United States Government Accountability Office

Report to Congressional Committees

October 2020

# NAVY MAINTENANCE

# Navy Report Did Not Fully Address Causes of Delays or Results-Oriented Elements

GAO-21-66

# GAO Highlights

Highlights of GAO-21-66, a report to congressional committees

October 2020

# NAVY MAINTENANCE

## Navy Report Did Not Fully Address Causes of Delays or Results-Oriented Elements

## Why GAO Did This Study

The Navy generally has been unable to complete ship and submarine maintenance on time, resulting in reduced time for training and operations, and additional costs. The Navy's ability to successfully maintain its ships is affected by numerous factors throughout a ship's life cycle, such as decisions made during acquisition, which occurs years before a ship arrives at a shipyard for maintenance. Others manifest during operational use of the ship or during the maintenance process.

The conference report accompanying a bill for the Fiscal Year 2020 Consolidated Appropriations Act directed the Secretary of the Navy to submit a report identifying the underlying causes of maintenance delays for aircraft carriers, surface ships, and submarines and to include elements of results-oriented management. The conference report also included a provision for GAO to review the Navy's report that was released in July 2020. This report evaluates the extent to which the Navy's report (1) identifies the underlying causes of maintenance delays and (2) incorporates elements of results-oriented management. GAO reviewed the Navy's report and interviewed Navy officials.

## What GAO Recommends

Since 2015, GAO has made 39 unclassified recommendations related to Navy maintenance delays. The Navy or the Department of Defense concurred or partially concurred with 37 recommendations, and had implemented six of them as of September 2020.

View GAO-21-66. For more information, contact Diana Maurer at (202) 512-9627 or MaurerD@gao.gov.

## What GAO Found

The Navy's July 2020 report identified two key causes and several contributing factors regarding maintenance delays for aircraft carriers, surface ships, and submarines, but did not identify other causes. For public shipyards, the Navy's report identified the key cause of maintenance delays as insufficient capacity relative to growing maintenance requirements. For private shipyards, the Navy's report identified the key cause as the addition of work requirements after a contract is awarded. These causes and other identified factors generally align with factors that GAO has previously identified as originating during the maintenance process. However, the Navy's report did not consider causes and factors originating in the acquisition process or as a result of operational decisions, as shown below.

**GAO-Identified Factors Contributing to Maintenance Delays That the Navy Identified in Its July 2020 Report**

| Acquisition | Operations | Maintenance |
|---|---|---|
| × Ineffective requirements for ship reliability and maintainability | × Ships' low crew levels and performance | ✓ Workforce capacity, capability, and prioritization |
| × Ineffective acquisition oversight of issues impacting sustainment | × Deferred maintenance | ✓ Unplanned work |
| × Optimistic sustainment assumptions not evaluated | × Extended deployments | ✓ Adherence to planning process |
| × Providing ships to fleet with defects due to gaps in the Navy's delivery policy | | ✓ Condition of facilities and equipment |
| × Insufficient technical data | | ✓ Insufficient shipyard capacity |
| | | ✓ Availability of parts and materials |
| | | ✓ Information technology infrastructure |
| | | × Modernizations and alterations |

✓ = Identified in the Navy's July 2020 report as contributing to maintenance delays
× = Not identified in the Navy's July 2020 report as contributing to maintenance delays

Source: GAO and GAO analysis of Navy documents. | GAO-21-66

The report identified stakeholders needed to implement action plans, but did not fully incorporate other elements of results-oriented management, including achievable goals, metrics to measure progress, and resources and risks. Some examples from the report:

- **Stakeholders**: Identified Naval Sea Systems Command as the primary implementer of most initiatives related to maintenance at shipyards.
- **Goals**: Included a goal of reducing days of maintenance delay by 80 percent during fiscal year 2020.The Navy did not achieve this goal based on GAO's analysis of Navy data.
- **Metrics**: Included some metrics. The Navy is still identifying and developing other key metrics.
- **Resources**: Did not identify costs of the actions in the report.
- **Risks**: Identified as risks the coronavirus pandemic, unstable funding, and limited material availability. However, the report did not assess additional risks that GAO previously identified.

# Contents

## Abbreviations

| | |
|---|---|
| COVID-19 | Coronavirus Disease 2019 |
| DOD | Department of Defense |
| NAVSEA | Naval Sea Systems Command |

U.S. GOVERNMENT ACCOUNTABILITY OFFICE
441 G St. N.W.
Washington, DC 20548

October 29, 2020

Congressional Committees

The 2018 National Defense Strategy states that restoring and retaining readiness is critical in the emerging security environment.[1] The Navy is working to rebuild its readiness while also growing and modernizing its aging fleet of aircraft carriers, surface ships, and submarines. Completing maintenance on time is integral to supporting fleet readiness, meeting strategic and operational requirements, and ensuring the Navy's ships reach their expected service lives. Since delays in maintenance result in fewer available ships for training or operations, a critical component for the Navy to rebuild and maintain readiness is completing maintenance on time.[2] However, the Navy has continued to face persistent maintenance delays that affect the majority of its maintenance efforts and threaten its attempt to restore readiness.

Since 2015, we have issued more than 20 reports and testimonies examining Navy maintenance challenges, shipyard workforce and capital investment, ship crewing, scheduling, force structure, and acquisition decisions (see Related GAO Products at the end of this report). We testified in December 2019 about significant, ongoing maintenance delays for aircraft carriers, surface ships, and submarines during fiscal years 2014 through 2019.[3] Since 2015, we have made 39 unclassified recommendations to the Navy or to Department of Defense (DOD) components in coordination with the Navy related to Navy maintenance delays. The Navy or DOD concurred or partially concurred with 37 recommendations, and had implemented six of them as of September 2020.

The conference committee report accompanying a bill for the Fiscal Year 2020 Consolidated Appropriations Act directed the Secretary of the Navy to assign responsibility to conduct a comprehensive and systematic

[1]DOD, *Summary of the 2018 National Defense Strategy of the United States of America* (Jan. 19, 2018).

[2]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).

[3]GAO-20-257T.

analysis to identify the underlying causes of aircraft carrier, surface ship, and submarine maintenance delays and to submit a report on its findings to congressional defense committees and GAO.[4] The conference report also directed the Navy to include results-oriented elements in the report, including analytically based goals related to maintenance delays; results-oriented metrics to measure progress; and required resources, risks, and stakeholders to achieve those goals.[5] Further, Congress included a provision for us to submit a review of the report to the congressional defense committees not later than 90 days after receiving the report from the Navy. That report was released in July 2020 (hereafter referred to as the July 2020 report). This report evaluates the extent to which the Navy's July 2020 report (1) identified the underlying causes of aircraft carrier, surface ship, and submarine maintenance delays, and (2) identified actions to address maintenance delays and incorporates elements of results-oriented management.

