



June 2020

# MILITARY DEPOTS

## The Navy Needs Improved Planning to Address Persistent Aircraft Maintenance Delays While Air Force Maintenance Has Generally Been Timely

Accessible Version

# GAO Highlights

Highlights of [GAO-20-390](#), a report to congressional committees

## Why GAO Did This Study

Three Air Force and three Navy aviation depots maintain critical fixed-wing aviation platforms, such as the KC-135 aerial refuelers and F/A-18 fighters. The ability of these depots to complete maintenance on time directly affects military readiness because delays reduce the time aircraft are available for operations and training.

Senate Report 115-262, accompanying a bill for the Fiscal Year 2019 National Defense Authorization Act, contained provisions that GAO examine the Department of Defense's (DOD) aviation depots. GAO's report evaluates the extent to which 1) the Air Force and Navy aviation depots completed selected fixed-wing aircraft maintenance on time from fiscal year 2014 through 2019, and 2) the Air Force and Navy accurately planned for depot maintenance requirements from fiscal year 2014 through 2019 and addressed any associated challenges.

GAO selected a non-generalizable sample of 18 Air Force and 18 Navy fixed-wing aircraft types; analyzed maintenance and planning data for fiscal year 2014 through 2019; and interviewed service officials.

## What GAO Recommends

GAO is making three recommendations to the Navy: to use historical data to set turnaround time targets for depot maintenance; provide planners information on maintenance performed outside the depots; and establish processes for communication between depot stakeholders. DOD concurred with all three recommendations.

View [GAO-20-390](#). For more information, contact Diana Maurer at (202) 512-9627 or [maurerd@gao.gov](mailto:maurerd@gao.gov) or Asif A. Khan at (202) 512-9869 or [khana@gao.gov](mailto:khana@gao.gov).

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## MILITARY DEPOTS

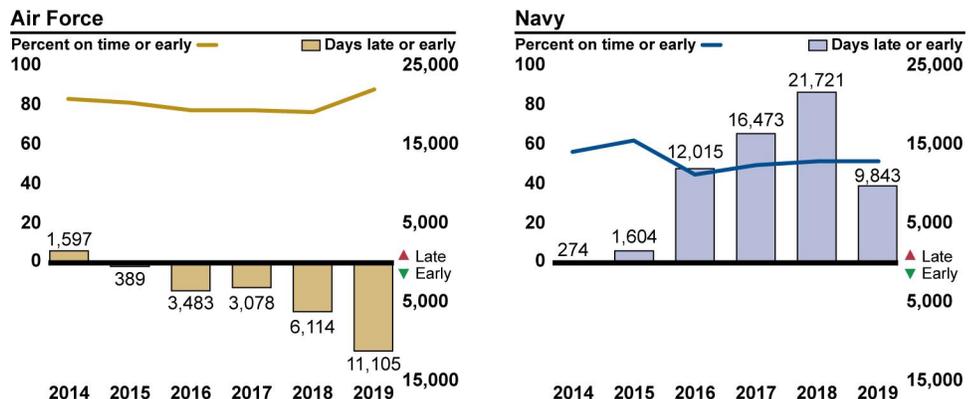
### The Navy Needs Improved Planning To Address Persistent Aircraft Maintenance Delays While Air Force Maintenance Has Generally Been Timely

#### What GAO Found

The Air Force and Navy varied in the extent that they completed depot maintenance on time for selected fixed-wing aircraft in fiscal years 2014 through 2019. Specifically, GAO's analysis of aggregate maintenance data found that:

- Air Force depots completed aircraft maintenance on time or early in 5 of 6 years, with percentages for on-time or early-completion maintenance ranging from 78 to 90 percent.
- Navy depots completed aircraft maintenance late for each of the 6 years, with percentages for on-time or early-completion maintenance ranging from 45 to 63 percent. Navy fixed-wing aircraft have spent over 62,000 more days in maintenance than expected since fiscal year 2014.

#### Aircraft Maintenance Completed On Time or Early by Service, Fiscal Years 2014 through 2019



Source: GAO analysis of Air Force and Navy data. | GAO-20-390

The Air Force generally has accurately planned for depot maintenance requirements for selected fixed-wing aircraft during fiscal year 2014 through 2019, but the Navy has not. Both services have initiatives underway to improve planning for aviation depot maintenance; however, GAO identified planning challenges that the Navy has not fully addressed:

- The Navy has not effectively used historical data to analyze turnaround time—total days planned for depot maintenance periods—and established accurate planning targets for aircraft maintenance packages.
- Navy depot planners do not have visibility into aircraft maintenance that is performed outside the depots by an operational unit or other maintenance facility—information critical to planning for the condition and depot maintenance needs of individual aircraft.
- The Navy does not yet have formal processes and related guidance for communication and coordination between depot stakeholders to inform maintenance requirements planning.

Without addressing these challenges, the Navy cannot appropriately plan for depot maintenance workload and will likely continue to experience maintenance delays that reduce the time aircraft are available for operations and training.

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### **Abbreviations**

COMFRC	Commander, Fleet Readiness Centers
DLH	Direct Labor Hours
DOD	Department of Defense
DPEH	Defense Production Earned Hours
NAVAIR	Naval Air Systems Command
WCF	Working Capital Fund

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June 23, 2020

### Congressional Committees

Three Air Force and three Navy aviation depots maintain the readiness of critical fixed-wing aircraft, such as KC-135 aerial refuelers and F/A-18A-D fighters that are required for military operations.<sup>1</sup> The ability of these depots to complete maintenance on time directly affects military readiness as maintenance delays reduce the amount of time during which aircraft are available for operations and training. A key component of completing maintenance on time is accurately forecasting workload requirements so the aviation depots can appropriately plan for and execute their maintenance workload. The Air Force and Navy have invested about \$3.3 billion in their aviation depots' capital budgets from fiscal years 2014 through 2019, and officials stated they have implemented a variety of initiatives intended to improve on-time performance.

Since 2009, we have issued several reports on the challenges experienced at the Department of Defense's (DOD) maintenance depots, including deteriorating equipment and facility condition, difficulty in filling critical personnel skills, and growing maintenance backlogs.<sup>2</sup> Our prior work has found that these and other factors have contributed to depot maintenance delays. We reported in 2018 that, in part due to these challenges at the depots, the Air Force and Navy have struggled to meet fixed-wing aircraft availability goals, hampering unit readiness.<sup>3</sup> We have

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<sup>1</sup>The Department of the Air Force operates three Air Logistics Complexes at Ogden, UT; Oklahoma City, OK; and Warner Robins, GA that perform depot-level maintenance. The Department of the Navy operates three major Fleet Readiness Centers (FRCs) in Cherry Point, NC (FRC-East); Jacksonville, FL (FRC-Southeast); and San Diego, CA (FRC-Southwest) that perform depot-level maintenance.

<sup>2</sup>See, for example, 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) and 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).

<sup>3</sup>GAO, *Weapon System Sustainment: Selected Air Force and Navy Aircraft Generally Have Not Met Availability Goals, and DOD and Navy Guidance Need to Be Clarified*, [GAO-18-678](#). (Washington, D.C.: Sept. 10, 2018). We plan on reporting in the summer of 2020 on the extent to which the military services met mission capable goals for 46 fixed- and rotary-wing aircraft, including trends in mission capable rates and sustainment challenges for those aircraft, and the costs to operate and support these aircraft.

made 39 recommendations to improve DOD depot operations. DOD has concurred with 38 of our 39 recommendations and has fully implemented three.

Senate Report 115-262 accompanying a bill for the National Defense Authorization Act for Fiscal Year 2019 included provisions for us to examine DOD's aviation depots and maintenance operations. Our report examines the extent to which 1) the Air Force and Navy aviation depots completed selected fixed-wing aircraft maintenance on time from fiscal year 2014 through 2019, and 2) the Air Force and Navy accurately planned for depot maintenance requirements for selected fixed-wing aircraft from fiscal year 2014 through 2019 and addressed any associated challenges. We have separate ongoing reviews to examine maintenance timeliness and related issues at the Army and Marine Corps key weapons systems depots and Navy shipyards.

For objective one, we selected a non-generalizable sample of 18 Air Force and 18 Navy types of fixed-wing aircraft, including fighters, bombers, and aerial refuelers, based on information from Air Force and Navy maintenance data, and a review of our prior work.<sup>4</sup> These aircraft had maintenance completed in fiscal years 2014 through 2019 at the Air Force's three Air Logistics Complexes and the Navy's three Fleet Readiness Centers. We selected this time period so we could identify and obtain insight on historical data trends regarding maintenance timeliness for the selected aircraft. For each aircraft, we collected data on the date maintenance began and was completed for individual aircraft, as well as the original estimate of time (in days) needed to complete maintenance.<sup>5</sup> We also collected updated estimates if available. We used this information to calculate the difference between the number of days planned for maintenance (using the updated estimate if available) and the number of days used for maintenance to determine whether the services completed aircraft maintenance on time, early, or late. Additionally, we used the total number of aircraft completed in each fiscal year to calculate a measure of average maintenance timeliness by aircraft type. We presented the data based on aircraft that had maintenance completed in a given fiscal year; however, not all of the maintenance was necessarily completed in that given fiscal year. For example, an aircraft may have

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<sup>4</sup>We excluded rotary wing, surveillance, unmanned, and early warning aircraft.

<sup>5</sup>The data set did not include depot-level repairables. These are items that are generally more cost-effective to repair and reuse than to dispose of and replace, such as a landing gear.

had maintenance started in one fiscal year and its maintenance was completed in the next fiscal year. In such a case, we would count that aircraft in the second fiscal year. In addition, we interviewed DOD and service officials to gain a better understanding of factors influencing fixed-wing aircraft maintenance timeliness and reviewed our prior work on depot maintenance.<sup>6</sup>

For objective two, we collected information on the depot maintenance planning processes for Air Force and Navy fixed-wing aircraft. Using the non-generalizable sample of 18 Air Force and 18 Navy types of fixed-wing aircraft identified in objective one, we analyzed data on maintenance duration for maintenance completed in fiscal years 2014 through 2019, and compared the number of days planned for maintenance to the number of days used for maintenance to determine the extent to which planned and actual numbers aligned. We interviewed DOD, Air Force, and Navy officials to obtain their views on any challenges related to planning, incorporating historical data, and coordinating with stakeholders related to the maintenance requirements planning process for aircraft depot maintenance. For specific challenges identified in the Navy, we reviewed documents including Naval Air Systems Command (NAVAIR) workload standards, applicable Navy guidance, and the Navy depot maintenance strategic plan. We also interviewed Commander, Fleet Readiness Centers (COMFRC) and NAVAIR officials to determine the extent to which the Navy incorporates historical data into the maintenance requirements planning process and the extent to which Navy depot stakeholders communicate and collaborate to inform this planning process.<sup>7</sup> In addition, we visited one Air Force aviation depot and one Navy aviation depot to interview officials from specific aircraft programs,

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<sup>6</sup>See, for example, 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) and 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).

<sup>7</sup>NAVAIR Instruction 13023.1A, *Naval Air Systems Command Workload Standards Required for the Aircraft and Engine Programs at the Fleet Readiness Centers* (Aug. 8, 2011); NAVAIR Instruction 5221.1B, *Workload Acceptance* (Oct. 2, 2018); *The United States Navy Depot Maintenance Strategic Plan 2014-2019* (October 2013).

depot production, and depot business offices to understand any challenges associated with planning for depot maintenance.<sup>8</sup>

To assess the reliability of the maintenance timeliness and planning data collected for both objectives, we reviewed and evaluated two systems—one for the Air Force and one for the Navy—that are used to collect and track data on depot maintenance.<sup>9</sup> We conducted these assessments by interviewing officials regarding their data-collection processes, reviewing related policies and procedures associated with the collection of the data, examining the data for missing values and other anomalies, and interviewing knowledgeable agency officials regarding their accuracy and completeness. Based on our assessments, we determined that the data used from these systems were sufficiently reliable for the purposes of summarizing trends in the selected aircraft maintenance timeliness and planning accuracy for fiscal years 2014 through 2019. A detailed discussion of our scope and methodology is in appendix I.

We conducted this performance audit from April 2019 to June 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.

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## Background

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### Roles and Responsibilities of Depots and Related DOD Organizations

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Depots are government-owned, government-operated industrial installations that maintain, overhaul, and repair a multitude of complex military weapons systems and equipment for DOD. The military services operate 17 depots that perform depot-level maintenance on a wide range of vehicles and other military equipment, including aircraft, engines,

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<sup>8</sup>We visited Oklahoma City Air Logistics Complex in Oklahoma City, OK, and Fleet Readiness Center Southwest in San Diego, CA.

