsolete. Ships' crews do not learn how to maintain equipment they are expected to repair. For example, crewmembers are trained on repairing boilers, which only apply to 10 percent of the Navy's ships.
- A surface ship had a camera system installed in 2005; however, personnel expected to repair the camera did not receive training on how to troubleshoot or fix it in school.
- Training at every level for every department involved in organizational level maintenance is substandard. Ships' crews often learn incorrect or incomplete group knowledge that negatively affects their abilities to complete work.
- Crewmembers cannot access needed training because there are not enough seats available at the school.
- Many of the Navy's schools do not teach crewmembers how to service equipment onboard ships because much of that equipment is obsolete.

MAIN CHALLENGE: Parts and Materials Shortages

What Sailors Had to Say

Parts and Materials Shortages

Every ships' crew meeting identified challenges with parts and materials. For example, ships' crews described waiting for months or even years for parts or materials. More than half of the ships' crews we met with stated that they resorted to cannibalizing parts (taking functional parts from other ships) so that their respective ships could remain operational. According to ships' crews, personnel often keep submarines and surface vessels operational through unorthodox approaches

Source: GAO analysis of discussions with Navy personnel. | GAO-22-104510

- The parts inventory is often insufficient for crewmembers' needs. For example, there are backordered parts that will not be available until 2023. If crewmembers cannot find a part, they may not perform maintenance until that equipment or system is upgraded.
- Crewmembers tend to receive some parts only if their submarine is next in line for deployment.
- A crewmember ordered portable hard drives for migration of data to a new network. It took 7 months to get the parts, when the crewmember could have walked across the street and purchased them from a store the same day.
- Because many of the ship's systems are obsolete, new parts are often unavailable. Crewmembers are told simply to make it work. This leads to swapping parts and improvising.
- Crewmembers have to sift through 1,500 excess parts on the parts list that are no longer even built, all with relatively similar names or identification numbers and with no way to visually identify them. Then crewmembers often get the wrong parts from the supply system.

ADDITIONAL CHALLENGE: Performance of Maintenance

What Sailors Had to Say

Performance of Maintenance

Ships' crews in 10 out of 12 meetings identified challenges involving the performance of maintenance onboard ships. Sailors described spending an excessive amount of time obtaining supervisory approval to perform the maintenance, maintenance taking significantly longer to perform than allowed, and challenges with tagging out work so that it could be performed in a safe manner and without damaging equipment. Crewmembers, also described challenges with the guidance or instructions used to perform work such as missing technical manuals and maintenance requirements cards that were too generic to inform the sailor on how to perform the maintenance. Lastly, crewmembers describe frequently using workarounds, "duct tape" and "bubblegum" in order to get the ship good enough to get underway.

Source: GAO analysis of discussions with Navy personnel. | GAO-22-104510

- Sometimes a job that takes crewmembers 3 hours on paper requires 9 hours to be completed. When this happens, crewmembers extend the work to the next day or stay late.
- It is hard to complete a tag-out within expected timeframes ("tagging a system or equipment out" is the process of preparing the equipment to be safely maintained or repaired such as ensuring that there is no power flowing through a system). For example, tagging-out a piece of equipment that should take 15 minutes, takes an hour.
- How long a job is supposed to take does not take into account some other associated tasks (e.g. documenting job requirements and approvals; briefing the requirements; retesting; and closing out). A 2-hour preventative maintenance job more accurately takes 5 to 6 hours. With multiple projects, this can add up.
- Ships' crews just fix equipment with Band Aids so that a submarine can get underway. Essentially, a commanding officer does not want the ship to be perceived by superiors as the "boat that cannot get underway."
- Some equipment across the fleet is always broken. For example, high-pressure air compressors have been broken for a long time. When a piston cracked in one of the compressors, management's response to this problem for 3 years was to instruct the ship's crew to use it sparingly.

ADDITIONAL CHALLENGE: Low Priority of Maintenance

What Sailors Had to Say

Low Priority of Maintenance

Ships' crews in 10 out of 12 meetings described the performance of maintenance as a low priority onboard the ships. These crewmembers described maintenance as being a lower priority at times than obtaining certifications and training. Crewmembers from one ship also noted that any type of evolution onboard a ship curtails the performance of maintenance.