For our first objective, we reviewed the July 2020 report to identify the causes of maintenance delays described in the report. In particular, we compiled a list of factors contributing to maintenance delays based on our recent prior work on Navy maintenance.[6] We categorized each factor by the phase of a ship's life cycle in which it occurs, namely: acquisition,

[4]H. Rep. Comm. Print No. 38-678, *Consolidated Appropriations Act, 2020*, 138 (January 2020).

[5]Our past work on results-oriented management cites a number of key practices that can strengthen the use of performance information for process improvements. These practices include aligning agency-wide goals and measures, and building analytic capacity to use the information. Our past work has further shown this information should then be incorporated into improvement plans that include identifying analytically based goals; results-oriented metrics to measure progress; and required resources, risks, and stakeholders to achieve those goals. See GAO, *Military Depots: Actions Needed to Improve Poor Conditions of Facilities and Equipment That Affect Maintenance Timeliness and Efficiency*, GAO-19-242 (Washington, D.C.: Apr. 29, 2019); GAO, *Managing For Results, Data-Driven Performance Reviews Show Promise but Agencies Should Explore How to Involve Other Relevant Agencies*, GAO-13-228 (Washington, D.C.: Feb. 27, 2013); GAO, *Government Performance: Strategies for Building a Results-Oriented and Collaborative Culture in the Federal Government*, GAO-09-1011T (Washington, D.C.: Sept. 24, 2009).

[6]GAO-20-257T; 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); GAO, *Navy Ship Maintenance: Actions Needed to Address Maintenance Delays for Surface Ships Based Overseas*, GAO-20-86 (Washington, D.C.: Feb. 26, 2020); GAO, *Navy Shipbuilding: Increasing Focus on Sustainment Early in the Acquisition Process Could Save Billions*, GAO-20-2 (Washington, D.C.: Mar. 24, 2020).

operations, and maintenance. We then developed an analysis tool to compare the causes and contributing factors of maintenance delays identified in the July 2020 report with those identified in our list. Two analysts independently used this analysis tool to determine whether the Navy had identified each factor from our list in their report. A third analyst adjudicated any differences in their determinations. We determined that the information and communication component of internal control was relevant to this objective, along with the underlying principle that management should use quality information to achieve the agency's objectives.[7] We evaluated this standard by comparing the information on causes of maintenance delays in the Navy's July 2020 report with the causes previously identified by GAO, as described previously. Finally, we met with officials in the Office of the Deputy Assistant Secretary of the Navy (Ships) and Naval Sea Systems Command (NAVSEA) to discuss the report's contents and methodology.

For our second objective, we reviewed the July 2020 report to determine what actions the report identifies to address maintenance delays. We also developed a second analysis tool to assess the extent to which the July 2020 report included elements of results-oriented management: analytically based goals; results-oriented metrics to measure progress; and required resources, risks, and stakeholders to achieve those goals. Two analysts used the analysis tool to independently assess the extent to which each element was included in the July 2020 report. A third analyst adjudicated any differences based on the report. We determined that the control environment and risk assessment components of internal control were relevant to this objective, along with the underlying principles that management should establish an organizational structure, assign responsibility, and delegate authority to achieve the entity's objectives, and define objectives clearly to enable the identification of risks.[8] As part of our assessment of the Navy's July 2020 report, we compared the Navy's report to these principles. Further, we met with officials in the Office of the Deputy Assistant Secretary of the Navy (Ships) and NAVSEA to discuss the July 2020 report's contents and the extent to which it included elements of results-oriented management. We used this information to add additional context to our report, but did not specifically

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

[8]GAO-14-704G.

consider the additional information when determining the extent to which the report itself included results-oriented elements.

We conducted this performance audit from June 2020 to October 2020 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

# Background

## Maintenance Infrastructure and Organizations

The Navy generally performs maintenance for the nuclear elements of the fleet (i.e., aircraft carriers and submarines) at the four public naval shipyards.[9] Contractors generally perform maintenance for the conventional elements of the fleet (e.g., cruisers, destroyers, amphibious assault ships, and Military Sealift Command ships) at private shipyards and ship repair companies throughout the United States.

The responsibilities for setting maintenance policies and planning, scheduling, and executing ship maintenance are shared among a number of organizations and commands within the Navy. Among those sharing such duties are the offices of the Secretary of the Navy, the Chief of Naval Operations, fleet commanders, and ships' crews.[10]

NAVSEA is the primary Navy ship maintenance organization. It is charged with, among other things, maintaining ships to meet fleet requirements within defined cost and schedule parameters; managing critical modernization, maintenance, and inactivation programs; managing maintenance requirements over a ship's life cycle; and managing and overseeing the public shipyards. Also, NAVSEA's offices perform contract administration, program management, and planning for future

[9]"Public" in this context means government-owned. Hereafter in this report we refer to the public naval shipyards as "public shipyards."

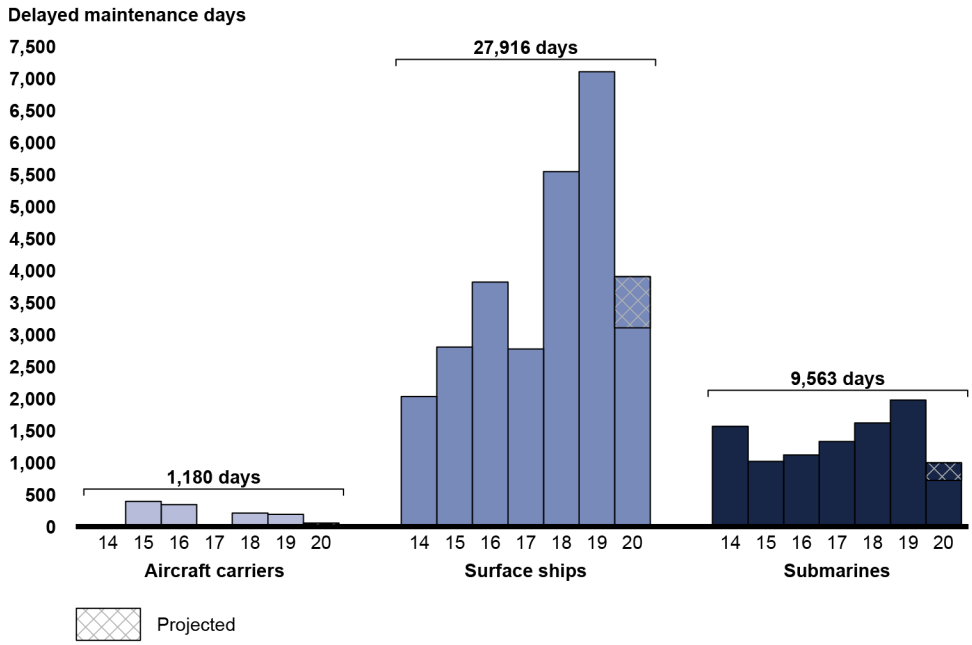
[10]The Navy categorizes ship maintenance at three levels: organizational maintenance, which is conducted by crews as part of their duties; intermediate maintenance, which exceeds the capacity of the crew and requires additional support, such as the use of fleet maintenance organizations; and depot-level maintenance, which exceeds the capacity of an intermediate maintenance facility and may be performed at a public or private shipyard.

maintenance periods informed by the historical maintenance needs of Navy ships.