<sup>9</sup>We obtained data from the Air Force's Aircraft Maintenance Production/Compression Report System and the Navy's Production Status Reporting system.

combat vehicles, ships, and software.<sup>10</sup> Of those, the Air Force operates three Air Logistics Complexes and the Navy operates three Fleet Readiness Centers for aviation depot maintenance (see figure 1). For the purposes of this report, we will be referring to them as Air Force and Navy aviation depots.

**Figure 1: Air Force and Navy Aviation Depots Where Depot-Level Maintenance on Fixed-Wing Aircraft Is Performed and Examples of Fixed-Wing Aircraft**



Source: GAO analysis of Department of Defense documents; Air Force and Defense Visual Information Distribution Service (photos). | GAO-20-390

The Air Force’s and Navy’s aviation depots operate through the Air Force and Navy working capital funds. Depot customers are charged for the anticipated full cost of goods and services.<sup>11</sup> Over the past decade, we

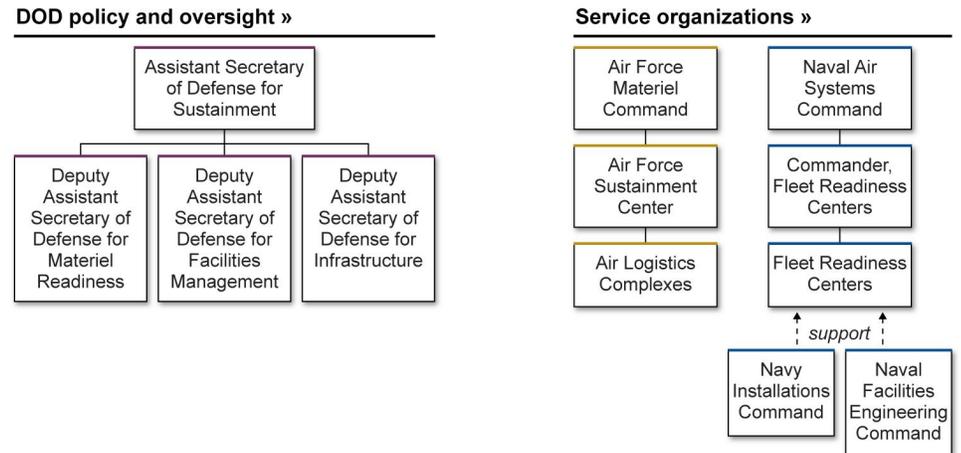
<sup>10</sup>Depot-level maintenance includes inspection, repair, overhaul, or the modification or rebuild of end items, assemblies, subassemblies, and parts that, among other things, require extensive industrial facilities, specialized tools and equipment, or uniquely experienced and trained personnel that are not available in other maintenance activities.

<sup>11</sup>A working capital fund is a type of revolving fund that operates as a self-supporting entity that conducts a regular cycle of businesslike activities. Working capital funds facilitate depot operations, which generate sufficient revenue to cover the full cost of operations on a break-even basis over time—that is, neither make a gain, nor incur a loss.

have audited the services' working capital funds activities related to carryover, new orders, and revenue that can affect depot maintenance timeliness.<sup>12</sup> For more information on the services' working capital funds depot maintenance activities, see appendix II.

The depots are part of a larger, DOD-wide logistics enterprise that involves a number of different organizations, which are identified in figure 2 and described below.

**Figure 2: Key DOD, Air Force, and Navy Aviation Organizations Related to Depot Management**



Source: GAO analysis of Department of Defense (DOD) and service documentation. | GAO-20-390

**Assistant Secretary of Defense for Sustainment.** This official serves as the principal assistant and advisor to the Under Secretary of Defense for Acquisition and Sustainment on materiel readiness. Among other responsibilities, the Assistant Secretary of Defense for Sustainment prescribes policies and procedures on maintenance, materiel readiness and sustainment support. DOD officials report that the Office of the Deputy Assistant Secretary of Defense for Materiel Readiness is

<sup>12</sup>GAO, *Army Working Capital Fund: Army Industrial Operations Could Improve Budgeting and Management of Carryover*, [GAO-16-543](#) (Washington, D.C.: June 23, 2016); GAO, *Navy Working Capital Fund: Budgeting for Carryover at Fleet Readiness Centers Could Be Improved*, [GAO-15-462](#) (Washington, D.C.: June 30, 2015); GAO, *Army Industrial Operations: Budgeting and Management of Carryover Could Be Improved*, [GAO-13-499](#) (Washington, D.C.: June 27, 2013); GAO, *Marine Corps Depot Maintenance: Budgeting and Management of Carryover Could Be Improved*, [GAO-12-539](#) (Washington, D.C.: June 19, 2012); and GAO, *Air Force Working Capital Fund: Budgeting and Management of Carryover Work and Funding Could Be Improved*, [GAO-11-539](#) (Washington, D.C.: July 7, 2011).

responsible for maintenance policy along with the development of a strategic vision for DOD's organic depot base. Also, the Air Force and Navy each has its own logistics or materiel command component, which provides day-to-day management and oversight of the services' depots.

**Air Force Materiel Command.** This command develops, acquires, and sustains weapon systems and their components, providing acquisition and life-cycle management services and logistics support, among other things. The Air Force Life Cycle Management Center within Air Force Materiel Command is responsible for the life-cycle management of weapon systems from inception to retirement, with a specific program office managing each type of aircraft. Air Force Materiel Command works with the program offices to develop, review, validate and prioritize aircraft depot maintenance workload requirements and associated funding.

**Naval Air Systems Command.** This command is responsible for providing life-cycle support of aircraft, weapons, and systems for the Navy and Marine Corps including, acquisition, repair and modification, and in-service engineering and logistics support. As with the Air Force, a specific program office manages each type of aircraft. According to Navy officials, Naval Air Systems Command (NAVAIR), and Commander, Fleet Readiness Centers (COMFRC) work with the program offices to plan and approve the maintenance depot work executed at the Navy aviation depots, including obtaining fixed-wing aircraft workload requirements and associated funding.

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### Information on Selected Air Force and Navy Fixed-Wing Aircraft

The 36 Air Force and Navy fixed-wing aircraft types we selected for our review ranged from fighters to bombers. These aircraft completed a total of 4,513 depot maintenance events in fiscal years 2014 through 2019. See figure 3 for more information.

**Figure 3: Selected Air Force and Navy Fixed-Wing Aircraft Completing Depot Maintenance from Fiscal Years 2014 through 2019**

	Aircraft	Number of incidences of aircraft undergoing depot maintenance	Oklahoma City ALC	Warner Robins ALC	Ogden ALC
Air Force	B-1B Lancer	110	✓		
	B-52 Stratofortress	97	✓		
	C-17 Globemaster III	291		✓	
	C-5M Super Galaxy	36		✓	
	C-130J Super Hercules	133	✓	✓	
	C-130T Hercules	22	✓		✓
	E-3 Sentry	32	✓		
	F-15 C-D Eagle	155		✓	
	F-15E Strike Eagle	198		✓	
	F-16C Fighting Falcon	734			✓
	F-16D Fighting Falcon	127			✓
	F-22 Raptor	112			✓
	F-35A Lightning II	98			✓
	KC-10 Extender	39	✓		
	KC-130J Super Hercules	40	✓		✓
	KC-130T Hercules	28	✓		✓
	KC-135 Stratotanker	552	✓		
	T-38 Talon	571			✓
			FRC East	FRC Southeast	FRC Southwest
Navy	AV-8B Harrier II	78	✓		✓
	C-2A Greyhound	63		✓	✓
	CV-22B Osprey	22	✓		✓
	EA-18G Growler	90		✓	✓
	EA-6B Prowler	42	✓	✓	
	F/A-18A-D Hornet	296	✓	✓	✓
	F/A-18E-F Super Hornet	397		✓	✓
	MV-22B Osprey	70	✓		✓
	NF/A-18C Hornet	1			✓
	NF/A-18D Hornet	2			✓
	NEA-18G Growler	1		✓	
	P-3C Orion	2		✓	
	T-34C Mentor	15		✓	
	T-44A Pegasus	6		✓	
	T-44C Pegasus	23		✓	
	T-6A Texan II	16		✓	
	T-6B Texan II Turboprop	7		✓	
TAV-8B Harrier II	7	✓			
<b>Total</b>		<b>4,513</b>			

ALC Air Logistics Center  
 FRC Fleet Readiness Center

Source: GAO analysis of Air Force and Navy information. | GAO-20-390

Note: The NF/A-18C and NF/A-18D are aircraft used in permanent test roles. The NEA-18G Growler is a modified version used for special testing. The TAV-8B Harrier II is the trainer version of the AV-8B aircraft.

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## Air Force and Navy Depot Maintenance Timeliness Has Varied for Selected Fixed-Wing Aircraft with a Range of Factors Affecting Depot Performance

For the selected aircraft in our review, the Air Force completed depot maintenance on time or earlier an average of 82 percent of the time during fiscal years 2014 through 2019. However, the Navy completed depot maintenance on time or early in the same period an average of 52 percent of the time. We found that a range of factors, such as unexpected repairs and aircraft operating beyond their designed service life, have affected Air Force and Navy depot maintenance timeliness for fixed-wing aircraft.

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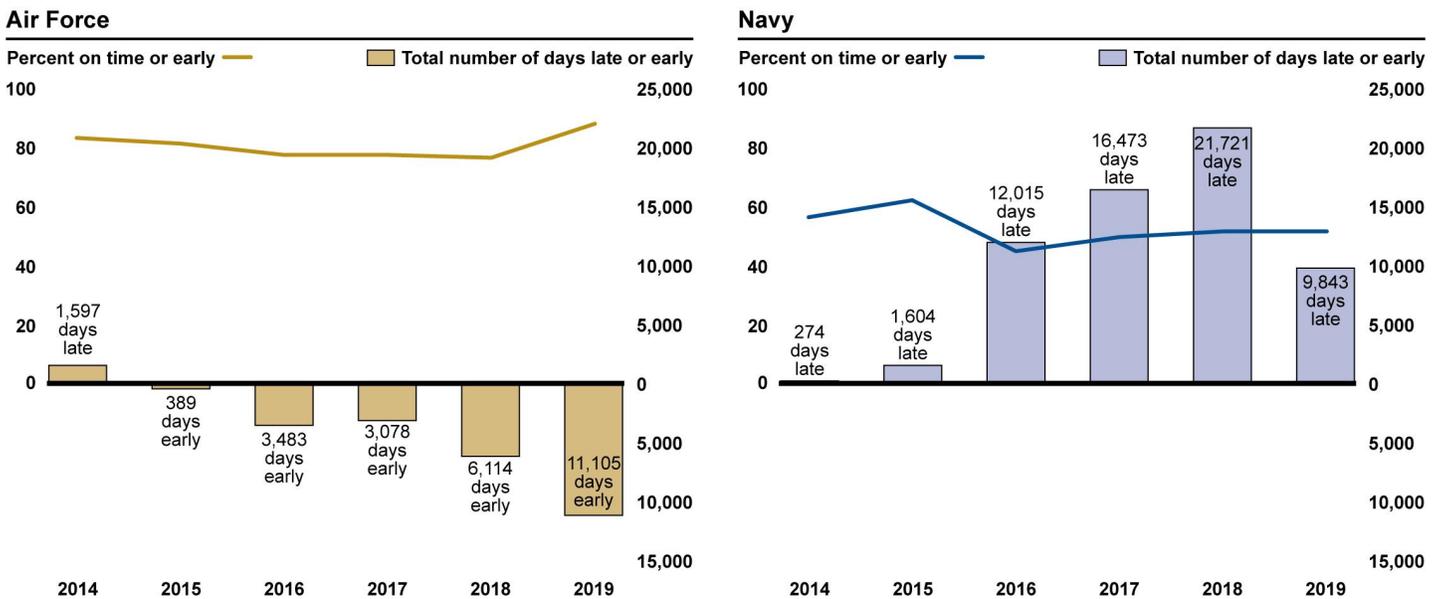
### The Air Force Has Generally Completed Depot Maintenance On Time While the Navy Has Not

Our analysis of aggregate depot maintenance data regarding fiscal years 2014 through 2019 shows that:

- Air Force aviation depots completed depot maintenance of the selected fixed-wing aircraft on time or early in 5 of 6 fiscal years. The annual average percentages for on-time or early-completion maintenance ranged from 78 to 90 percent. In total, selected Air Force fixed-wing aircraft have spent 22,572 fewer days in maintenance than expected since fiscal year 2014.
- Navy aviation depots were late in completing depot maintenance of the selected fixed-wing aircraft for each of the 6 fiscal years. The annual average percentages for on-time or early-completion maintenance ranged from 45 to 63 percent. In total, the maintenance for selected Navy fixed-wing aircraft has taken over 62,000 more days than expected since fiscal year 2014.