Source: GAO analysis of discussions with Navy personnel. | GAO-22-104510

- Maintenance is usually not a priority for a ship's leadership until leadership wonders why maintenance is incomplete.
- Maintenance is on the backburner during the week. This happens because crewmembers work hard all week on other tasks.
- Crewmembers often work on Saturdays and Sundays to accomplish maintenance because it was pushed to the side given the extra duties they must complete.
- Crewmembers stated that obtaining certifications and training, especially when ships need to get underway, are the highest priority.
- Whenever a ship is undergoing an evolution of any kind performing maintenance is frequently stopped.
- A crewmember stated that the biggest issue facing his crew is the condensed schedule. Under a condensed schedule, work starts to pile up due to other priorities such as training and interactions with outside contractors. There is no time for preventive maintenance.

Appendix II: Objectives, Scope, and Methodology

This report examined the extent to which the Navy (1) collected and used data regarding the performance of intermediate maintenance periods for submarines, surface ships, and aircraft carriers during fiscal years 2015 through 2020, and (2) has addressed challenges affecting the performance of intermediate maintenance periods.

The scope of our review included intermediate maintenance periods performed during fiscal years 2015 through 2020 on submarines, surface ships, and aircraft carriers, which account for about 200 of the Navy's approximately 260 active ships.[1] Our scope included the following submarines, surface ships, and aircraft carriers:[2]

Submarines:

- *Los Angeles*-class and *Virginia*-class attack submarines
- *Ohio*-class ballistic missile submarines

Surface ships:

- *Arleigh Burke*-class guided missile destroyers
- *Ticonderoga*-class guided missile cruisers
- *Whidbey Island*-class and *Harpers Ferry*-class dock landing ships
- *Wasp*-class amphibious assault ships
- *San Antonio*-class amphibious transport docks

Aircraft Carriers:

[1]The Navy refers to this maintenance in several ways: scheduled continuous maintenance availability (CMAV); pre-overseas movement; and planned window of opportunity maintenance periods. In this report, we use the term "intermediate maintenance period" to describe these various terms.

[2]We generally excluded classes of ships with three or fewer operational submarines or ships such as the *America*-class amphibious assault ships and *Seawolf*-class fast attack submarines. We also excluded both classes of Littoral Combat Ships—due to related, recently completed GAO work and limited deployment history—coastal patrol boats; and mine countermeasures ships. For more information on the Littoral Combat Ships see GAO, *Littoral Combat Ship: Unplanned Work on Maintenance Contracts Creates Schedule Risk as Ships Begin Operations,* GAO-21-172 (Washington, D.C.: Apr. 29, 2021).

- *Nimitz*-class aircraft carriers

Our scope also included the following locations of 12 homeports in which these ships were located as of October 2021:

- Naval Submarine Base New London (Groton, Connecticut)
- Naval Station Norfolk (Norfolk, Virginia)/Joint Expeditionary Base Little Creek-Fort Story (Virginia Beach, Virginia)
- Naval Submarine Base Kings Bay (Kings Bay, Georgia)
- Naval Station Mayport (Mayport, Florida)
- Naval Base San Diego, Naval Base Coronado, Naval Base Point Loma (San Diego, California)
- Naval Base Kitsap-Bangor (Bangor, Washington)
- Naval Station Everett (Everett, Washington)
- Joint Base Pearl Harbor-Hickam (Pearl Harbor, Hawaii)
- Naval Station Rota (Rota, Spain)
- Commander Fleet Activities Yokosuka (Yokosuka, Japan)
- Commander Fleet Activities Sasebo (Sasebo, Japan)
- Naval Base Guam (Apra Harbor, Guam)

Because Navy ships' crews perform organizational-level maintenance as part of intermediate maintenance periods, in addition to performing it while in port and underway, we focused on planned intermediate maintenance periods. The Navy typically schedules intermediate maintenance periods more frequently and for a much shorter duration than Chief of Naval Operations (CNO) maintenance periods.[3] The scheduled duration of these maintenance periods varies based on whether the periods apply to submarines, surface ships, or aircraft carriers.