## GAO's Prior Work on Maintenance Delays

Our prior work has found that the Navy generally has been unable to complete ship and submarine maintenance on time, resulting in reduced time for training and operations and additional costs in a resource-constrained environment. The Navy's efforts to restore its readiness are premised on the adherence to set deployment, training, and maintenance schedules. However, from fiscal year 2014 to the end of fiscal year 2020, the Navy had incurred over 38,600 days of maintenance delay (see fig. 1).

**Figure 1: Days of Maintenance Delay for Aircraft Carriers, Surface Ships, and Submarines, Fiscal Years 2014–2020**

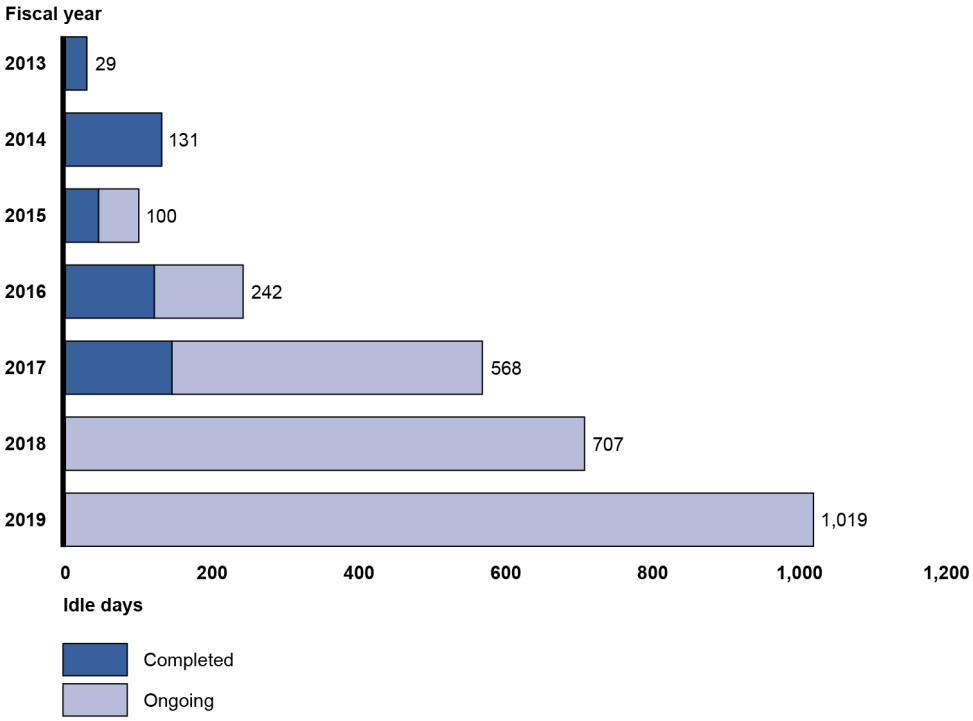



Source: GAO analysis of Navy data. | GAO-21-66

Note: Delayed maintenance days are allocated to the fiscal year in which they occurred. Days of maintenance delay that are projected between July 1, 2020, and September 30, 2020, are marked in the fiscal year 2020 column above. Delayed maintenance days data for aircraft carriers for this analysis are limited to the Navy's public shipyards and do not include data from private shipyards. Data for submarines includes days of maintenance delay for maintenance conducted at both public and private shipyards. Surface-ship maintenance is conducted at private shipyards. We analyzed data relating to days of delayed maintenance as of July 2020. Projected days are GAO estimates based on the Navy's projected completion dates.

In addition, we reported in August 2020 that idle time for submarines—time when submarines are waiting for available facilities to begin a maintenance period and unable to conduct normal operations—has grown in both frequency and duration every year since fiscal year 2015.[11] Submarines with completed or ongoing maintenance periods from fiscal years 2015 through 2019 incurred 2,796 days of idle time—the equivalent of nearly 8 years (see fig. 2).

**Figure 2: Idle Time Incurred on Completed and Ongoing Submarine Maintenance Periods from Fiscal Years 2015–2019**




Source: GAO analysis of Navy data. | GAO-21-66

Note: Idle time occurs on submarines whose safety certifications have expired or will soon expire and prevent the submarines from performing submerged operations while awaiting available facilities to begin a maintenance period. Our analysis included idle time incurred in fiscal years 2013 and 2014 on two of the five submarines whose maintenance periods were completed from fiscal years 2015 through 2019.

When maintenance is not completed on time, there are two primary effects. First, fewer ships are available to conduct training or operations,

[11]GAO-20-588.

which can hinder readiness. For example, in fiscal year 2019, maintenance delays resulted in the Navy losing the equivalent of 19 surface ships.[12] Second, maintenance delays are costly. In November 2018, we examined attack submarine maintenance delays and reported that the Navy incurred significant operating and support costs to crew and maintain attack submarines that are delayed during maintenance periods.[13] We estimated that from 2008 to 2018, the Navy spent $1.5 billion to support attack submarines that provided no operational capability, including submarines sitting idle.[14]

In addition, our prior work has found that the Navy's ability to successfully maintain its ships—meaning the completion of all required maintenance on time and within estimated cost—is affected by numerous factors occurring throughout a ship's life cycle.[15] Some of these factors involve decisions made during the acquisition phase, which occurs years before a ship arrives at a shipyard for maintenance. Other factors manifest during operational use of the ship or during the maintenance phase, as illustrated in figure 3.

[12]GAO-20-257T.

[13]GAO, *Navy Readiness: Actions Needed to Address Costly Maintenance Delays Facing the Attack Submarine Fleet*, GAO-19-229 (Washington, D.C.: Nov. 19, 2018).

[14]We calculated the costs in fiscal year 2018 constant dollars. While acknowledging the magnitude of these costs, Navy officials stated that there may be some benefits that could be realized from supporting these idle attack submarines since crews on idle attack submarines can conduct some limited training. See GAO-19-229.

[15]GAO-20-2, GAO-20-86, GAO-20-588, and GAO-20-257T.