Figure 4 shows the percentage of depot maintenance completed on time or early, as well as total days of maintenance delays, if applicable, for the Air Force and Navy.<sup>13</sup>

**Figure 4: Air Force and Navy Percentages of Depot Maintenance Completed On Time or Early and Total Days Late or Early for Selected Fixed-Wing Aircraft, Fiscal Years 2014 through 2019**



Source: GAO analysis of Air Force and Navy data. | GAO-20-390

Analyzing the maintenance timeliness data on a per aircraft basis shows similar trends. The Air Force completed depot maintenance on average about 7 days early per aircraft during fiscal years 2014 through 2019, while the Navy completed depot maintenance on average nearly 55 days late per aircraft (see figure 5).

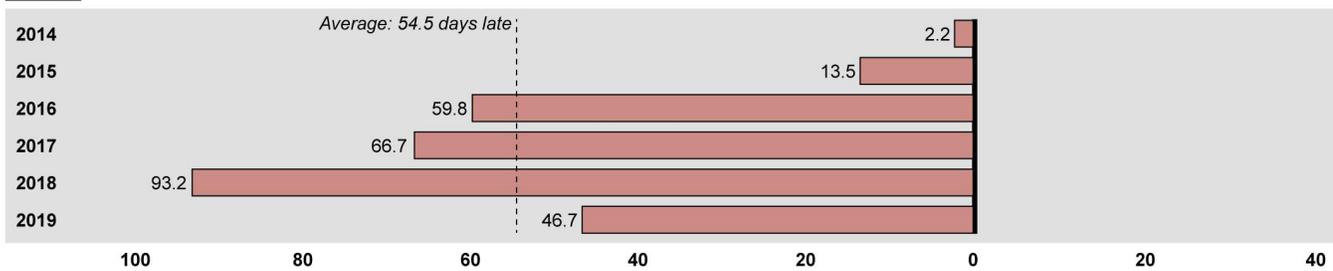
<sup>13</sup>To determine if aircraft maintenance was completed on time, early, or late, we examined individual aircraft that had depot maintenance completed in a given fiscal year. For each aircraft, we compared the planned number of days—the number of days between the date depot maintenance began and when officials estimated it would be completed—with the actual number of days—the number of days between the date depot maintenance began and the date depot maintenance was completed. We used this to determine the number of days an aircraft was completed early, on time, or late. We totaled these days by fiscal year, and figure 4 shows the aggregate numbers and the percentages.

**Figure 5: Average Number of Days Air Force and Navy Aviation Depots Completed Selected Fixed-Wing Aircraft Maintenance Earlier or Later than Projected on a Per Aircraft Basis (Fiscal Years 2014 through 2019)**

**Air Force »**



**Navy »**



Source: GAO analysis of Air Force and Navy data. | GAO-20-390

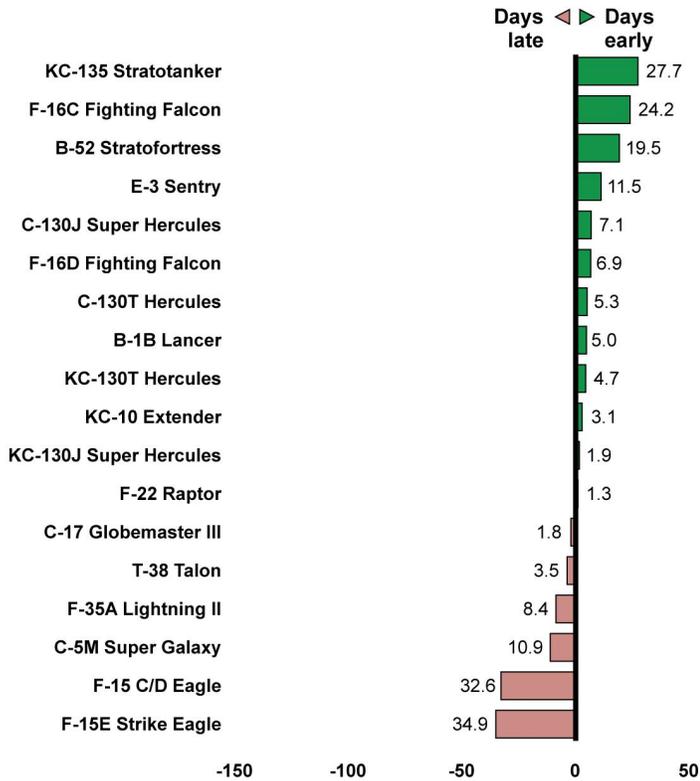
In comparing depot maintenance timeliness for specific aircraft types, we found that timeliness varied for both Air Force and Navy aircraft. For example, Air Force aviation depots completed individual KC-135 aircraft maintenance an average of about 28 days earlier than projected and completed F-15E aircraft maintenance an average of almost 35 days later than projected. Navy aviation depots completed individual EA-6B aircraft maintenance an average of about 1 day earlier than projected and completed F/A-18A-D aircraft maintenance on average about 137 days later than projected.<sup>14</sup>

Figure 6 shows the average number of days—by aircraft type—that the Air Force and Navy aviation depots completed maintenance earlier or later than projected in fiscal years 2014 through 2019.

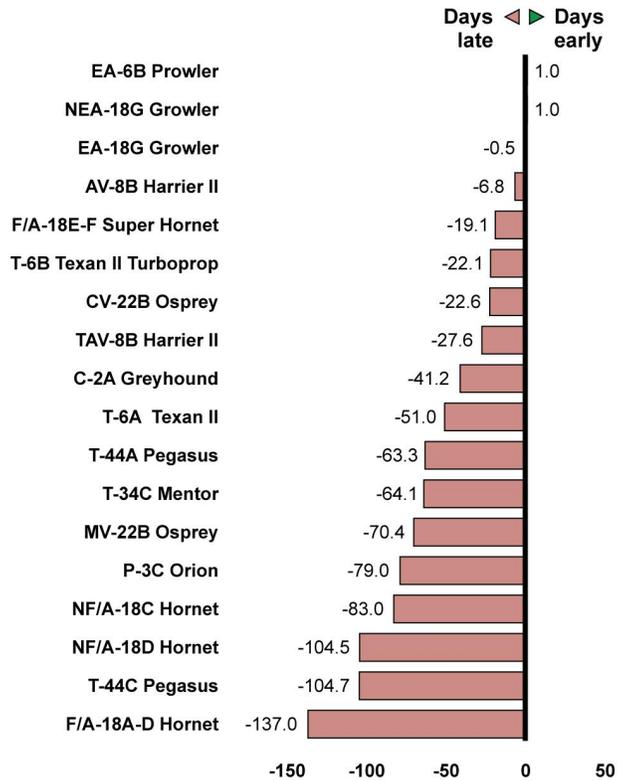
<sup>14</sup>Navy officials noted that our analysis of depot maintenance timeliness occurred during a time period in which there were unique conditions affecting depot maintenance for F/A-18A-Ds, including operating the aircraft beyond their original service life. We included the F/A-18A-D in our analysis because it represented about 46 percent of actual cycle days (96,735) between fiscal years 2014 through 2019.

**Figure 6: Average Number of Days That Depot Maintenance Was Completed Early or Late by Aircraft Type for Selected Air Force and Navy Fixed-Wing Aircraft, Fiscal Years 2014 through 2019**

**Air Force**



**Navy**



Source: GAO analysis of Air Force and Navy data. | GAO-20-390

Note: The NF/A-18C and NF/A-18D are aircraft used in permanent test roles. The NEA-18G Growler is a modified version used for special testing. The TAV-8B Harrier II is the trainer version of the AV-8B aircraft.

### A Range of Factors Has Affected Air Force and Navy Aviation Depot Maintenance Timeliness

Our prior work has identified multiple factors that contribute to depot maintenance delays, including the size and skill of the depot workforce, the condition of weapon systems upon arrival at the depot, the availability of spare parts, and the condition of the depot’s facilities and equipment,

among others.<sup>15</sup> In addition, all of these factors can be affected by funding and operational considerations (such as unexpected accidents). DOD officials have stated that disruptions to funding, to include continuing resolutions, also affect the ability to conduct depot maintenance.<sup>16</sup> Over the course of this review, Air Force and Navy officials cited many of these factors as continuing to affect depot maintenance timeliness while offering specific details on issues contributing to the trends we identified above.

**Air Force’s perspectives on early and late completions:** Air Force officials stated a variety of reasons for completing aircraft maintenance earlier than projected, including frequent communication between program offices and depot stakeholders. For example, Air Force Sustainment Center officials told us that they conduct weekly aircraft performance review meetings with commanders and senior staff to provide a comprehensive status update on aircraft maintenance performance that has occurred since the previous meeting. In addition, on the KC-135 depot production line, Air Force officials told us they document tasks that can be done concurrently during a specific phase in the maintenance process, which has helped them meet their timeliness targets. Air Force officials from across the sustainment enterprise agreed that proactive planning for depot maintenance requirements helps the depots provide the appropriate resources to perform aircraft maintenance. Officials cited unexpected repairs or shortage of skilled depot maintainers as reasons for later-than-projected completion of maintenance on an aircraft.

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<sup>15</sup>See, for example, GAO, *F-35 Aircraft Sustainment DOD Needs to Address Substantial Supply Chain Challenges*, [GAO-19-321](#) (Washington, D.C.: Apr. 25, 2019); 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); GAO, *Military Readiness: Analysis of Maintenance Delays Needed to Improve Availability of Patriot Equipment for Training*, [GAO-18-447](#) (Washington, D.C.: June 20, 2018); GAO, *Weapon System Sustainment: Selected Air Force and Navy Aircraft Generally Have Not Met Availability Goals, and DOD and Navy Guidance Need to Be Clarified*, [GAO-18-678](#) (Washington, D.C.: Sept. 10, 2018); GAO, *F-35 Aircraft Sustainment: DOD Needs to Address Challenges Affecting Readiness and Cost Transparency*, [GAO-18-75](#) (Washington, D.C.: Oct., 26, 2017); GAO, *Naval Shipyards: Actions Needed to Improve Poor Conditions that Affect Operations*, [GAO-17-548](#) (Washington, D.C.: Sept. 12, 2017); GAO, *Military Readiness: Progress and Challenges in Implementing the Navy’s Optimized Fleet Response Plan*, [GAO-16-466R](#) (Washington, D.C.: May 2, 2016); GAO, *Defense Inventory: Actions Needed to Improve the Defense Logistics Agency’s Inventory Management*, [GAO-14-495](#) (Washington, D.C.: June 19, 2014).

<sup>16</sup>[GAO-19-242](#).

**Navy’s perspectives on late completions:** Navy officials stated various reasons for completing aircraft maintenance later than projected, including growth in the scope of needed work after the aircraft was evaluated (e.g., finding damage that required tailored engineering instructions), a diminishing supply of manufactured parts for aircraft, and aircraft operating well beyond their designed service life—such as the F/A-18A-D fighters and C-2A cargo aircraft.<sup>17</sup> In addition to operating F/A-18A-Ds longer than originally planned, Navy officials stated that they also had to manage aircraft production delays related to the F-35, which was scheduled to replace the F/A-18A-Ds.

Navy officials explained that they have implemented a variety of strategies to improve on-time maintenance. These initiatives primarily focus on mitigating or reducing maintenance delays in the year of execution. For example:

- *Naval Sustainment System initiative:* The Navy implemented this initiative at the beginning of fiscal year 2019, which led to the service implementing private industry best practices and employing new strategies such as “swarming,” which refers to many artisans being put to work on a particular aircraft to expedite completion. The initial focus of these strategies was on the F/A-18E-F.<sup>18</sup> During a site visit to Fleet Readiness Center Southwest, officials showed us how the initiative prompted reconfiguration of workstations—clearing storage and material areas in the hangar and creating direct line of vision for maintainers—to maximize an artisan’s time spent on an aircraft.
- *Tracking depots efficiency:* Officials are using a new software program that enables real-time tracking of the progress of aircraft maintenance, which they told us has led to improved efficiency because it provides increased visibility into aircraft with delays. For example, officials stated over the past 2 years, they have decreased the number of

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<sup>17</sup>To mitigate some challenges associated with the age of the fixed-wing aircraft, Navy program officials said that they have conducted engineering analysis to develop new repair procedures, which resulted in aircraft being placed in delay for extended periods of time.

<sup>18</sup>According to Navy officials, the Navy implemented the Naval Sustainment System initiative to address meeting the Secretary of Defense’s 80-percent mission-capable goal for fighter aircraft, including the F/A-18. See Office of the Under Secretary of Defense Memorandum, *NDS Implementation—Mission Capability of Critical Aviation Platform Metrics* (Nov. 20, 2018).

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aircraft undergoing maintenance from 390 in 2017 to about 270 across the aviation depots.