For objective one, we analyzed the Navy's available intermediate maintenance period data. We asked the Navy for the following fiscal year 2015 through 2020 data for each completed intermediate maintenance period for the submarines and surface ships:

[3]CNO maintenance periods are equivalent to depot-level maintenance, which exceeds the capacity of fleet and intermediate maintenance facilities and may be performed at a public or private shipyard.

- Planned and actual start and completion dates, including the causes of any delays if a period took longer than planned to complete;
- Actual number of jobs completed;
- The number of jobs and associated actual days of labor that were deferred to another planned maintenance period; and
- Planned and actual costs.

For aircraft carriers, we asked the Navy only for data on planned and actual start and completion dates. During the course of our review, we received conflicting information about what types of maintenance periods constituted intermediate maintenance periods for aircraft carriers. Initially, Navy officials told us that there were no planned intermediate maintenance periods for aircraft carriers. In July 2021, type commander (TYCOM) officials told us that aircraft carriers' planned windows of opportunity maintenance periods met our definition of intermediate maintenance periods. We then focused our requests for information about intermediate maintenance periods for aircraft carriers on planned and actual start and completion dates.

We did not receive complete intermediate maintenance period data to support analysis for submarines, surface ships, and aircraft carriers. To assess the reliability of the data we did receive, we reviewed the data for anomalies, such as whether the start date for a maintenance period occurred later than the completion date, and asked Navy officials to explain any discrepancies or outliers that we encountered. We also asked the Navy officials questions about the reliability of the data and received responses from them during meetings and in writing. We found the data that we did use to be sufficiently reliable for the purpose of our report. Below we discuss the available data specific to submarines, surface ships, and aircraft carriers.

Submarines. The Navy provided us data on planned and actual start and completion dates for intermediate maintenance periods, which we found to be reliable. We ensured that these data were reliable by reviewing them for anomalies and asking the Navy for explanations when we found potential mistakes or outliers. We were able to use these data to determine the days of maintenance delay for the periods. We also used the actual start and completion dates to analyze the average number of days for each completed period.

We determined the days of maintenance delay by comparing Navy-compiled data on planned and actual days needed to complete 414

intermediate maintenance periods.[4] That is, we subtracted the number of days the Navy planned to complete an intermediate maintenance period from the actual days it took to complete the period.[5] We completed this analysis for each of the 414 intermediate maintenance periods to obtain the days of maintenance delay for the periods. We then added together the days of maintenance delay across all submarines to obtain the overall total days of maintenance delay for submarines. We subsequently grouped the intermediate maintenance periods into three categories: periods finished early, on time, and late. We then determined the percentage for each category by dividing the result for that category by the total number of intermediate maintenance periods within the scope of our engagement.

In addition to calculating days of maintenance delay for all submarines, we also calculated them for submarines by fiscal year.[6] This allowed us to determine whether the number of days of maintenance delay for each year were increasing, decreasing, or remaining the same. We completed our analysis of the days of maintenance delay for intermediate maintenance periods for submarines by grouping the submarines by their shore-based maintenance providers. We calculated the average number of days of maintenance delay for intermediate maintenance periods completed late and total days of maintenance delay for each of the shore-based maintenance providers. We also divided the number of intermediate maintenance periods completed late for each shore-based

[4]Specifically, we reviewed data for scheduled Continuous Maintenance Availabilities (CMAV) and Pre-Overseas Movement 1 and 2 periods. The Navy compiled these data from Lead Maintenance Activity "Departure and Assessment" reports and spreadsheets, according to Navy officials. We did not include the following intermediate maintenance periods in our analysis: maintenance periods completed at Naval Base Guam because submarine tenders completed them and maintenance periods completed at Puget Sound Naval Station and Intermediate Maintenance Facility because they included *Seawolf*-class submarines, which were outside of the scope of this report.

[5]The Navy referred to additional days needed to complete intermediate maintenance periods as "unplanned days" in its data submission to us. We have referred to them as "days of maintenance delay" to align with our terminology in past reports. For example, see GAO, *Navy Maintenance: Persistent and Substantial Ship and Submarine Maintenance Delays Hinder Efforts to Rebuild Readiness,* GAO-20-257T (Washington, D.C.: Dec. 4, 2019), and *Navy Shipyards: Actions Needed to Address the Main Factors Causing Maintenance Delays for Aircraft Carriers and Submarines,* GAO-20-588 (Washington, D.C.: Aug. 20, 2020).