**Figure 3: GAO-Identified Factors Contributing to Delays in Navy Maintenance during Three Phases**

| Factor | GAO's analysis |
|---|---|
| **Acquisition** | |
| Ineffective requirements for ship reliability and maintainability | Sustainment requirements must accurately define the reliability and maintainability of a ship or there is a risk the ship will cost more to own and operate than expected and will not be available for use when needed. |
| Ineffective acquisition oversight of issues impacting sustainment | Sustainment needs and costs should be considered by leadership during acquisition or shipbuilding programs will continue to pass sustainment risks to the fleet. |
| Optimistic sustainment assumptions not evaluated | Sustainment risks need to be identified, analyzed and mitigated in planning documents because they affect maintenance strategies used throughout the life cycle of a ship. |
| Providing ships to the fleet with defects due to gaps in the Navy's delivery policy | Providing ships to the fleet that still have a number of unresolved construction and quality deficiencies adds to the maintenance burden. |
| Insufficient technical data | Decisions to acquire or not acquire technical data need to be made by analyzing sustainment needs in planning documents because this data can affect DOD's ability to sustain the systems and competitively procure parts and services. |
| **Operations** | |
| Ships' low crew levels and performance | The performance of the ship's force along with the size of the crew can result in minor maintenance being deferred. |
| Deferred maintenance | Maintenance deferred while a ship is deployed can develop into more costly issues that must be addressed later, often during depot-level maintenance. |
| Extended deployments | Decisions to extend deployments can result in declining ship conditions and increased time that ships require to complete maintenance in the shipyards. |
| **Maintenance** | |
| Workforce capacity, capability, and prioritization | Workforce shortages, inexperience, and underperformance result in maintenance delays at public and private shipyards. |
| Unplanned work | Unplanned work, including late identification of work and requirements, extend durations of maintenance periods. |
| Adherence to planning process | Inaccurately defining the work for each ship's maintenance period can result in missing or not meeting planning milestones. |
| Condition of facilities and equipment | Poor condition of facilities and equipment at the public shipyards contribute to delays for aircraft carriers and submarines. |
| Insufficient shipyard capacity | Public shipyards have a limited number of dry docks, some of which cannot currently support newer classes of ships. |
| Availability of parts and materials | Not being able to find or use the right spare parts or material, cannibalization, incomplete order history, and long lead time contribute to delays. |
| Information technology infrastructure | Obsolete systems, inability for systems to communicate with each other, and not being able to have technology in controlled areas contribute to delays. |
| Modernizations and alterations | Adding new equipment and systems adds complexity to a maintenance period. |

Source: GAO. | GAO-21-66

Decisions based on these factors can be interrelated. For example, decisions to increase deployment lengths to meet the Navy's operational demands can result in declining ship conditions and material readiness.

Also, the declining condition of the ships can increase the time that ships spend undergoing maintenance at the shipyards. The increased maintenance time at shipyards can have a ripple effect—officials may have to extend deployment lengths for other ships to compensate for the ships experiencing maintenance delays.

## Navy's July 2020 Report to Congress

According to NAVSEA officials, the Navy's July 2020 report was based on the Navy's prior and ongoing work, including reports to Congress beginning in 2018, that focused on managing maintenance periods at the ship depot-level.[16] For example, the July 2020 report draws on the conclusions of the Navy's Performance to Plan initiative to better understand the causes of maintenance delays.[17] In a separate review, we reported in August 2020 that Performance to Plan for shipyard maintenance began in the fall of 2018, and that the initiative is still underway.[18]

Additionally, NAVSEA officials told us they also identified the key causes of maintenance delays for the July 2020 report based on a series of summits beginning in February 2017 that involved various stakeholders in Navy maintenance. These included not only the NAVSEA officials involved in depot maintenance at both public and private shipyards, but also officials of fleet and vessel type commands to represent the interests of those employing the vessels. During these summits, subject matter experts were assigned to lead analyses of causes for various aspects of ship maintenance. This analysis resulted in a matrix of actions intended to reduce maintenance delays in areas such as project management. The officials said they plan to continue to meet at least annually with representatives across disciplines to refine their actions to reduce maintenance delays.

[16]These prior reports include the Navy's *Report to Congress on Submarine and Ship Depot Maintenance* (February 2018); *Report to Congress on Submarine Depot Maintenance* (December 2018); and *President's FY 2020 Budget Update to Report to Congress on Submarine Depot Maintenance* (March 2019).

[17]In fiscal year 2019, the Navy began an initiative to improve Navy surface ship, submarine, and aviation readiness. This initiative, called Performance to Plan, designates Commander, Naval Surface Forces, and Commander, NAVSEA, to improve performance of ship maintenance in private and public shipyards.

[18]GAO-20-588. In this report, we describe Performance to Plan for shipyard maintenance and its associated metrics.

## Navy Report Identified Some Causes of Maintenance Delays, but Did Not Describe Causes Arising from Acquisition and Operational Decisions

We found that the Navy's July 2020 report identified two key causes and several contributing factors of maintenance delays for aircraft carriers, surface ships, and submarines. However, the Navy's report focused only on causes and factors of delays related to the management of depot-level maintenance at the public and private shipyards, rather than also considering causes and factors originating in the acquisition process or as a consequence of operational decisions.

Specifically, for public shipyards, the July 2020 report identified the key cause of maintenance delays as insufficient public shipyard capacity relative to growing maintenance requirements. The July 2020 report also identified various contributing factors related to this key cause, including understated workload requirements, a diminishing vendor base for replacement parts, and overly optimistic maintenance assumptions, among others.

**Operational Decisions in Areas Such as Crewing Can Add to Sustainment Issues**

We reported in May 2017 that the Navy reduced average crew sizes from fiscal year 2004 to fiscal year 2010, resulting in reductions in personnel costs. However, reduced crew levels resulted in minor maintenance being deferred, which further developed into more costly issues that needed to be addressed at the depot level. Low crew levels also prevented ship crews from performing the minimal required level of preventative maintenance, resulting in a growing maintenance backlog and increased equipment malfunctions.

We reported in March 2020 that this effort to reduce crew levels used unverified assumptions to develop the initial operating and support estimates.

Additionally, we reported in August 2020 that issues with the ship's crew—including those related to training, qualifications, and performance— contributed to more than 1,550 days of maintenance delay from fiscal years 2015 through 2019.

Source: GAO, Navy Force Structure: Actions Needed to Ensure Proper Size and Composition of Ship Crews, GAO-17-413 (Washington, D.C.: May 18, 2017), GAO-20-588, and GAO-20-2 (text); U.S. Navy/T. Ramos (image). | GAO-21-66

For private shipyards, the July 2020 report identified the key cause of delays as the addition of work requirements after a contract is awarded. The July 2020 report also identified contributing factors, including challenges in starting maintenance periods on time, imprecise estimates of the duration of maintenance periods, insufficient visibility by the Navy into the capacity of private shipyards, and the limitations associated with the single-year duration of the Navy's operations and maintenance appropriations.[19]

We found that these key causes and contributing factors generally align with depot-level factors that contribute to maintenance delays we had previously identified.[20] However, the July 2020 report did not describe key causes or contributing factors that arise from decisions made in acquisition and operations, such as optimistic sustainment assumptions, insufficient technical data, ships' crew levels and performance (see sidebar), and deferred maintenance during operational deployments.[21] Figure 4 compares factors associated with maintenance delays that we have identified in prior work with the key causes and contributing factors of maintenance delays identified by the Navy's July 2020 report.

[19]Amounts appropriated to the Navy's operations and maintenance account are available for obligation for one fiscal year, after which time amounts remaining in the account expire and are no longer available for new obligations.

[20]GAO-20-257T, GAO-20-86, and GAO-20-588.