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## The Air Force Generally Has Accurately Planned for Aviation Depot Maintenance, but the Navy Has Not Fully Addressed Several Planning Challenges

The Air Force has largely accurately planned for aviation depot maintenance requirements for selected fixed-wing aircraft during fiscal years 2014 through 2019, but the Navy has not. Both services have initiatives underway to improve planning for aviation depot maintenance; however, we identified several planning challenges that the Navy has not fully addressed, such as not effectively using historical data to establish accurate planning targets for aircraft depot maintenance packages.

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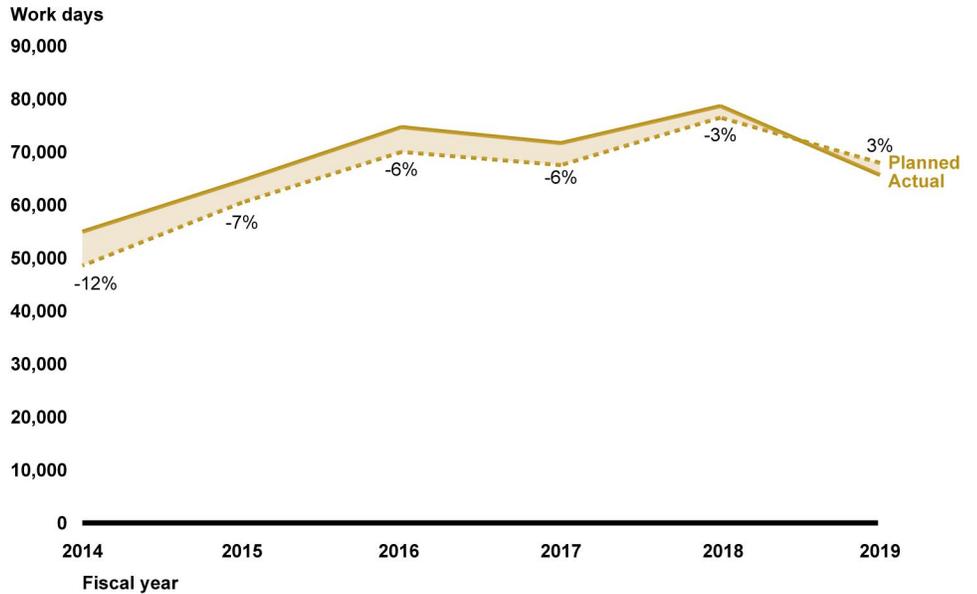
### The Air Force Generally Has Accurately Planned for Aviation Depot Maintenance Requirements

Our analysis of Air Force planned maintenance workload data—estimates of the number of days planned for depot maintenance made 3 years in advance—found that the Air Force largely accurately planned for aviation depot maintenance requirements for selected aircraft for fiscal years 2014 through 2019.<sup>19</sup> The difference between the number of days the Air Force planned in advance that it would need for maintenance and actually needed has been small and trending downward, from 12 percent in fiscal year 2014 to 3 percent in fiscal years 2018 and 2019 (see figure 7). Our analysis shows that, for the 6 fiscal years we reviewed, the Air Force slightly underestimated the amount of time it needed to complete fixed-wing aircraft maintenance by an average of about 6 days per aircraft.

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<sup>19</sup>We analyzed data on maintenance duration for maintenance completed in fiscal years 2014 through 2019, and compared the number of days planned for maintenance to the number of days used for maintenance to determine the extent to which planned and actual numbers aligned.

**Figure 7: Differences between Planned and Actual Days Needed for Maintenance for Selected Air Force Fixed-Wing Aircraft, Fiscal Years 2014 through 2019**



Source: GAO analysis of Air Force data. | GAO-20-390

To accurately plan for aviation depot maintenance, Air Force Materiel Command officials told us they had implemented three key initiatives including:

- Conducting early inspections:* Air Force officials stated that they have been conducting pre-inspections of selected aircraft a year before scheduled maintenance to check for unplanned maintenance needs, and to ensure the availability of parts. Officials stated that the early inspections can clarify the scope of work and avoid extended delays in completing maintenance. For example, the Air Force has been conducting pre-inspections of its KC-135—an aerial refueling aircraft—by sending Boeing engineers to pre-inspect a sample of KC-135s that are scheduled for depot maintenance in the following year. The inspections can inform parts orders with long-lead times and initiate developing procedures to resolve any new repairs identified during inspections, Air Force officials stated.
- Developing and implementing a new metric:* To help measure the effectiveness of planning, Air Force officials stated that in 2017 Air Force Materiel Command created a new metric—the Planned Obligations Weighted for Execution Review—comparing which customer orders were planned for funding versus which ones actually received funding. According to Air Force officials, the metric provides

visual information to leaders of the degree of variance between the planned and actual aircraft that come into the depots for maintenance. Air Force Materiel Command officials stated that the metric has helped them identify factors affecting the differences between planned and actual aircraft entering the depots for maintenance and to adjust resources when needed to address the workload.

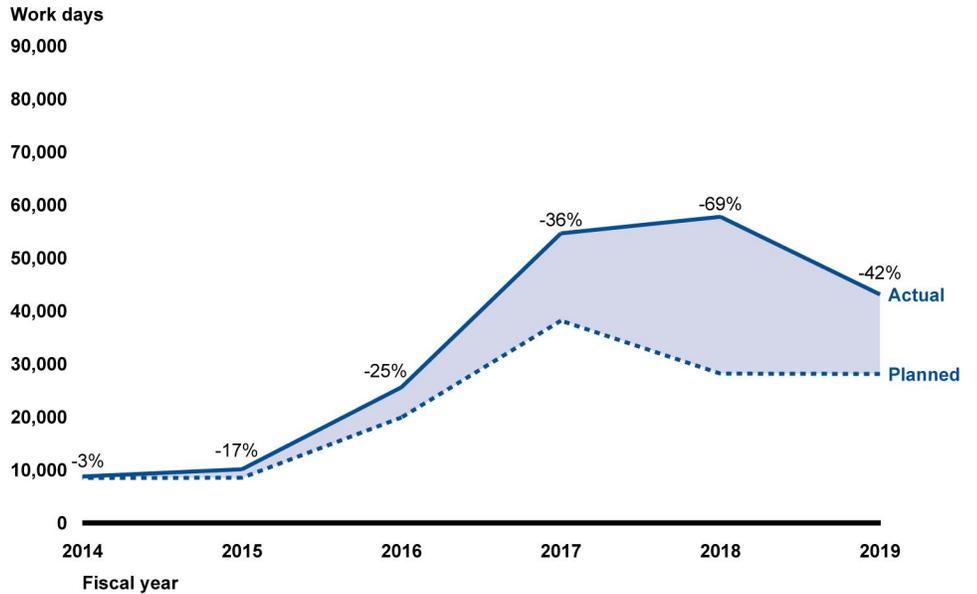
- *Reviewing planning performance and making adjustments:* Air Force Materiel Command annually conducts a two-phased planning process to establish the organic Air Force depot-level resources necessary to support the projected funded maintenance requirements for the next 2 fiscal years. Later, the Air Force conducts an after-action review of the performance of the planning process. In addition, command leadership, senior staff, and other members of the aviation depot community hold weekly performance review meetings and make necessary adjustments. This includes reviewing visual information such as standardized charts and graphs that provide the current status of aircraft undergoing depot maintenance, as well as any issues they are monitoring.

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## The Navy Generally Has Not Accurately Planned for Aviation Depot Maintenance Requirements

Our analysis of Navy-planned maintenance workload data—estimates of the number of days planned for depot maintenance made 3 years in advance—found that the Navy generally has not accurately planned for aviation depot maintenance requirements for selected fixed-wing aircraft for fiscal years 2014 through 2019. We found a trend of underestimating actual days needed for aircraft maintenance. The difference between the number of days the Navy planned in advance it would need for maintenance and the number actually needed ranged from a low of 3 percent in fiscal year 2014 to a high of 69 percent in fiscal year 2018. However, we found the difference declined to 42 percent in fiscal year 2019. Figure 8 shows the difference between planned and actual work days for selected Navy fixed-wing aircraft in fiscal years 2014 through 2019.

**Figure 8: Differences between Planned and Actual Days Needed for Maintenance for Selected Navy Fixed-Wing Aircraft, Fiscal Years 2014 through 2019**



Source: GAO analysis of Navy data. | GAO-20-390

Our analysis, for the 6 fiscal years that we reviewed, showed that the Navy underestimated the amount of time it needed to complete fixed-wing aircraft maintenance by an average of about 55 days per aircraft.

The Navy has acknowledged that it has not accurately planned for depot maintenance requirements. The Navy conducted risk assessments and internal control assessments in 2018 and 2019 and found material weaknesses, such as a trend of underestimating time needed to address aviation depot maintenance requirements.<sup>20</sup> Specifically, the two risk and internal control assessments stated that Navy policies for defining, costing, and executing maintenance did not allow them to correctly predict cost estimates and duration of depot maintenance. In addition, the Navy’s 2019 risk and internal control assessment highlighted the need to improve planning accuracy; the report stated that internal reviews found

<sup>20</sup>The Navy’s 2018 and 2019 Statements of Assurance were conducted as required by the Federal Managers’ Financial Integrity Act of 1982 (FMFIA), and the Federal Financial Management Improvement Act of 1996 (FFMIA). The Office of Management and Budget (OMB) Circular No. A-123, Management’s Responsibility for Enterprise Risk Management and Internal Control, and the GAO’s Standards for Internal Control in the Federal Government establish the standards against which assessments are made.

workload standards did not accurately capture the required maintenance and that planned maintenance requirements exceeded depot capacity.

Navy officials stated that they implemented an initiative in fiscal year 2020 to improve maintenance requirements called Performance to Plan. This initiative is focused on incorporating data collection and analysis to, among other things, improve forecasts of maintenance period durations according to Navy documentation.<sup>21</sup> For example, the approach of Performance to Plan is to incorporate predictive data into planning to improve forecasts of maintenance period durations, according to the same documentation. While this initiative is a positive step, it is still in the early stages of implementation and we identified three reasons that have in part led to inaccurate planning that the Navy has not fully addressed.

#### The Navy Has Not Effectively Used Historical Data to Update Maintenance Planning

The Navy measures depot performance using turnaround time as one of the key timeliness metrics. Turnaround time is the overall duration of the maintenance cycle, from when the aircraft is inducted into the depot to when it is provided back to the squadron. According to Navy officials, the Navy reviews historical data to support the maintenance requirements planning process in various ways, including adjusting turnaround time based on historical depot performance.

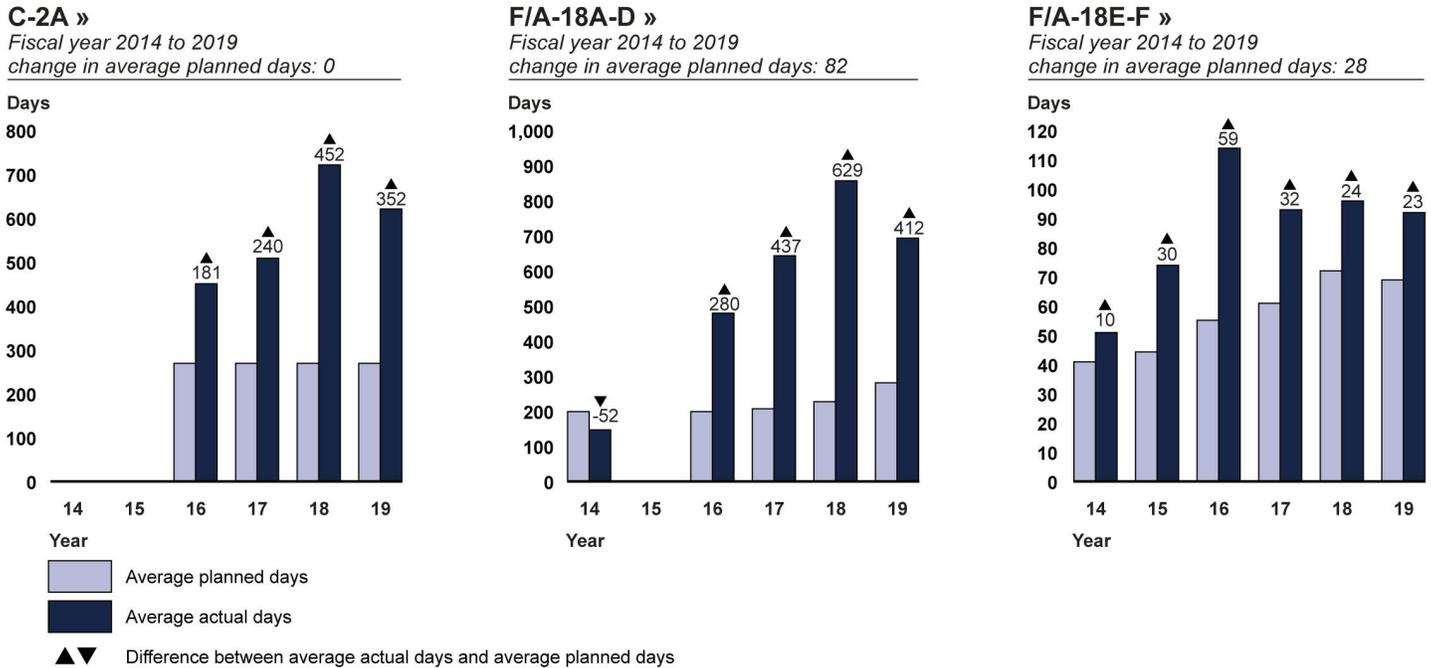
However, we found that the Navy has not effectively used historical data to analyze turnaround time—total days planned for depot maintenance periods—and to update maintenance requirements planning for selected fixed-wing aircraft. Specifically, our analysis of average turnaround time for selected aircraft depot maintenance packages shows that the Navy has not adjusted maintenance planning effectively to account for the actual days needed to perform maintenance.<sup>22</sup> Figure 9 shows that the Navy kept planned turnaround time the same or with minimal changes for maintenance packages for the C-2A, the F/A-18A-D, and the F/A-18E-F, despite worsening trends in maintenance execution during fiscal years 2014 through 2019.