[6]We assigned fiscal years to the intermediate maintenance periods according to when the Navy reported that the shore-based maintenance providers completed the maintenance periods.

maintenance provider by the total number of intermediate maintenance periods each provider completed. This analysis allowed us to calculate the percentage of intermediate maintenance periods each shore-based maintenance provider completed late out of their total completed periods.

Surface ships. The Navy provided us inaccurate and unreliable data on intermediate maintenance periods for surface ships, and we were unable to perform any analyses regarding the timely completion of intermediate maintenance periods. We determined that the Navy-compiled data were inaccurate and unreliable due to missing dates or our identifying anomalies—for example, actual completion dates that preceded the actual start dates, among other issues.[7]

Aircraft carriers. The Navy provided us partial data on intermediate maintenance periods for aircraft carriers that we determined were unreliable for determining the completion of these periods. For example, the Navy provided planned start and completion dates, not actual start and completion dates, which we needed to determine days of maintenance delay for the periods. Through identification of anomalies in the planned start and completion dates and through discussions with Navy officials, we determined that the data provided were unreliable.

Overall, the Navy was unable to provide reliable data for the other types of data we requested related to the performance of intermediate maintenance periods on submarines, surface ships, and aircraft carriers. We compared the reliability of these data against the *Navy's Maintenance Policy for Navy Ships*, which requires that the Navy obtain maintenance completion and cost data to help refine maintenance actions through the development of lessons learned.[8] Specifically, the *Joint Fleet Maintenance Manual* states that fleet commander and TYCOMs plan and monitor availability execution and monitor corrective maintenance actions

[7]We determined the data were unreliable by analyzing information provided by Commander, Naval Regional Maintenance Center from Mid-Atlantic Regional Maintenance Center, Southeast Regional Maintenance Center, and Southwest Regional Maintenance Center. During our analysis, we found that Southeast Regional Maintenance Center provided the planned, not the actual, number of days for the 148 intermediate maintenance periods it completed. In addition, we found that Southwest Regional Maintenance Center provided data on 280 maintenance periods, of which 138 had planned start dates beginning later than the planned completion dates, while 165 periods had actual completion dates ending before the actual start dates.

[8]Chief of Naval Operations Instruction (OPNAVINST) 4700.7M, *Maintenance Policy for Navy Ships* (May 8, 2019).

taken, respectively.[9] We also compared the reliability of these data against *Standards for Internal Control in the Federal Government*, which states that management should use quality information to achieve the entity's objectives by identifying information requirements, obtaining relevant data from reliable sources, and processing the obtained data into quality information that supports the internal control system.[10]

For objective two, we engaged ships' crews in discussion groups about challenges to ship maintenance and efforts to address those challenges, and asked officials responsible for shore-based intermediate maintenance corroborative questions related to those discussions. To understand the challenges affecting the performance of intermediate maintenance periods and the organizational-level maintenance included in those maintenance periods, we spoke with ships' crews from submarines, surface ships, and aircraft carriers within the scope of our review and from eight of the homeports to which these crews' ships had been assigned as of April 2021. We held 12 discussion groups with 107 junior and senior enlisted sailors from 16 submarines, surface ships, and aircraft carriers to discuss challenges affecting the completion of maintenance from the crews' perspectives. Specifically, we met with ships' crews from the following types and classes of ships:

- three *Los Angeles*-class and one *Virginia*-class fast attack submarines
- three *Ohio-class* ballistic missile submarines
- two *Arleigh Burke*-class guided missile destroyers
- one *Ticonderoga*-class guided missile cruiser
- one *Whidbey Island*-class and one *Harpers Ferry*-class dock landing ship
- one *Wasp*-class amphibious assault ship
- one *San Antonio*-class amphibious transport dock
- two *Nimitz*-class aircraft carriers

[9]Commander, U.S. Fleet Forces Command Instruction (COMUSFLTFORCOMINST) 4790.3, *Joint Fleet Maintenance Manual* (Jan. 15, 2021) (incorporating revision D, change 1).