[21]In comments on this report, the Navy agreed that its July 2020 report did not discuss causes of maintenance delays arising in the acquisition and operations phases. The Navy stated that it had previously addressed causes of maintenance delays arising in acquisitions and operations in a March 2019 report to Congress, Secretary of the Navy, *President's FY 2020 Budget Update to Report to Congress on Submarine Depot Maintenance* (March 21, 2019).

**Figure 4: GAO-Identified Factors Contributing to Maintenance Delays the Navy Identified in Its July 2020 Report**

| Acquisition | Operations | Maintenance |
|---|---|---|
| × Ineffective requirements for ship reliability and maintainability | × Ships' low crew levels and performance | ✓ Workforce capacity, capability, and prioritization |
| × Ineffective acquisition oversight of issues impacting sustainment | × Deferred maintenance | ✓ Unplanned work |
| × Optimistic sustainment assumptions not evaluated | × Extended deployments | ✓ Adherence to planning process |
| × Providing ships to fleet with defects due to gaps in the Navy's delivery policy | | ✓ Condition of facilities and equipment |
| × Insufficient technical data | | ✓ Insufficient shipyard capacity |
| | | ✓ Availability of parts and materials |
| | | ✓ Information technology infrastructure |
| | | × Modernizations and alterations |

✓ = Identified in the Navy's July 2020 report as contributing to maintenance delays
× = Not identified in the Navy's July 2020 report as contributing to maintenance delays

Source: GAO and GAO analysis of Navy documents. | GAO-21-66

While it is encouraging that the Navy has begun identifying some causes of and factors relating to maintenance delays, we have previously reported that its process is still ongoing and work remains. Specifically, we reported in February 2020 that various factors contribute to delays in overseas surface ship maintenance, such as the discovery that unanticipated additional repairs were needed, planning milestones were missed, or key staff experienced shortages. We reported that the Navy's efforts to understand the causes of delays often focused solely on individual maintenance periods, and the Navy had not conducted a comprehensive analysis to systematically identify and address the underlying causes of delays.[22] We concluded that without such an analysis, the Navy would not be able to effectively target corrective actions, and risked continuing to underestimate maintenance needs and the time and resources required to address them. Accordingly, we recommended that the Navy comprehensively analyze and address the causes of maintenance delays for overseas surface ships, and the Navy agreed. The Navy has assigned responsibility for conducting a single comprehensive analysis of delays in overseas surface-ship maintenance to NAVSEA's Deputy Commander for Ship Maintenance and Modernization. Additionally, the Navy is incorporating this analysis into the work being done in response to the Chief of Naval Operations' order

[22]GAO-20-86.

to improve ship depot-level maintenance and modernization. We will continue to monitor the status of this recommendation.

Further, in March 2020, we reported that the Navy had identified 150 class-wide problems with new ships that ended up requiring more maintenance effort than planned for during acquisition. For example, problems maintaining commercial equipment on ships, ship designs that did not effectively consider maintainability, and untested sustainment assumptions that turned out to be incorrect are all issues that resulted from the Navy not identifying, analyzing, or mitigating such issues during acquisition, which contributed to maintenance delays. We made nine recommendations to the Navy relating to the consideration of maintenance and sustainment during the acquisition process, including that the Navy should develop a mechanism that ensures that sustainment outcomes are a factor in shipbuilding programs' decision-making during the acquisition process.[23] DOD concurred or partially concurred with these recommendations. For example, in response to our recommendation to develop a mechanism that ensures that sustainment outcomes are a factor in shipbuilding programs' decision-making during acquisition, the Navy said it would review the results of related demonstration programs and issue guidance, but did not identify a time frame for doing so. We continue to believe that if the recommendations are not implemented fully then DOD and the Navy may miss key opportunities to improve the Navy's sustainment requirements. We will continue to monitor the status of the recommendations.

## Navy Report Identified Actions to Reduce Maintenance Delays, but Did Not Incorporate All Elements of Results-Oriented Management

The Navy's July 2020 report described the Navy's actions to address the causes of depot-level maintenance delays it had identified, but it did not incorporate all elements of results-oriented management that were required by the conference report, including analytically based goals; results-oriented metrics to measure progress; and required resources, risks, and stakeholders to achieve those goals. Specifically, we found that the July 2020 report identified stakeholders needed to implement and oversee its plan of action. However, we found that the Navy did not include an achievable goal in the report, is still developing metrics to measure progress, and did not fully describe the resources needed and risks involved.

[23]GAO-20-2.

## Navy Identified Actions to Mitigate Causes of Delays at the Depot Level

The July 2020 report outlined a NAVSEA plan of action for on-time depot-level maintenance delivery, which was created in response to a December 2019 order from the Chief of Naval Operations.[24] This plan centers on three key lines of effort: developing and sustaining the industrial base, improving the planning process and material management, and improving productivity in the execution of ship-depot maintenance.

The July 2020 report stated that the NAVSEA plan of action complements other needed investments and ongoing initiatives that span depot-level maintenance at public and private shipyards. These include, but are not limited to:

- The Shipyard Infrastructure Optimization Program, an initiative to improve conditions at public shipyards initially estimated to cost $21 billion and take 20 years to implement.
- Naval Sustainment System—Shipyards, a process reform initiative to reduce waste and increase productivity.
- Workforce improvements, including increased hiring for public shipyards, from 26,588 full-time equivalents in fiscal year 2010 to 36,162 by the end of fiscal year 2019.
- New contracting strategies, such as giving contractors more time to plan work, procure material, and prepare their workforce before the start of a maintenance period.
- Performance to Plan, a leadership approach to use data analytics to identify drivers of maintenance delays and develop associated metrics.

[24]Chief of Naval Operations, Fragmentary Order (FRAGO) 01/2019, *A Design for Maintaining Maritime Superiority* (December 2019).

## The Navy's Report Incorporated the Stakeholder Element of Results-Oriented Management, but Did Not Fully Include Achievable Goals, Metrics, Resources, and Risks

We found that the Navy's July 2020 report identified stakeholders needed to implement and oversee its plan of action; however, the Navy will not achieve the overall goal identified in the report, is still developing metrics, and did not fully account for the needed resources and risks involved.[25]

### Identification of Stakeholders

The July 2020 report identified stakeholders needed to implement and oversee the plan. Specifically, the report identified NAVSEA as the primary implementer of most initiatives related to depot-level maintenance. The report stated that Performance to Plan incorporates clarified command and control and accountability for executing performance plans to improve outcomes, a quarterly leadership forum providing accountability and increased responsiveness from senior leadership, and monthly oversight forums cochaired by U.S. Pacific Fleet and U.S. Fleet Forces Command.

### Analytically Based Goals

The Navy's goal in the July 2020 report is to reduce days of maintenance delay by 80 percent in fiscal year 2020 compared with fiscal year 2019, and eliminate days of maintenance delay by the end of fiscal year 2021. However, the Navy did not provide us any analysis behind the establishment of this goal, instead noting that it originated from an order from the Chief of Naval Operations. Further, we found two issues with this goal.