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<sup>21</sup>Navy, *Performance to Plan Overview* (February 2020).

<sup>22</sup>The Navy conducts scheduled depot maintenance packages called planned maintenance intervals—a period of time needed for execution of a maintenance event.

**Figure 9: Differences between Average Planned and Average Actual Turnaround Time for Selected Maintenance Packages for the Navy C-2A, F/A-18A-D, and F/A-18E-F, Fiscal Years 2014 through 2019**



Source: GAO analysis of Navy data. | GAO-20-390

Note: A planned maintenance interval (PMI) is a period of time for execution of a maintenance event. There are various PMIs, including PMI 1, PMI 2, and PMI 3, and when the PMI is conducted varies according to aircraft type. Our analysis is based on the following depot maintenance packages: a PMI 3 for the C-2A, a PMI 1 for the F/A-18A-D, and a PMI 2 for the F/A-18E-F. The C-2A did not have a PMI 3 depot maintenance package in fiscal years 2014 and 2015. The F/A-18A-D did not have a PMI 1 depot maintenance package in fiscal year 2015.

- **C-2A:** In fiscal years 2016 through 2019, the Navy did not adjust its planned turnaround time—270 days—while the average number of actual work days to complete maintenance increased from 451 days in fiscal year 2016 to a high of 722 days in fiscal year 2018.<sup>23</sup> Further, the difference between the average planned turnaround time and the average actual number of days needed to complete maintenance increased from 181 days in fiscal year 2016 to 352 days in fiscal year 2019, and peaked at 452 days in fiscal year 2018.
- **F/A-18A-D:** In fiscal years 2014 through 2019, the Navy adjusted its planned turnaround time by a total of 82 days, while the average number of actual work days to complete maintenance increased from

<sup>23</sup>In fiscal years 2014 and 2015, the Navy did not conduct this particular maintenance event on the C-2A.

148 days in fiscal year 2014 to 694 days in fiscal year 2019, and peaked to 857 days in fiscal year 2018.<sup>24</sup> In addition, the difference between the average planned turnaround time and the average actual number of days needed to complete maintenance increased from 52 days in fiscal year 2014 to 412 days in fiscal year 2019, and peaked at 629 days in fiscal year 2018.

- *F/A-18E-F*: In fiscal years 2014 through 2019, the Navy adjusted its planned turnaround time by a total of 28 days, while the average number of actual work days to complete maintenance increased from 51 days in fiscal year 2014 to 92 days in fiscal year 2019. In addition, the difference between the average planned turnaround time and the average actual number of days needed to complete maintenance increased from 10 days in fiscal year 2014 to 23 days in fiscal year 2019, and peaked at 59 days in fiscal year 2016.

*Naval Air Systems Command Workload Standards Required for the Aircraft and Engine Programs at the Fleet Readiness Centers* states that COMFRC should analyze and review naval aviation proposed workload standard packages and compare to actual production and historical data.<sup>25</sup> It also states that the workload standard development process, which includes the estimation and development of turnaround time—is to provide a basis for the identification of resource requirements at the naval aviation depot, such as personnel skills mix and materials, and as a budgetary justification of workload for the repair of aircraft. In addition, the *Navy 2014-2019 Depot Maintenance Strategic Plan* states that NAVAIR and COMFRC will identify and sustain requisite core maintenance capabilities through a planning process that effectively estimates and monitors near and long-term workload.

Navy officials explained that they have worked to incorporate historical data into their maintenance requirements planning process; however, they acknowledged that planning needs to improve and they are in the process of revising how COMFRC and NAVAIR determines planned turnaround time. For example, COMFRC and F/A-18 program office officials said as part of the Naval Sustainment System initiative, COMFRC is moving toward a 60-day fixed turnaround time on some F/A-18E-F depot maintenance packages in an effort to drive depot maintenance

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<sup>24</sup>In fiscal year 2015, the Navy did not conduct this particular maintenance event on the F/A-18A-D.

<sup>25</sup>NAVAIR Instruction 13023.1A.

efficiency and, ultimately, improve aircraft mission capability rates.<sup>26</sup> According to officials, they plan to apply a fixed turnaround time across all aircraft. As the Navy moves forward, it must ensure that it effectively uses historical data to analyze turnaround time and establish accurate turnaround time targets for fixed-wing aircraft depot maintenance packages. If it does not do so, the Navy will likely continue to underestimate the number of days required to perform depot maintenance and misalign the resources and funding needed at the depots to perform aircraft maintenance, which in part contributes to persistent maintenance delays that reduce the time aircraft are available for operations and training.

#### Navy Depot Planners Do Not Have Direct Visibility of Maintenance Performed Outside Aviation Depots

We found that Navy depot maintenance planners do not have direct visibility into fixed-wing aircraft maintenance that is performed outside the Navy aviation depots by an operational unit or at an intermediate maintenance facility—information critical to planning for the condition and depot maintenance needs of individual aircraft.<sup>27</sup> Navy officials said that data exists on maintenance conducted on an aircraft outside the Navy aviation depots—by an operational unit or at an intermediate maintenance facility—and on the condition of an aircraft while deployed with squadrons. However, depot planners do not have direct visibility over squadron-level information because the Navy has not provided depot planners regular reporting on fixed-wing aircraft maintenance performed outside the aviation depots. Instead, depot planners can access that data only through a request to the squadron and typically rely on general

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<sup>26</sup>A planned maintenance interval (PMI) is a period of time for execution of a maintenance event. There are various PMIs, including PMI 1, PMI 2, and PMI 3, and when the PMI is conducted varies according to aircraft type. According to COMFRC and F/A-18E-F program office officials, a fixed 60-day turnaround time was applied only to planned maintenance interval 2 (PMI 2) depot maintenance packages on the F/A-18E-F, not to all depot maintenance packages on the F/A-18E-F.

<sup>27</sup>COMNAVAIRFORINST 4790.2C, *The Naval Aviation Maintenance Program* (Jan. 15, 2017) states that field maintenance is maintenance performed at shore and sea operational sites to rapidly return aircraft and equipment to operational status. Organizational-level maintenance is defined as basic maintenance performed by an activity on its assigned equipment. Organizational-level maintenance is typically organized to achieve quick turnaround of aircraft or equipment to optimize operational availability. Intermediate-level maintenance is defined as material maintenance or repair in direct support of organizational-level activities. Some examples of intermediate-level maintenance include diagnostic testing performed with automated equipment and repair or replacement of damaged or unserviceable parts, among others.

planning factors rather than aircraft-specific data when estimating maintenance needs.

According to Navy officials, the lack of direct visibility into the condition and maintenance history of an aircraft has driven maintenance delays in the past. For example, COMFRC and F/A-18 program office officials said that high turnaround time on certain F/A-18A-Ds undergoing maintenance was due to extended squadron usage on the aircraft combined with a lack of logistics support to address these issues. Furthermore, for aircraft damage that was outside of the depot's repair capabilities, long lead times on parts procurement and extensive engineering analysis resulted in aircraft being placed in delay for extended periods of time, sometimes years, according to the officials. Figure 10 shows an F/A-18 undergoing depot maintenance at a Navy aviation depot.

**Figure 10: F/A-18 Undergoing Depot Maintenance at Fleet Readiness Center Southwest**



Source: Fleet Readiness Center Southwest. | GAO-20-390

In other cases, high usage by squadrons can cause unexpected corrosion on many types of fixed-wing aircraft that depots have not prepared to address. For example, Office of the Chief of Naval Operations officials said that some aircraft have panels that are taken off during depot maintenance events. If depot maintainers find unexpected corrosion behind a panel, it may require additional time to repair that aircraft,

resulting in an increase in the turnaround time. In addition, a COMFRC official stated an AV-8B arrived at an aviation depot without the engine installed, which prevents full operational checks being performed during disassembly. Once maintenance was completed, the aircraft went through operational checks and officials found canopy seal issues, which could have been identified if the depot had received data from the intermediate-level maintenance facility.

*The Navy 2014-2019 Depot Maintenance Strategic Plan* states that NAVAIR and COMFRC will identify and sustain the necessary capabilities to perform maintenance through a planning process that effectively estimates and monitors near and long-term workload.<sup>28</sup> Navy officials said direct visibility into data on the current condition and maintenance history of an aircraft at the squadron level better prepares COMFRC and NAVAIR to more accurately plan aircraft depot maintenance. This has been corroborated by Naval Sustainment System initiative findings that revealed that the Navy should be better informed about the condition of aircraft in order to improve their maintenance requirements planning.

However, depot planners do not have direct visibility over squadron-level information because the Navy has not provided depot planners regular reporting on fixed-wing aircraft maintenance performed outside the aviation depots. Without regular reporting on fixed-wing aircraft maintenance performed outside the Navy aviation depots by an operational unit or at an intermediate maintenance facility, depot planners cannot plan for the condition and depot maintenance needs of individual aircraft, which in part contributes to persistent maintenance delays that reduce the time aircraft are available for operations and training.

#### The Navy Does Not Have Formal Processes and Guidance for Communication and Coordination between Depot Stakeholders to Inform Maintenance Planning

We found that the Navy does not have formal processes and related guidance for communication and coordination between depot stakeholders to inform maintenance requirements planning. Navy officials explained that depot maintenance stakeholders communicate in a variety of ways to inform maintenance requirements planning. For example, the Navy conducts annual and mid-year workload planning meetings. At the

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<sup>28</sup>Navy, *The United States Navy Depot Maintenance Strategic Plan, 2014-2019* (October 2013).

annual workload planning meeting, COMFRC and aircraft program leads provide plans to meet aircraft workload requirements for the current year and the next 2 fiscal years. The mid-year review provides an update on the current year's performance and the final workload plan for the next 2 fiscal years, according to Navy documentation. Various aircraft program office leads attend both the annual and mid-year planning meetings to provide an update on workload plans—among others—to COMFRC. Navy officials stated that they also informally communicate in a variety of ways to inform maintenance requirements planning. For example, depot maintenance engineers may find extra corrosion on an aircraft, and use those findings to update maintenance plans for other individual aircraft.

While these meetings provide opportunities for collaboration and officials utilize other means to informally communicate, NAVAIR and COMFRC do not have formal processes and related guidance for communication and coordination between depot stakeholders to ensure they receive input from all key subject-matter experts regarding workload planning. Navy officials noted that not having formal processes and related guidance presents several challenges including:

- Navy officials said that there is no formal process or guidance for communication and coordination, and that the process instead involves a series of documents that COMFRC receives that are assembled to create a representation of future workload from the Commander, Naval Air Forces and from each of the aircraft program offices, among others. A COMFRC official said that different stakeholders manage various parts of workload planning and without guidance on specific documentation needs and process owners, it is challenging for the Navy to identify accountable stakeholders and discuss specific planning needs.
- NAVAIR officials said workload planners hold periodic meetings, but attendance by subject-matter experts is not mandatory. For example, subject-matter experts from the Fleet Support Teams—officials who provide engineering and logistics technical support to fleet and aviation depot maintenance organizations—are not required to attend workload planning meetings. Experts may potentially attend via video teleconference, but others, due to time zone differences, may not participate. As a result, workload planning meetings may not consistently include workload input from all relevant subject-matter experts.
- Navy officials said that once the Naval Sustainment System initiative began focusing on improving depot maintenance on the F/A-18E-F,

deficiencies in the workload planning process became more apparent. They noted the challenges of coordinating key stakeholders along the maintenance planning timeline and its impact on planning and budgeting. In particular, Navy officials stated the current depot maintenance planning-time horizon was disconnected from long-range planning, such as the Program Objective Memorandum process.<sup>29</sup> For example, due to a misalignment in the planning and budgeting processes, COMFRC reacts to the outcome of the Program Memorandum Objective process rather than influencing it, which results in many adjustments to their productions plans, such as improper staffing, material management, and facility-usage plans.