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

These crews represented submarines, surface ships, and aircraft carriers from Navy homeports in the following locations:

- Naval Submarine Base New London (Groton, Connecticut)
- Naval Station Norfolk (Norfolk, Virginia)/Joint Expeditionary Base Little Creek-Fort Story (Virginia Beach, Virginia)
- Naval Station Mayport (Mayport, Florida)
- Naval Base Coronado (San Diego, California)
- Naval Station Kitsap-Bangor (Bangor, Washington)
- Joint Base Pearl Harbor-Hickam (Pearl Harbor, Hawaii)
- Naval Station Rota (Rota, Spain)
- Commander Fleet Activities, Yokosuka (Yokosuka, Japan)

We identified the type and class of submarine or ship from each homeport to be as inclusive of the homeports in the scope of our review as possible while minimizing the impact to those ships missions. To do this, we requested that the Navy provide 8 to 12 sailors for each meeting and allowed the Navy to both identify the available submarine or ship and select junior and senior enlisted crew based on the location, class of ship, and time frames we identified for holding the meetings. We also asked the Navy to include representatives from multiple crews of the same class of ship if available. For example, we held one discussion group for *Los Angeles*-class submarines from Pearl Harbor, which included representatives from three different *Los Angeles*-class submarines. Similarly, we held one meeting with crews from *Ohio*-class ballistic missile submarines, which also included representatives from three different submarines. In two other cases, we held multiple meetings with different crews from the same class of ships for the *Arleigh Burke*-class guided missile cruiser and the *Nimitz*-class aircraft carriers. Although the views of these participants cannot be generalized to all sailors in the Navy, they provide insights into the challenges sailors face while performing maintenance.

We held the discussion group meetings with ship's crew members responsible for performing maintenance, informed by ship maintenance challenges detailed in prior GAO reports.[11] Specifically, we asked questions about any challenges the sailors faced while performing

[11]For example, see GAO-20-86 and GAO-20-588.

maintenance and efforts they undertook to mitigate those challenges. We performed a content analysis of the 12 discussion groups we held with the ships' crews to identify challenges shared by the crews during those meetings. Two analysts independently reviewed the notes from the discussion group meetings to identify common challenges identified by the ships' crews. The analysts then compared their results to reach a consensus.

We characterized challenges to ship maintenance that every discussion group identified as main challenges to ship maintenance, and challenges raised by the majority of the ships' crews as other challenges. The list of challenges may not represent all challenges sailors face while performing organizational-level maintenance. The perspectives provided by the ships' crews from 16 ships regarding challenges to maintenance are not generalizable across the fleet of Navy warships, but corroboration by officials and examples provided in the meetings with ships' crews provide important insights into actual conditions in the fleet. See appendix I for more detailed examples from the ships' crews regarding these challenges.

In addition to these crew discussion group meetings, we interviewed Navy officials with responsibility for, and awareness of, the performance of intermediate maintenance periods including officials from Naval Sea Systems Command; Commander, Navy Regional Maintenance Centers; the submarine, surface ship, and aircraft carrier type commanders; and officials from shore-based maintenance providers such as the Mid-Atlantic, Southeast, and Southwest Regional Maintenance Centers, among others.

We corroborated the results of our content analysis of the ships' crews discussion groups by having independent analysts review notes and perform a content analysis from the meetings and written responses from headquarters-level officials and shore-based intermediate maintenance provider officials to determine if they corroborated challenges identified by the ships' crews. Specifically we met with, or received written responses from, officials from the following organizations:

Department of the Navy

- U.S. Fleet Forces Command
  - Commander, Naval Air Force, U.S. Atlantic Fleet
  - Commander, Naval Surface Force, U.S. Atlantic Fleet
  - Commander, Submarine Force, U.S. Atlantic Fleet
- U.S. Pacific Fleet
  - Commander, Naval Air Force, U.S. Pacific Fleet
  - Commander, Naval Surface Force, U.S. Pacific Fleet
  - Commander, Submarine Force, U.S. Pacific Fleet
- Program Executive Office Submarines
- Naval Sea Systems Command (NAVSEA)
  - Industrial Operations
  - Submarine Maintenance Engineering, Planning, and Procurement
  - Surface Maintenance Engineering Planning Program
  - Director for Surface Ship Maintenance and Modernization
- Shore-based maintenance providers
  - Commander, Navy Regional Maintenance Centers (CNRMC)—including Mid-Atlantic, Southeast, and Southwest Regional Maintenance Centers (RMC)
  - Regional Support Group and Naval Submarine Support Facility, Submarine Base New London, Groton, Connecticut
  - Submarine Tender, Naval Base Guam, Apra Harbor, Guam
  - Naval Station Norfolk, Norfolk, Virginia
  - Portsmouth Naval Shipyard, Kittery, Maine, (including their San Diego detachment)
  - Pearl Harbor Naval Shipyard & Intermediate Maintenance Facility, Pearl Harbor, Hawaii
  - Puget Sound Naval Shipyard & Intermediate Maintenance Facility, Bremerton, Washington

In addition, we analyzed the Navy's departure from specifications data to determine the frequency with which the Navy had completed repairs

outside of the specifications or requirements normally applied to submarines.

To determine what efforts, if any, the Navy has undertaken to address the four main challenges affecting the performance of intermediate maintenance periods identified from group discussions, we interviewed Navy officials and senior leadership and requested information from these officials about their efforts to improve ship maintenance. We analyzed the information provided by the Navy in response to our questions and then compared the results with best practices for coordinating work as well as for sharing lessons learned, such as those identified in our prior reports related to ship maintenance.[12]

To determine whether the Navy considered the performance of intermediate maintenance periods in strategic planning and related efforts, we identified Navy maintenance strategies—such as the Navy's *Maintenance Policy for Navy Ships, the Joint Fleet Maintenance Manual*, the CNO's *Navigation Plan 2021*, the NAVSEA *Campaign Plan to Expand the Advantage 3.0*, and the Shipyard Infrastructure Optimization Program, among other things, to determine what efforts the Navy had undertaken to address these challenges.[13] We reviewed the CNO's *Transforming Naval Logistics for Great Power Competition* strategy that states the Navy should formally establish the structure, governance, and authorities to provide a single voice for naval logistics and a mechanism for strategic coordination among logistics stakeholders.[14] We also reviewed the Navy's previous Performance to Plan (P2P) strategic efforts to improve the maintenance operations for *Arleigh Burke*-class destroyers (P2P Surface) and at the Navy's four shipyards for submarines and aircraft carriers (P2P

[12]GAO, *Military Depots: DOD Can Benefit from Further Sharing of Best Practices and Lessons Learned*, GAO-20-116 (Washington, D.C.: Jan. 30, 2020).

[13]Documents we reviewed include the following: DOD Directive 4151.18, *Maintenance of Military Materiel* (March 31, 2004) (Incorporating Change 1, Aug. 31, 2018); DOD Instruction 1336.07, *Management of Personnel Tempo* (Dec. 28, 2020); CNO, *Navigation Plan 2021* (Jan, 2021); OPNAVINST 4700.7M; COMUSFLTFORCOMINST 4790.3; NAVSEA, *Campaign Plan to Expand the Advantage 3.0* (Jan. 2021); and Department of the Navy, *The Shipyard Infrastructure Optimization Program (SIOP): President's Fiscal Year 22 Budget 5-Year Plan* (Sept. 2021). See also GAO-14-704G. We used the following seven principles from the *Standards for Internal Control in the Federal Government* as applicable: (1) Establish Structure, Responsibility, and Authority; (2) Demonstrate Commitment to Competence; (3) Identify, Analyze, and Respond to Risk; (4) Identify, Analyze, and Respond to Change; (5) Design Control Activity; (6) Design Activities for the Information System; and (7) Evaluate Issues and Remediate Deficiencies.

[14]CNO, *Transforming Naval Logistics for Great Power Competition* (January 2021).

Shipyards). To the extent that the Navy's strategic plans and related initiatives considered Navy ship maintenance, we determined that these efforts primarily focused on the performance of CNO maintenance periods

We conducted this performance audit from September 2020 to February 2022 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.