First, our analysis shows that the Navy has not met the 80 percent reduction in fiscal year 2020. NAVSEA officials said they still hope to meet the 80 percent reduction in days of maintenance delay by the end of fiscal year 2020 for both private surface ship maintenance and maintenance at public shipyards. However, our analysis of Navy data showed that the Navy had already incurred significantly more days of maintenance delay than would allow it to meet this goal. Specifically, the Navy incurred 3,096 days of maintenance delay through June of fiscal year 2020 on surface ships—more than twice the 1,419 days or fewer

[25]Our past work has identified elements of results-oriented management that should be incorporated into improvement plans. These include identifying analytically based goals; results-oriented metrics to measure progress; and required resources, risks, and stakeholders to achieve those goals. See GAO-19-242, GAO-13-228, and GAO-09-1011T.

that would have allowed it to achieve an 80 percent reduction. Likewise, the Navy incurred 730 days of maintenance delay through June of fiscal year 2020 on aircraft carriers and submarines at public shipyards, more than the 430 days or fewer that would have allowed it to achieve an 80 percent reduction.

Second, NAVSEA officials told us that they do not expect to eliminate days of maintenance delay by the end of fiscal year 2021. According to these officials, it is already apparent that there will be delays in fiscal year 2021 because delays in fiscal year 2020 pushed back the start dates for some fiscal year 2021 maintenance periods. These officials said that the effects of the Coronavirus Disease 2019 (COVID-19) on shipyard workforce capacity have been a major cause for the delays, in addition to the other factors contributing to delays identified in the July 2020 report.

## Metrics to Measure Progress

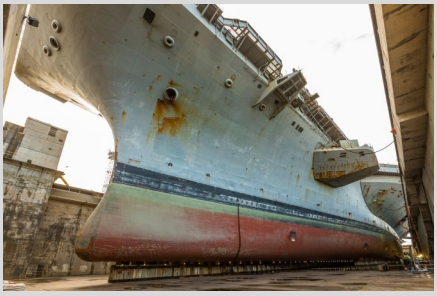
The Navy's July 2020 report described metrics developed through the Navy's Performance to Plan initiative that the Navy is using to inform management decisions. According to NAVSEA officials, Performance to Plan is a monitoring tool to identify underperforming areas of maintenance or drivers of maintenance delays, and they have identified many of these drivers and developed associated strategic metrics. According to the July 2020 report, Performance to Plan is in an early stage of development, and the Navy is still identifying and developing these drivers and metrics.

We reported in August 2020 that as of February 2020 NAVSEA had not developed over half of its Performance to Plan metrics intended to measure various aspects of maintenance at shipyards.[26] We recommended that the Navy ensure that NAVSEA identify a timeframe for completing the development of metrics for its Performance to Plan initiative for shipyard maintenance and complete the development of metrics to address the main factors contributing to maintenance delays and improve the timely completion of ship maintenance at public shipyards. The Navy agreed with this recommendation and said it will continue identifying drivers of delays and associated metrics through Performance to Plan.

[26]GAO-20-588. The Navy developed these metrics for its Performance to Plan Shipyard initiative.

## Identification of Required Resources

**Costs of Optimizing Shipyards Could Exceed Navy Estimate**



The Navy estimated in 2018 that its efforts to improve the facilities and equipment at public shipyards would require $21 billion over 20 years to implement. However, we found in November 2019 that the estimate does not include inflation and other significant costs, such as those for utilities, roads, or environmental remediation, which could add billions to the final cost.

Moreover, even at a cost of $21 billion, this effort would require funding levels beyond what the Navy has historically spent for shipyard infrastructure.

In November 2019, we recommended that the Navy prepare more accurate cost estimates, using best practices, so that it can request accurate funding from Congress and avoid common pitfalls associated with inaccurate estimates. The Navy agreed with this recommendation, and said it will use cost estimating best practices in its second cost estimate.

Source: GAO, Naval Shipyards: Key Actions Remain to Improve Infrastructure to Better Support Navy Operations, GAO-20-64 (Washington, D.C.: Nov. 25, 2019) (text); Puget Sound Naval Shipyard & Intermediate Maintenance Facility/T. Nguyen (image). | GAO-21-66

The July 2020 report identified some, but not all, of the resources required for its implementation. The report stated that the Navy continues to require consistent funding for ship maintenance. It also described types of resources or investments needed, such as budgetary, human capital, and information technology. However, the report did not identify the costs of the actions in the NAVSEA plan of action or complementary initiatives. We reported in November 2019 on the importance of developing accurate cost estimates for actions like the Shipyard Infrastructure Optimization Program (see sidebar for more information on this program).[27]

[27]GAO, *Naval Shipyards: Key Actions Remain to Improve Infrastructure to Better Support Navy Operations,* GAO-20-64 (Washington, D.C.: Nov. 25, 2019).

## Identification of Risks

According to the July 2020 report and NAVSEA officials, the main risks to plans to improve on-time delivery of maintenance periods are the effects of COVID-19 on shipyard workforce capacity; future ship maintenance funding, including the effects of continuing resolutions; and material availability for Virginia-class submarines. While these are significant ongoing challenges to executing on-time maintenance, they do not represent a complete assessment of risk. For example, we reported in November 2019 that the Navy has not yet fully incorporated risk into its cost estimates for its Shipyard Infrastructure Optimization Program.[28] We also reported in November 2019 on the risk that the Shipyard Infrastructure Optimization Program might not be able to stay on schedule. The program involves a complex effort to develop detailed facility optimization plans for each shipyard, and at this stage, the time frame for completion remains uncertain.

In addition, we reported in February 2020 that Navy officials said the Navy has not assessed risks to successful implementation of new maintenance approaches overseas.[29] We recommended that the Navy assess and mitigate risks posed by any challenges to successful implementation of its new maintenance approach in Japan. The Navy agreed and said it will conduct a review of its new maintenance strategies and implement updates, as needed, by the second quarter of fiscal year 2021. We will continue to monitor the Navy's implementation of this recommendation.

While we are encouraged that the Navy has begun identifying some elements of results-oriented management, its analytical process is still ongoing and work remains to fully implement a comprehensive results-oriented approach (one with analytically-based goals; supporting metrics; and identified resources, risks, and stakeholders) to address maintenance delays. We have previously reported on the importance of including elements of results-oriented management in the Navy's plans to address maintenance delays for both maintenance on surface ships overseas and maintenance on aircraft carriers and submarines at public shipyards.

For example, in a February 2020 report we concluded that without conducting an analysis to understand the underlying, interrelated causes of maintenance delays, and incorporating that analysis into a comprehensive results-oriented plan to address them, the Navy cannot

[28]GAO-20-64.