*NAVAIR Instruction 5221.1B, Workload Acceptance* states that commanders will establish internal competency guidelines for communication and coordination of workload-related issues. In addition, the *Navy 2014-2019 Depot Maintenance Strategic Plan*, states the Navy will forge a strong liaison between maintenance activities and the acquisition community to ensure that maintenance requirements and planning are in sync. As a result of the Naval Sustainment System initiative, Navy officials said that COMFRC is developing a new workload planning process to become more proactive in depot maintenance planning and increase information exchanges. This includes ensuring that the new process involves all key depot maintenance stakeholders, such as COMFRC officials, program managers, and fleet officials. For example, NAVAIR officials said that most of the Fleet Support Team scheduled maintenance leads will be the primary point of contact to assist COMFRC with developing the future maintenance requirements planning and will be invited and asked to attend workload planning meetings. If they are unable to attend, they will then ask to have a program office representative attend in their place.

However, Navy officials acknowledged that their efforts are still in the developmental stages and that the Navy needs formal processes and related guidance for communication and coordination between depot stakeholders to inform maintenance requirements planning. Without these in place, the Navy cannot be assured that all subject-matter expert input is proactively solicited and incorporated into depot workload planning,

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<sup>29</sup>The Program Objective Memorandum is the final product of the programming process within DOD and displays the resource allocation decisions of the military departments in response to and in accordance with planning and programming guidance.

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which in part can contribute to persistent maintenance delays that reduce the time aircraft are available for operations and training.

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## Conclusions

The ability of the Air Force and Navy aviation depots to complete maintenance on time directly affects military readiness. Poor planning for depot maintenance contributes to longer delays and reduced unit readiness. The Air Force has generally accurately planned for aviation depot maintenance over the last 6 years and in turn has completed the vast majority of its depot maintenance on time or early over this timeframe. In contrast, the Navy has not accurately planned for aviation depot maintenance over the last 6 years and in turn has completed only half of its depot maintenance on time over this timeframe, which has adversely affected aircraft availability.

While the Navy has implemented an initiative to improve maintenance planning, the Navy has not effectively used historical data to analyze turnaround time and establish accurate planning targets for aircraft maintenance packages. In addition, Navy depot planners do not have visibility into aircraft maintenance that is performed outside the depots by an operational unit or other maintenance facility—information critical to planning for the condition and depot maintenance needs of individual aircraft. The Navy also has not established formal processes and related guidance for communication and coordination between depot stakeholders to ensure they receive input from all key subject-matter experts to inform maintenance planning. Without addressing these challenges, the Navy cannot appropriately plan for depot maintenance workload and may continue to experience maintenance delays that reduce the availability of aircraft for operations and training.

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## Recommendations for Executive Action

We are making three recommendations to the Department of Navy.

The Secretary of the Navy should ensure that Naval Air Systems Command and Commander, Fleet Readiness Centers effectively use historical data to analyze turnaround time and establish accurate turnaround time targets for fixed-wing aircraft depot maintenance packages. (Recommendation 1)

The Secretary of the Navy should ensure that Commander, Naval Air Forces and Commander, Naval Air Force, Pacific provide depot planners regular reporting on fixed-wing aircraft maintenance performed outside the Navy aviation depots by an operational unit or at an intermediate maintenance facility to ensure they have information on the current condition and depot maintenance needs of individual aircraft. (Recommendation 2)

The Secretary of the Navy should ensure that Naval Air Systems Command and Commander, Fleet Readiness Centers establish formal processes and related guidance for communication and coordination between depot stakeholders to inform maintenance requirements planning. (Recommendation 3)

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## Agency Comments

We provided a draft of this report to DOD for review and comment. In written comments on a draft of this report, DOD concurred with all three of our recommendations. DOD's comments are reprinted in their entirety in appendix III. DOD also provided technical comments, which we incorporated as appropriate.

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

If you or your staff has any questions about this report, please contact Diana Maurer at (202) 512-9627 or [maurerd@gao.gov](mailto:maurerd@gao.gov) or Asif A. Khan, at (202) 512-9869, or [khana@gao.gov](mailto:khana@gao.gov). Contact points for our Office 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

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Asif A. Khan  
Director, Financial Management  
and Assurance

*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: Scope and Methodology

Senate Report 115-262 accompanying a bill for the National Defense Authorization Act for Fiscal Year 2019 included provisions for us to examine the Department of Defense's (DOD) aviation depots and maintenance operations. Our report examines the extent to which 1) the Air Force and Navy aviation depots completed selected fixed-wing aircraft maintenance on time from fiscal years 2014 through 2019, and 2) the Air Force and Navy accurately planned for depot maintenance requirements for selected fixed-wing aircraft from fiscal years 2014 through 2019 and addressed any associated challenges. We have separate ongoing reviews to examine maintenance timeliness and related issues at the Army and Marine Corps key weapons systems depots and Navy shipyards.

For objective one, we selected a non-generalizable sample of 18 Air Force and 18 Navy fixed-wing aircraft types, including fighters, bombers, and aerial refuelers, based on information from Navy and Air Force maintenance data and our prior work.<sup>1</sup> These aircraft had maintenance completed in fiscal years 2014 through 2019, at the Navy's three Fleet Readiness Centers and the Air Force's three Air Logistics Complexes. We selected this time period so we could identify and obtain insight on historical data trends regarding maintenance timeliness for the selected aircraft.

For each aircraft, we collected data on the date maintenance began and was completed for individual aircraft, as well as the original estimate of time (in days) needed to complete maintenance.<sup>2</sup> We also collected updated estimates if available. We used this information to calculate the difference between the number of days planned for maintenance (using the updated estimate if available) and the number of days used for

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<sup>1</sup>We excluded rotary wing, surveillance, unmanned, and early warning aircraft.

<sup>2</sup>The data set did not include depot-level repairables. These are items that are generally more cost-effective to repair and reuse than to dispose of and replace, such as a landing gear.

maintenance in order to determine whether the services completed aircraft maintenance on time, early, or late.

Additionally, we used the total number of aircraft completed in each fiscal year to calculate a measure of average maintenance timeliness by aircraft type. We presented the data based on aircraft that had maintenance completed in a given fiscal year; however, not all of the maintenance was necessarily completed in that given fiscal year. For example, an aircraft may have had maintenance begun on it in one fiscal year and its maintenance completed in the next fiscal year. In such case, we would count that aircraft in the second fiscal year. The aircraft types we selected were:

**Air Force:**

- B-1B Lancer
- B-52 Stratofortress
- C-17 Globemaster III
- C-5M Super Galaxy
- C-130T Hercules
- C-130J Super Hercules
- E-3 Sentry
- F-15 C-D Eagle
- F-15E Strike Eagle
- F-16C Fighting Falcon
- F-16D Fighting Falcon
- F-22 Raptor
- F-35A Lightning II
- KC-10 Extender
- KC-130J Super Hercules
- KC-130T Hercules
- KC-135 Stratotanker
- T-38 Talon

**Navy:**

- AV-8B Harrier II
- C-2A Greyhound
- CV-22B Osprey
- EA-18G Growler
- EA-6B Prowler
- F/A-18A-D Hornet
- F/A-18E-F Super Hornet
- MV-22B Osprey
- N F/A-18C Hornet
- N F/A-18D Hornet
- NEA-18G Growler
- P-3C Orion
- TAV-8B Harrier II
- T-34C Mentor
- T-44A Pegasus
- T-44C Pegasus
- T-6A Texan II
- T-6B Texan II Turboprop

In addition, we interviewed DOD and service officials to gain a better understanding of factors influencing fixed-wing aircraft maintenance timeliness and reviewed our prior work on depot maintenance.<sup>3</sup>

For objective two, we collected information on the depot maintenance planning processes for Air Force and Navy fixed-wing aircraft. Using the non-generalizable sample of 18 Air Force and 18 Navy fixed-wing aircraft identified in objective one, we analyzed data on maintenance duration for maintenance completed in fiscal years 2014 through 2019, and compared the number of days planned for maintenance to the number of days used for maintenance to determine the extent to which planned and actual

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<sup>3</sup>See, for example, 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) and *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).

numbers aligned. We interviewed DOD, Navy, and Air Force officials to obtain their views on the challenges related to planning, incorporating historical data, and coordinating with stakeholders related to the maintenance requirements planning process for aircraft depot maintenance. For specific challenges identified in the Navy, we reviewed documents including Naval Air Systems Command (NAVAIR) workload standards, applicable Navy guidance, and the Navy depot maintenance strategic plan and interviewed Commander, Fleet Readiness Centers (COMFRC) and NAVAIR officials to determine the extent to which the Navy incorporates historical data into the maintenance requirements planning process and the extent to which Navy depot stakeholders communicate and coordinate to inform this planning process.<sup>4</sup> In addition, we visited one Air Force aviation depot and one Navy aviation depot to interview officials from specific aircraft programs, depot production, and depot business offices to understand challenges associated with planning for depot maintenance.<sup>5</sup>

To assess the reliability of the maintenance timeliness and planning data collected for both objectives, we reviewed and evaluated two systems—one for the Air Force and one for the Navy—that are used to collect and track data on depot maintenance.<sup>6</sup> We conducted these assessments by interviewing officials regarding their data-collection processes, reviewing related policies and procedures associated with the collection of the data, examining the data for missing values and other anomalies, and interviewing knowledgeable agency officials regarding their accuracy and completeness. Based on our assessments, we determined that the data used from these systems were sufficiently reliable for the purposes of summarizing trends in selected aircraft maintenance timeliness and planning accuracy for fiscal years 2014 through 2019. We also assessed the reliability of the working capital fund data related to aviation depot maintenance activities included in Appendix II, by (1) reviewing our prior work to determine if there were reported concerns with Air Force and Navy budgetary data, and (2) reconciling the working capital fund data

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<sup>4</sup>NAVAIR Instruction 13023.1A, *Naval Air Systems Command Workload Standards Required for the Aircraft and Engine Programs at the Fleet Readiness Centers* (Aug. 8, 2011); NAVAIR Instruction 5221.1B, *Workload Acceptance* (Oct. 2, 2018); *The United States Navy Depot Maintenance Strategic Plan 2014-2019* (October 2013).

<sup>5</sup>We visited Oklahoma City Air Logistics Complex in Oklahoma City, OK, and Fleet Readiness Center Southwest in San Diego, CA.

<sup>6</sup>We obtained data from the Air Force's Aircraft Maintenance Production/Compression Report System and the Navy's Production Status Reporting system.

that was previously published in our reports for consistency.<sup>7</sup> Based on our assessment, we determined that these data were sufficiently reliable for the purposes of presenting information on the services' working capital funds activities and budget estimates for fiscal years 2014 through 2019.

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<sup>7</sup>GAO, *Depot Maintenance: DOD Should Adopt a Metric That Provides Quality Information on Funded Unfinished Work*, [GAO-19-452](#) (Washington, D.C.: July 26, 2019); 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); GAO, *Depot Maintenance: Executed Workload and Maintenance Operations at DOD Depots*, [GAO-17-82R](#) (Washington, D.C.: Feb. 3, 2017); GAO, *Army Working Capital Fund: Army Industrial Operations Could Improve Budgeting and Management of Carryover*, [GAO-16-543](#) (Washington, D.C.: June 23, 2016); GAO, *Navy Working Capital Fund: Budgeting for Carryover at Fleet Readiness Centers Could Be Improved*, [GAO-15-462](#) (Washington, D.C.: June 30, 2015); GAO, *Army Industrial Operations: Budgeting and Management of Carryover Could Be Improved*, [GAO-13-499](#) (Washington, D.C.: June 27, 2013); GAO, *Marine Corps Depot Maintenance: Budgeting and Management of Carryover Could Be Improved*, [GAO-12-539](#) (Washington, D.C.: June 19, 2012); GAO, *Air Force Working Capital Fund: Budgeting and Management of Carryover Work and Funding Could Be Improved*, [GAO-11-539](#) (Washington, D.C.: July 7, 2011); GAO, *Army Working Capital Fund: Actions Needed to Improve Budgeting for Carryover at Army Ordnance Activities*, [GAO-09-415](#) (Washington, D.C.: June 10, 2009); GAO, *Army Working Capital Fund: Actions Needed to Reduce Carryover at Army Depots*, [GAO-08-714](#) (Washington, D.C.: July 8, 2008); GAO, *Navy Working Capital Fund: Management Action Needed to Improve Reliability of the Naval Air Warfare Center's Reported Carryover Amounts*, [GAO-07-643](#) (Washington, D.C.: June 26, 2007); GAO, *Defense Working Capital Fund: Military Services Did Not Calculate and Report Carryover Amounts Correctly*, [GAO-06-530](#), (Washington, D.C.: June 27, 2006).