Appendix III: Comments from the Department of the Navy

DEPARTMENT OF THE NAVY
OFFICE OF THE ASSISTANT SECRETARY
RESEARCH, DEVELOPMENT AND ACQUISITION
1000 NAVY PENTAGON
WASHINGTON, DC 20350-1000

JAN 2 1 2022

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

Dear Ms. Maurer:

Attached are the Department of Defense (DoD) technical comments and responses to the recommendations in GAO Draft Report GAO-22-104510 "NAVY SHIP MAINTENANCE: Actions Needed to Monitor and Address the Performance of Intermediate Maintenance Periods" (GAO Code 104510).

Sincerely,

Frederick J. Stefany
Principal Civilian Deputy Assistant Secretary of the Navy
(Research, Development and Acquisition)
Performing the Duties of the Assistant Secretary of the Navy
(Research, Development and Acquisition)

Attachments:
As Stated

GAO DRAFT REPORT DATED NOVEMBER 22, 2021
GAO-22-104510 (GAO CODE 104510)

"NAVY SHIP MAINTENANCE: ACTIONS NEEDED TO MONITOR AND ADDRESS THE PERFORMANCE OF INTERMEDIATE MAINTENANCE PERIODS"

DEPARTMENT OF DEFENSE COMMENTS TO THE GAO RECOMMENDATION

RECOMMENDATION 1: The GAO recommends that the Secretary of the Navy should ensure that the shore-based maintenance providers and the Fleet/Type Commanders establish and implement procedures to collect and analyze complete and reliable data on the performance of intermediate maintenance periods for submarines, surface ships, and aircraft carriers. These data include the planned and actual start and completion dates, costs, and the causes of any delays in the completion of maintenance periods, amongst others.

DoD RESPONSE: Concur. The Navy recognizes the value of data collection and is taking action to standardize the collection and analysis of Intermediate Maintenance Period data at Regional Maintenance Centers and within the four public shipyards and at NAVSEA headquarters.

RECOMMENDATION 2: The GAO recommends that the Secretary of the Navy should ensure that a single entity is designated to address challenges affecting intermediate maintenance periods for submarines, surface ships, and aircraft carriers.

DoD RESPONSE: Concur. NAVSEA is the lead organization tasked with improving Intermediate Maintenance in close partnership with Fleet and the Type Commanders to execute these responsibilities, and recognizing platform specific lifecycle maintenance requirements.

RECOMMENDATION 3: The GAO recommends that the Secretary of the Navy should ensure that shore-based maintenance providers' and Fleet/Type commanders implement a mechanism to share best practices and lessons learned regarding the performance of intermediate maintenance periods across submarines, surface ships, and aircraft carriers.

DoD RESPONSE: Concur. While the Navy has internal processes and forums to share best practices and lessons learned that enable knowledge sharing across the enterprise, the Navy will expand those efforts to standardize the procedures for collection and analysis of complete and reliable data on the performance of Intermediate Maintenance.

RECOMMENDATION 4: The GAO recommends that the Secretary of the Navy should ensure that the Navy's maintenance-related, strategic planning and initiatives, such as its

Performance to Plan efforts, include issues associated with the performance of intermediate maintenance periods.

DoD RESPONSE: Concur. The Navy will leverage the Performance to Plan and Naval Sustainment System forums to drive improvements to maintenance as a whole, encompassing both intermediate and depot level maintenance.

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

JAN 21 2022

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Frederick J. Stefany
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(Research, Development and Acquisition)
Performing the Duties of the Assistant Secretary of the Navy (Research, Development and Acquisition)

Attachments
As Stated

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Appendix IV: GAO Contact and Staff Acknowledgments

GAO Contact

Diana Maurer, 202-512-9627 or maurerd@gao.gov

Staff Acknowledgments

In addition to the contact listed above, Jodie Sandel (Assistant Director), Scott M. Behen (Analyst-in-Charge), John Craig, Gina M. Hoover, David L. Jones, Mae F. Jones, Felicia Lopez, Keith E. McDaniel, Kevin Newak, Michael Perkins, and John E. “Jet” Trubey made key contributions to this report.

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