[29]GAO-20-86.

effectively target corrective actions to improve timely completion of ship maintenance in order to ensure ships are available for the critical training crews need and operations to support U.S. military and national security goals.[30] Therefore, we recommended that the Navy use the results of a comprehensive analysis of causes of delays to develop a plan to address delays in surface-ship maintenance overseas, and stated that such a plan should incorporate results-oriented elements. The Navy agreed with this recommendation, and said it is conducting an analysis of delays in surface-ship maintenance overseas, which it will use to develop a plan that implements process improvements and incorporates results-oriented elements. The Navy estimates that it will complete this plan in the second quarter of fiscal year 2021.

In addition, we reported in August 2020 that unless NAVSEA uses the elements of results-oriented management to address factors contributing to maintenance delays at the public naval shipyards, delays in maintenance periods are likely to persist.[31] We recommended that the Navy ensure NAVSEA develop and implement goals, action plans, milestones, and a monitoring process for its Performance to Plan initiative to address the main factors contributing to maintenance delays and improve the timely completion of ship maintenance at public shipyards. The Navy agreed with this recommendation and said it developed an improvement plan to address maintenance delays, and continues to work toward completion of actions in the plan. We will continue to monitor the status of these recommendations.

## Agency Comments

We provided a draft of this report to DOD for review and comment. In response, the Navy provided technical comments, which we incorporated as appropriate.

Among other comments, the Navy noted that we calculated days of maintenance delay differently than the Navy did. The Navy stated that it was able to reduce such delays by nearly 80 percent in fiscal year 2020 from the prior year. However, the Navy also acknowledged that its method included adjusting the baselines—the expected durations of the maintenance periods—for fiscal year 2020 maintenance periods. The Navy stated that it made these adjustments to align work with available shipyard capacity and improvements in planning and directed maintenance. Our calculations did not include such adjustments to

[30]GAO-20-86.

[31]GAO-20-588.

baselines, and instead measured the days that a maintenance period extended past its original planned end date. We believe this is a more appropriate method for measuring days of delay during any given maintenance period, rather than adjusting the baseline.

The Navy also disputed the accuracy of our characterization of the goal outlined in its July 2020 report. The Navy characterized the goal as a "stretch" goal designed to drive urgency in addressing maintenance delays. It also stated that the goal was informed by efforts such as the Performance to Plan initiative. None of the Navy's comments demonstrated that our characterization was inaccurate. Our analysis found that while the Navy did reduce days of maintenance delay during 2020, it did not achieve its goal for fiscal year 2020 and is no longer able to achieve its fiscal year 2021 goal. Therefore, the plans to address maintenance delays outlined in the July 2020 report lack an achievable goal.

The Navy's comments are reproduced in full in appendix I.

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

If you or your staff have questions about this report, please contact us at MaurerD@gao.gov or (202) 512-9627. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix II.

Diana Maurer
Director, Defense Capabilities and Management

*List of Committees*

The Honorable James M. Inhofe
Chairman
The Honorable Jack Reed
Ranking Member
Committee on Armed Services
United States Senate

The Honorable Richard C. Shelby
Chairman
The Honorable Dick Durbin
Ranking Member
Subcommittee on Defense
Committee on Appropriations
United States Senate

The Honorable Adam Smith
Chairman
The Honorable Mac Thornberry
Ranking Member
Committee on Armed Services
House of Representatives

The Honorable Pete Visclosky
Chairman
The Honorable Ken Calvert
Ranking Member
Subcommittee on Defense
Committee on Appropriations
House of Representatives

# Appendix I: Comments from the Department of Defense

THE ASSISTANT SECRETARY OF THE NAVY
Research, Development and Acquisition
1000 Navy Pentagon
Washington DC 20350-1000

19 Oct 20

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

Dear Ms. Maurer,

Attached is the Department of Defense (DoD) response to the GAO Draft Report, GAO-21-66SU, "NAVY MAINTENANCE: Navy Report Did Not Fully Address Causes of Delays or Results-Oriented Elements" dated (GAO Code 104370).

Sincerely,

GEURTS.JAMES.F.1034185286 Digitally signed by GEURTS.JAMES.F.1034185286 Date: 2020.10.19 13:06:14 -04'00'

James F. Geurts

Attachments:
As Stated

**GAO DRAFT REPORT**
**GAO-21-66SU (GAO CODE 104370)**

**NAVY MAINTENANCE: NAVY REPORT DID NOT FULLY ADDRESS CAUSES OF DELAYS OR RESULTS-ORIENTED ELEMENTS**

**DRAFT REPORT GAO-21-66SU**

1. Page 5 – Fig. 1
    a. Issue: Clarity. There's a difference in calculation of DMD between GAO's method and Navy method.
    b. Comment: "The CNO established the Fragmentary Order (FRAGO) goal midway through the second quarter of FY2020 to focus the maintenance community's efforts on reduction of late ship availability with a target of an 80% reduction in FY2020. To date, the Navy has achieved the following: For private contracted surface ship availabilities, the Navy incurred 7,094 DoMD (Days of Maintenance Delays) in FY2019 as compared to a projected 1,075 DoMD that occurred during FY2020, representing a nearly 85% reduction in delays. For public shipyard availabilities, the Navy incurred 1,528 DoMD in FY2019 as compared to a projected 147 DoMD that occurred during FY2020, representing over a 90% reduction in delays. For private shipyard nuclear availabilities, the Navy incurred 620 DoMD in FY2019 as compared to a projected 236 DoMD that occurred during FY2020, representing a nearly 62% reduction in delays. In summary across submarines and surface ship there is a 79% reduction." The Navy's calculation of DoMD in 2020 includes adjustments in maintenance availability baseline duration to account for alignment of work to available shipyard capacity and improved planning and directed maintenance to reduce growth and new work.
    c. Recommendation: None

2. Page 7, Footnote 14
    a. Issue: Context
    b. Comment: Add a footnote or expand footnote 14 to clarify that idle time can reflect a rational, cost based management choice.
    c. Recommendation: Revise or add footnote as follows, "While not desirable, "idle" submarines reflect a Navy management decision not to induct a submarine into a shipyard when the shipyard does not have the productive workforce capacity to execute the availability on expected schedule. Such an induction would result in shipyard support costs and project labor that are not incurred while "idle" awaiting induction. This rebaselining of expected duration is part of the systemic analysis and resolution lines of effort addressed on p.14."

3. Page 10 "[…] we found that the July 2020 report does not describe key causes or contributing factors that arise from decisions made in acquisitions and operations."
    a. Issue: Accuracy

b. Comment: Navy's March 2019 report discusses some of these acquisitions/operations ideas. The July 2020 report states it does not repeat acquisitions/operations, as they were covered in the March 2019 report. Statement is accurate to say the July 2020 report does not discuss acquisitions and operations, however, it is not accurate to imply the Navy has never considered them.
c. Recommendation: Add that the March 2019 report does discuss acquisition/operations ideas or delete statement.