## Appendix II: Air Force and Navy Working Capital Funds Used for Aviation Depot Maintenance Activities

The U.S. military use working capital funds to procure and provide certain materiel and commercial products and services to its forces. A Working Capital Fund (WCF) is a type of revolving fund that operates as a self-supporting entity conducting a regular cycle of businesslike activities, such as acquiring parts and supplies, equipment maintenance, transporting personnel, research and development. Department of Defense (DOD) WCFs are authorized under 10 U.S.C. § 2208 and their amounts are generally available until expended. Ongoing WCF operations and maintenance of a minimum cash balance are funded through reimbursements to the WCF comprised of customer payments for goods or services received from WCF-supported activities, such as Navy and Air Force aviation depots. DOD WCFs operate on a break-even basis, although they may realize gains or losses within each fiscal year. As part of the annual budget submission for each upcoming fiscal year, however, prior year gains and losses are taken into account when new rates are established at levels estimated to recover the budgeted costs of goods and services, including all general and administrative overhead costs. Regardless, WCFs must maintain a net-positive cash balance at all times.<sup>1</sup>

Section 2464 of title 10 of the United States Code requires DOD to maintain a core depot-level maintenance and repair capability that is government-owned and operated. Maintaining this capability provides a ready and controlled source of technical competence and resources to enable effective and timely response to mobilizations, contingencies, or other emergencies. Additionally, DOD must assign these government-

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<sup>1</sup>See DOD 7000.14-R, *Financial Management Regulation*, vol. 2B, chap. 9 (July 2017 Draft). DOD revised its cash management policy to require a positive cash balance throughout the year and an adequate ending balance to support continuing operations into the subsequent year. Although the update has not yet been officially published, the updated guidance is being implemented by the working capital funds.

owned and operated facilities (the depots) sufficient workload to ensure cost efficiency and technical competence during peacetime, while preserving the surge capacity and reconstitution capabilities necessary to fully support the strategic and contingency plans prepared by the Chairman of the Joint Chiefs of Staff.

The three Air Force and three Navy aviation depots operate through the Air Force and Navy working capital funds. Depot customers are charged for the anticipated full cost of requested goods and services.<sup>2</sup> We reviewed the Air Force's and the Navy's budget estimates for fiscal years 2014 through 2019 and describe the information at a summary level below:

- **Carryover** (funded maintenance work leftover at the end of the fiscal year): Both services' aviation depots underestimated carryover for most years during fiscal years 2014 through 2019.
- **New orders** (funded workload customers place at the aviation depots for maintenance work to be performed on their aircraft): Both services generally underestimated the amount of funds that their aviation depots received from new orders placed by customers and the work performed did not keep pace with those orders from year to year, during fiscal years 2014 through 2019.
- **Revenue** (dollar amount of work performed by depots in a single fiscal year): The services have varying trends for revenue for fiscal years 2014 through 2019. In fiscal years 2014 and 2017 through 2019 the Air Force, and for fiscal years 2014 through 2017 the Navy, overestimated the amount of revenue that was actually earned. Conversely, the Air Force underestimated for fiscal years 2015 through 2016, and the Navy underestimated during fiscal years 2018 through 2019.
- **Workload** (workload projections are expressed in Direct Production Earned Hours (DPEHs) for the Air Force and Direct Labor Hours (DLHs) for the Navy): A DPEH or DLH is an hour earned by a direct employee against an established work order, and includes civilians, contractors and military personnel. In fiscal years 2014 through 2019,

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<sup>2</sup>The Air Force and Navy working capital funds contribute to readiness through the depots' skills to sustain the Air Force and Navy's organically maintained weapon systems and manage critical assets within the supply chain. In support of the Air Force and Navy's core functions, the Air Force and Navy working capital funds provide the maintenance divisions of the Air Force and Navy depots with continuous base-support services, utilities, and the in-house industrial capability to repair and overhaul a wide range of weapon systems (e.g., aircraft) and military equipment.

Air Force depots' workload increased from 21,337,000 DPEHs to 24,511,000 DPEHs—an increase of about 3.2 million (14.9 percent) DPEHs. During those same years, Navy depots' workload generally increased from 10,161,000 DLHs to 11,668,000 DLHs—an increase of about 1.5 million (14.8 percent) DLHs.

- **Personnel** (civilian and military personnel performing depot maintenance at aviation depots and civilian staff performing support functions, such as finance and budgeting and supply and acquisitions): In fiscal years 2014 through 2019 the number of civilian personnel working at the aviation depots has generally increased by around 3,000 for both the Air Force and the Navy.

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## Carryover

Each year, customers order billions of dollars of maintenance work that the depots cannot complete by the end of the fiscal year. To the extent that the depots do not complete work at year-end, the work and related funding will be carried into the next fiscal year. DOD refers to this reported dollar value of work that has been ordered and funded (obligated) by customers, but not completed by working capital fund activities at the end of the fiscal year as “Carryover”.<sup>3</sup>

DOD allows and the congressional defense committees recognize that some carryover from one fiscal year to the next is needed to ensure a smooth flow of maintenance work during the transition from one fiscal year to the next. However, past congressional defense committee reports have raised concerns that the level of carryover may be more than is needed. DOD has reported that approximately 6 months of carryover is optimal. Excess carryover (i.e., more unfinished work than allowed) may reflect an inefficient use of resources and tie up funds that could be used for other priorities. Excessive amounts of carryover may result in future appropriations or budget requests of depot customers being subject to reductions by DOD and the congressional defense committees during the annual budget-review process. Tables 1 and 2 show Air Force and Navy carryover for fiscal years 2014 through 2019, respectively.

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<sup>3</sup>DOD 7000.14-R, Financial Management Regulation, vol. 2B, chap. 9, § 090207(A)(6) (July 2017 Draft).

**Appendix II: Air Force and Navy Working  
Capital Funds Used for Aviation Depot  
Maintenance Activities**

**Table 1: Air Force Depots' Carryover (Budgeted and Actual), Fiscal Years 2014 through 2019 (Dollars in Millions)**

<b>Fiscal year</b>	<b>Budgeted carryover (dollars)</b>	<b>Actual carryover (dollars)</b>	<b>Difference (dollars)</b>	<b>Difference from actual (percent)</b>
2014	1,587	2,269	(682)	(30)
2015	2,026	2,187	(161)	(7)
2016	2,178	2,252	(74)	(3)
2017	2,093	2,320	(227)	(10)
2018	2,081	2,413	(332)	(14)
2019	2,229	2,542	(313)	(12)

Legend: (number) = negative dollars or percent

Source: GAO analysis of Air Force Working Capital Fund budget data. | GAO-20-390

Note: Dollar amounts do not always add due to rounding. These dollar amounts are actual dollars and are not adjusted for inflation. The carryover amounts are not adjusted for waivers (exceptions) or exclusions.

**Table 2: Navy Aviation Depots' Carryover (Budgeted and Actual), Fiscal Years 2014 through 2019**

Dollars in millions

<b>Fiscal year</b>	<b>Budgeted carryover (dollars)</b>	<b>Actual carryover (dollars)</b>	<b>Difference (dollars)</b>	<b>Difference from actual (percent)</b>
2014	826	1,008	(182)	(18)
2015	1,012	939	74	8
2016	935	903	32	4
2017	798	990	(192)	(19)
2018	1,067	1,208	(141)	(12)
2019	1,063	1,291	(228)	(18)

Legend: (number) = negative dollars or percent

Source: GAO analysis of Navy Working Capital Fund budget data. | GAO-20-390

Note: Dollar amounts do not always add due to rounding. These dollar amounts are actual dollars and are not adjusted for inflation. The carryover amounts are not adjusted for waivers (exceptions) or exclusions.

## New Orders

Accurate budgets for the amount of new orders to be received by the depots are essential for them to plan their work, such as determining the right number of personnel, parts, and material needed. For example, if the services include workload in their new order estimates that do not materialize, a depot is at risk of incurring unplanned financial loss because the depot is allocating its overhead costs over less work than planned. These losses may lead the depots to increase their rates for repairing assets. If the customer receives more funding (e.g., Operations & Maintenance or Procurement) than they originally anticipated and they

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**Appendix II: Air Force and Navy Working  
Capital Funds Used for Aviation Depot  
Maintenance Activities**

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in turn increase their orders with the depots (new orders or just an increase to an existing order), or if operational decisions lead to changes in requirements or priorities, unplanned workload may materialize at the depots resulting in additional carryover. Tables 3 and 4 show Air Force and Navy new orders for fiscal years 2014 to 2019, respectively.

**Appendix II: Air Force and Navy Working  
Capital Funds Used for Aviation Depot  
Maintenance Activities**

**Table 3: Air Force Depots' Budgeted and Actual New Orders, Fiscal Years 2014 through 2019**

Dollars in millions

<b>Fiscal year</b>	<b>Budgeted new orders (dollars)</b>	<b>Actual new orders (dollars)</b>	<b>Difference (dollars)</b>	<b>Difference from actual (percent)</b>
2014	6,339	6,398	(59)	(1)
2015	5,950	6,397	(447)	(7)
2016	6,102	6,655	(553)	(8)
2017	6,525	6,854	(329)	(5)
2018	6,763	7,040	(276)	(4)
2019	7,218	6,925	293	4
<b>Total</b>	<b>38,897</b>	<b>40,269</b>	<b>(1,372)</b>	<b>(3)</b>

Legend: (number) = negative dollars or percent

Source: GAO analysis of Air Force Working Capital Fund budget data. | GAO-20-390

Note: Dollar amounts do not always add due to rounding. These dollar amounts are actual dollars and are not adjusted for inflation. For fiscal years 2014 through 2018, actual new orders exceeded budgeted new orders received from aviation depot customers. For fiscal year 2019, the reverse was true.

**Table 4: Navy Aviation Depots' Budgeted and Actual New Orders, Fiscal Years 2014 through 2019**

Dollars in millions

<b>Fiscal year</b>	<b>Budgeted new orders (dollars)</b>	<b>Actual new orders (dollars)</b>	<b>Difference (dollars)</b>	<b>Difference from actual (percent)</b>
2014	2,130	1,882	248	13
2015	2,064	1,845	220	12
2016	2,123	1,988	135	7
2017	2,245	2,294	(49)	(2)
2018	2,427	2,747	(320)	(12)
2019	2,492	2,728	(236)	(9)
<b>Total</b>	<b>13,481</b>	<b>13,484</b>	<b>(3)</b>	<b>(0)</b>

Legend: (number) = negative dollars or percent

Source: GAO analysis of Navy Working Capital Fund budget data. | GAO-20-390

Note: Dollar amounts do not always add due to rounding. These dollar amounts are actual dollars and are not adjusted for inflation. For fiscal years 2017 through 2019, the actual new orders exceeded the budgeted new orders received from aviation depot customers.

## Revenue

Revenue represents the dollar amount of work performed by depots in a single fiscal year. DOD WCFs conduct businesslike activities to generate revenue from the sale of goods or services to customers, such as the military services or combatant commands, to cover costs expended

**Appendix II: Air Force and Navy Working  
Capital Funds Used for Aviation Depot  
Maintenance Activities**

throughout the year in support of those services. The DOD FMR 7000.14-R directs DOD WCFs to operate on a “break-even” basis (revenue generated equals the cost associated with receiving the revenue). See tables 5 and 6 for Air Force and Navy Depots’ Revenue (Budgeted vs Actual) for fiscal years 2014 through 2019.

**Table 5: Air Force Depots’ Revenue (Budgeted versus Actual), Fiscal Years 2014 through 2019**

Dollars in millions

<b>Fiscal year</b>	<b>Budgeted revenue</b>	<b>Actual revenue</b>	<b>Difference (dollars)</b>	<b>Difference from actual (percent)</b>
2014	5,998	5,569	429	8
2015	5,903	6,371	(467)	(7)
2016	6,044	6,429	(385)	(6)
2017	6,644	6,615	29	0
2018	6,850	6,774	76	1
2019	7,214	6,768	445	7
<b>Total</b>	<b>38,653</b>	<b>38,526</b>	<b>127</b>	<b>0</b>

Legend: (number) = negative dollars or percent

Source: GAO analysis of Air Force Working Capital Fund budget data. | GAO-20-390

Note: Dollar amounts do not always add due to rounding. These dollar amounts are actual dollars and are not adjusted for inflation.