4. Page 13, GAO report: "We made nine recommendations to the Navy relating to the consideration of maintenance and sustainment during the acquisition process, including that the Navy should develop a mechanism that ensures that sustainment outcomes are a factor in shipbuilding programs' decision making during the acquisition process"
   a. Issue: Context
   b. Comment: The Navy is implementing utilization of Sustainment Program Baselines (SPB) to specify sustainment requirements for programs during early acquisition phases.
   c. Recommendation: Add "The Navy has started developing Sustainment Program Baselines to specify sustainment requirements for programs and plans to use those validated requirements earlier in the acquisition process."

5. Page 15, GAO report: In reference to the Navy's goal to reduce days of maintenance delay by 80%, GAO commented: "However, the Navy could not provide us any analysis behind the establishment of this goal, instead noting that they originated from an order from the Chief of Naval Operations."
   a. Issue: Accuracy
   b. Comment: This is not an accurate characterization of what was directed in the CNO FRAGO and what the 80% was based on. The purpose of the CNO's FRAGO is to lay out Navy priorities to maintain maritime superiority and push the Navy Team to focus on these efforts with urgency. One of the Navy's toughest near-term challenges and an impediment to maintaining maritime superiority is the trend of delivering only 40 percent of ships from maintenance on time. To address this, the CNO FRAGO directed Naval Sea Systems Command (NAVSEA) to develop a plan to improve shipyard performance, focused on reducing days of maintenance delay by 80% in FY20 and eventually eliminating lost days by FY21. The FRAGO provided stretch goals that are deliberately challenging and ambitious in order to drive urgency and innovation to achieve meaningful outcomes. There was significant discussion among Navy leadership about these goals and the need to aggressively improve on-time completion without creating unintended consequences, such as descoping work in order to meet the demanding benchmarks. These goals were determined by leadership to be the best balance to drive the improved performance needed with urgency.
   c. Recommendation: GAO revise the first two sentences in that section as follows: "The Navy's stretch goal in the July 2020 report, derived from the CNO's direction, is to reduce days of maintenance delay by 80 percent in fiscal year 2020

compared with fiscal year 2019, and eliminate days of maintenance delay by the end of fiscal year 2021. This stretch goal--deliberately challenging and ambitious to drive urgency--was informed by Performance to Plan-Shipyard and lessons learned in fiscal year 2019 within the Naval Shipyard Enterprise.

6. Page 16-17,"We reported in August 2020 that as of February 2020 NAVSEA had not developed over half of its Performance to Plan metrics intended to measure various aspects of maintenance at shipyards."
    a. Issue: Clarity
    b. Comment: Navy has multiple P2P initiatives, leaving it ambiguous as to whether the GAO report is referring to specific P2P, surface, shipyard, undersea, or other initiatives.
    c. Recommendation: Specify "P2P Shipyards" where appropriate.

7. Page 17,"…(see sidebar for more information on this plan)."
    a. Issue: Clarity
    b. Comment: This parenthetical is referring to Shipyard Infrastructure Optimization Plan (SIOP), which is no longer a plan and is now a program.
    c. Recommendation: Change "Plan" to "Program."

# Appendix II: GAO Contact and Staff Acknowledgments

## GAO Contact

Diana Maurer, (202) 512-9627 or MaurerD@gao.gov.

## Staff Acknowledgments

In addition to the contact named above, Jodie Sandel (Assistant Director), Simon Hirschfeld (Analyst-in-Charge), Gina M. Hoover, David L. Jones, Felicia Lopez, Yoki Moody Wong, Richard Powelson, and William Tedrick made key contributions to this report.

# Related GAO Products

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

*Navy Shipyards: Actions Needed to Address the Main Factors Causing Maintenance Delays for Aircraft Carriers and Submarines*. GAO-20-588. Washington D.C.: August 20, 2020.

*Navy Ship Maintenance: Evaluating Pilot Program Outcomes Could Inform Decisions to Address Persistent Schedule Challenges*. GAO-20-370. Washington, D.C.: May 11, 2020.

*Navy Shipbuilding: Increasing Focus on Sustainment Early in the Acquisition Process Could Save Billions*. GAO-20-2. Washington, D.C.: March 24, 2020.

*Navy Ship Maintenance: Actions Needed to Address Maintenance Delays for Surface Ships Based Overseas*. GAO-20-86. Washington, D.C.: February 26, 2020.

*Navy Maintenance: Persistent and Substantial Ship and Submarine Maintenance Delays Hinder Efforts to Rebuild Readiness*. GAO-20-257T. Washington, D.C.: December 4, 2019.

*Naval Shipyards: Key Actions Remain to Improve Infrastructure to Better Support Navy Operations*. GAO-20-64. Washington, D.C.: November 25, 2019.

*Military Depots: Actions needed to Improve Poor Conditions of Facilities and Equipment that Affect Maintenance Timeliness and Efficiency*. GAO-19-242. Washington, D.C.: April 29, 2019.

*DOD Depot Workforce: Services Need to Assess the Effectiveness of Their Initiative to Maintain Critical Skills*. GAO-19-51. Washington, D.C.: December 14, 2018 [Reissued with revisions on Dec. 26, 2018].

*Navy and Marine Corps: Rebuilding Ship, Submarine, and Aviation Readiness Will Require Time and Sustained Management Attention.* GAO-19-225T. Washington, D.C.: December 12, 2018.

*Navy Readiness: Actions Needed to Address Costly Maintenance Delays Facing the Attack Submarine Fleet*. GAO-19-229. Washington, D.C.: November 19, 2018.

*Navy Readiness: Actions Needed to Address Costly Maintenance Delays Affecting the Attack Submarine Fleet*. GAO-19-192C. Washington, D.C.: October 31, 2018.

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

*Weapon Systems Annual Assessment: Knowledge Gaps Pose Risks to Sustaining Recent Positive Trends*. GAO-18-360SP. Washington, D.C.: April 25, 2018.

*Columbia Class Submarine: Immature Technologies Present Risks to Achieving Cost, Schedule, and Performance Goals*. GAO-18-158. Washington, D.C.: December 21, 2017.

*Navy Readiness: Actions Needed to Address Persistent Maintenance, Training, and Other Challenges Affecting the Fleet*. GAO-17-809T. Washington, D.C.: September 19, 2017.

Naval Shipyards: Actions Needed to Improve Poor Conditions that Affect Operations. GAO-17-548. Washington, D.C.: September 12, 2017.

Navy Readiness: Actions Needed to Address Persistent Maintenance, *Training, and Other Challenges Facing the Fleet.* GAO-17-798T. Washington, D.C.: September 7, 2017.

*Navy Shipbuilding: Policy Changes Needed to Improve the Post-Delivery Process and Ship Quality*. GAO-17-418. Washington, D.C.: July 13, 2017.

*Department of Defense: Actions Needed to Address Five Key Mission Challenges.* GAO-17-369. Washington, D.C.: June 13, 2017.

*Navy Force Structure: Actions Needed to Ensure Proper Size and Composition of Ship Crews*. GAO-17-413. Washington, D.C.: May 18, 2017.

*Military Readiness: DOD's Readiness Rebuilding Efforts May Be at Risk without a Comprehensive Plan.* GAO-16-841. Washington, D.C.: September 7, 2016.

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

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