**Table 6: Navy Aviation Depots’ Revenue (Budgeted versus Actual), Fiscal Years 2014 through 2019**

Dollars in millions

<b>Fiscal year</b>	<b>Budgeted revenue</b>	<b>Actual revenue</b>	<b>Difference (dollars)</b>	<b>Difference from actual (percent)</b>
2014	2,154	1,938	215	11
2015	2,087	1,914	173	9
2016	2,140	2,024	116	6
2017	2,317	2,208	109	5
2018	2,380	2,527	(147)	(6)
2019	2,543	2,648	(105)	(4)
<b>Total</b>	<b>13,621</b>	<b>13,259</b>	<b>362</b>	<b>3</b>

Legend: (number) = negative dollars or percent

Source: GAO analysis of Navy Working Capital Fund budget data. | GAO-20-390

Note: Dollar amounts do not always add due to rounding. These dollar amounts are actual dollars and are not adjusted for inflation.

## Workload

The Air Force and Navy express depot workload projections in Direct Production Earned Hours (DPEHs) for the Air Force, and Direct Labor Hours (DLHs) for the Navy. A DPEH or DLH is an hour earned by a direct employee against an established work order in the performance of depot work on an end item.<sup>4</sup> The Air Force and Navy include direct labor hours worked by civilians, contractors and military personnel in their DPEH and DLH projections. Tables 7 and 8 show Air Force DPEHs and Navy DLHs for fiscal years 2014 through 2019, respectively.

**Table 7: Air Force Depots' Budgeted and Actual Direct Production Earned Hours, Fiscal Years 2014 through 2019**

Hours in thousands

Fiscal year	Budgeted direct production earned hours	Actual direct production earned hours	Difference
2014	22,966	21,337	1,629
2015	20,628	22,695	(2,067)
2016	21,769	23,158	(1,389)
2017	23,436	23,978	(542)
2018	24,232	24,333	(101)
2019	25,283	24,511	772
Total	138,314	140,012	(1,698)

Legend: (number) = negative

Source: GAO analysis of Air Force Working Capital Fund budget data. | GAO-20-390

Note: A DPEH is an hour earned by a direct employee against an established work order in the performance of depot work on an end item. DPEH includes direct labor hours worked with overtime by civilians, contractors and military personnel. DPEH rates are based on DPEHs required for stabilized workload.

<sup>4</sup>Department of Defense Instruction 4151.20, *Depot Maintenance Core Capabilities Determination Process* (May 4, 2018). According to this instruction, workload is measured in direct labor hours.

**Appendix II: Air Force and Navy Working  
Capital Funds Used for Aviation Depot  
Maintenance Activities**

**Table 8: Navy Aviation Depots’ Budgeted and Actual Direct Labor Hours, Fiscal Years 2014 through 2019**

Hours in thousands

<b>Fiscal year</b>	<b>Budgeted direct labor hours</b>	<b>Actual direct labor hours</b>	<b>Difference</b>
2014	11,102	10,161	941
2015	10,697	10,549	148
2016	11,063	10,595	468
2017	10,813	10,843	(30)
2018	11,258	10,894	364
2019	11,538	11,668	(130)
<b>Total</b>	<b>66,471</b>	<b>64,710</b>	<b>1,761</b>

Legend: (number) = negative

Source: GAO analysis of Navy Working Capital Fund budget data. | GAO-20-390

Note: A DLH is an hour earned by a direct employee against an established work order in the performance of depot work on an end item. DLH includes direct labor hours worked with overtime by civilians, contractors and military personnel. DLH rates are based on DLHs required for stabilized workload.

## Personnel

The number of civilian personnel at the Air Force and Navy aviation depots—referred to as end strength—perform the majority of depot-level maintenance activities and are made up of personnel such as artisans and maintainers—welders, machinist, sheet metal mechanics, aircraft mechanics, aircraft electricians, engineers and scientists—performing aviation depot maintenance, but also includes personnel performing support functions such as finance and budgeting. Tables 9 and 10 show total civilian and military personnel employed at the Air Force and Navy aviation depots for fiscal years 2014 through 2019, respectively. As seen in table 9, in fiscal years 2014 through 2019, the number of civilian personnel working at the Air Force aviation depots has grown by over 3,000 civilians (25,540 to 28,576). As seen in table 10, in fiscal years 2014 through 2019, the number of civilian personnel working at the Navy aviation depots has grown by over 3,100 civilians (8,515 to 11,643).

**Appendix II: Air Force and Navy Working  
Capital Funds Used for Aviation Depot  
Maintenance Activities**

**Table 9: Air Force Depots' Budgeted and Actual End Strength, Fiscal Years 2014 through 2019**

<b>Civilian Personnel</b>				
<b>Fiscal year</b>	<b>Budgeted</b>	<b>Actual</b>	<b>Difference</b>	<b>Difference from actual (percent)</b>
2014	25,600	25,540	60	0.2
2015	25,691	25,707	(16)	(0.1)
2016	25,653	25,653	0	0
2017	25,162	27,220	(2,058)	(7.6)
2018	24,399	27,777	(3,378)	(12.2)
2019	25,749	28,576	(2,827)	(9.9)
<b>Military Personnel</b>				
<b>Fiscal year</b>	<b>Budgeted</b>	<b>Actual</b>	<b>Difference</b>	<b>Difference from actual (percent)</b>
2014	225	200	25	12.5
2015	225	224	1	0.4
2016	225	227	(2)	(0.9)
2017	224	229	(5)	(2.2)
2018	211	268	(57)	(21.3)
2019	218	208	10	4.8
<b>Civilian and Military Personnel</b>				
<b>Fiscal year</b>	<b>Budgeted</b>	<b>Actual</b>	<b>Difference</b>	<b>Difference from actual (percent)</b>
2014	25,825	25,740	85	0
2015	25,916	25,931	(15)	0
2016	25,878	25,880	(2)	0
2017	25,386	27,449	(2,063)	(8)
2018	24,610	28,045	(3,435)	(12)
2019	25,967	28,784	(2,817)	(10)

Legend: (number) = negative

Source: GAO analysis of Air Force Working Capital Fund budget data. | GAO-20-390

**Appendix II: Air Force and Navy Working  
Capital Funds Used for Aviation Depot  
Maintenance Activities**

**Table 10: Navy Aviation Depots' Budgeted and Actual End Strength, Fiscal Years 2014 through 2019**

**Civilian Personnel**

<b>Fiscal year</b>	<b>Budgeted</b>	<b>Actual</b>	<b>Difference</b>	<b>Difference from actual (percent)</b>
2014	8,442	8,515	(73)	(0.9)
2015	8,442	9,368	(926)	(9.9)
2016	8,570	10,004	(1,434)	(14.3)
2017	9,306	10,106	(800)	(7.9)
2018	9,995	11,362	(1,367)	(12)
2019	10,211	11,643	(1,432)	(12.3)

**Military Personnel**

<b>Fiscal year</b>	<b>Budgeted</b>	<b>Actual</b>	<b>Difference</b>	<b>Difference from actual (percent)</b>
2014	121	127	(6)	(4.7)
2015	123	122	1	0.8
2016	121	121	0	0
2017	122	122	0	0
2018	129	129	0	0
2019	130	130	0	0

**Civilian and Military Personnel**

<b>Fiscal year</b>	<b>Budgeted</b>	<b>Actual</b>	<b>Difference</b>	<b>Difference from actual (percent)</b>
2014	8,563	8,642	(79)	(1)
2015	8,565	9,490	(925)	(10)
2016	8,691	10,125	(1,434)	(14)
2017	9,428	10,228	(800)	(8)
2018	10,124	11,491	(1,367)	(12)
2019	10,341	11,773	(1,432)	(12)

Legend: (number) = negative

Source: GAO analysis of Navy Working Capital Fund budget data. | GAO-20-390

# Appendix III: Comments from the Department of Defense



OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE  
3500 DEFENSE PENTAGON  
WASHINGTON, DC 20301-3500

SUSTAINMENT

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

Dear Ms. Maurer,

Attached to this letter is the Department of Defense (DoD) response to the GAO Draft Report GAO-20-390, "MILITARY DEPOTS: The Navy Needs Improved Planning to Address Aircraft Maintenance Delays While Air Force Maintenance has Generally Been Timely," dated June 1, 2020 (GAO Code 103529).

My point of contact is Colonel Curtis Hafer, who can be reached at (571) 253-2169 or [curtis.r.hafer.mil@mail.mil](mailto:curtis.r.hafer.mil@mail.mil).

Sincerely,

MORANI.STEVE  
N.J.1174632444  
Steven J. Morani  
Deputy Assistant Secretary of Defense  
(Materiel Readiness)

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MORANI.STEVEN.J.11746324  
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Attachments:  
As stated

GAO DRAFT REPORT DATED JUNE 1, 2020  
GAO-20-390 (GAO CODE 103529)

**“MILITARY DEPOTS: The Navy Needs Improved Planning to Address  
Persistent Aircraft Maintenance Delays While Air Force Maintenance Has  
Generally Been Timely”**

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

**RECOMMENDATION 1:** The GAO recommends that the Secretary of the Navy should ensure that Naval Air Systems Command and Commander, Fleet Readiness Centers effectively use historical data to analyze turnaround time and establish accurate turnaround time targets for fixed-wing aircraft depot maintenance packages.

**DoD RESPONSE:** Concur. The Secretary of the Navy will ensure that Naval Air Systems Command and Commander, Fleet Readiness Centers effectively use historical data to analyze turnaround time and establish accurate turnaround time targets for fixed-wing aircraft depot maintenance packages.

**RECOMMENDATION 2:** The GAO recommends that the Secretary of the Navy should ensure that Commander, Naval Air Forces and Commander, Naval Air Force, Pacific provide depot planners regular reporting on fixed-wing aircraft maintenance performed outside the Navy aviation depots by an operational unit or at an immediate maintenance facility to ensure they have information on the current condition and depot maintenance needs of individual aircraft.

**DoD RESPONSE:** Concur. The Secretary of the Navy should ensure that Commander, Naval Air Forces and Commander, Naval Air Force, Pacific provide depot planners regular reporting on fixed-wing aircraft maintenance performed outside the Navy aviation depots by an operational unit or at an immediate maintenance facility to ensure they have information on the current condition and depot maintenance needs of individual aircraft.

**RECOMMENDATION 3:** The GAO recommends the Secretary of the Navy should ensure that Naval Air Systems Command and Commander, Fleet Readiness Centers establish formal processes and related guidance for communication and coordination between depot stakeholders to inform maintenance requirements planning.

**DoD RESPONSE:** Concur. The Secretary of the Navy should ensure that Naval Air Systems Command and Commander, Fleet Readiness Centers establish formal processes and related guidance for communication and coordination between depot stakeholders to inform maintenance requirements planning.

Text of Appendix III: Comments from the Department of  
Defense

Page 1

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE  
3500 DEFENSE PENTAGON  
WASHINGTON, DC 20301-3500

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

Dear Ms. Maurer,

Attached to this letter is the Department of Defense (DoD) response to the GAO Draft Report GAO-20-390, "MILITARY DEPOTS: The Navy Needs Improved Planning to Address Aircraft Maintenance Delays While Air Force Maintenance has Generally Been Timely," dated June 1, 2020 (GAO Code 103529).

My point of contact is Colonel Curtis Hafer, who can be reached at  
(571) 253-2169 or [curtis.r.hafer.mil@mail.mil](mailto:curtis.r.hafer.mil@mail.mil).

Sincerely,

MORANI.STEVE

Steven J. Morani  
Deputy Assistant Secretary of Defense (Materiel Readiness)  
Attachments: As stated

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GAO DRAFT REPORT DATED JUNE 1, 2020 GAO-20-390 (GAO CODE  
103529)

“MILITARY DEPOTS: The Navy Needs Improved Planning to Address Persistent Aircraft Maintenance Delays While Air Force Maintenance Has Generally Been Timely”

DEPARTMENT OF DEFENSE COMMENTS TO THE GAO  
RECOMMENDATION

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The GAO recommends that the Secretary of the Navy should ensure that Naval Air Systems Command and Commander, Fleet Readiness Centers effectively use historical data to analyze turnaround time and establish accurate turnaround time targets for fixed-wing aircraft depot maintenance packages.

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**DoD RESPONSE:**

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# Appendix IV: GAO Contacts and Staff Acknowledgments

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## GAO Contacts

Diana Maurer at (202) 512-9627 or [maurerd@gao.gov](mailto:maurerd@gao.gov), or  
Asif A. Khan at (202) 512-9869 or [khana@gao.gov](mailto:khana@gao.gov).

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## Staff Acknowledgments

In addition to the contacts listed above, Chris Watson (Assistant Director), Delia Zee (Analyst-in-Charge), John Craig, Sergio Enriquez, Amie Lesser, Felicia Lopez, Amanda Manning, Keith McDaniel, Richard Powelson, Benjamin Sclafani, Michael Silver, and Roger Stoltz (Assistant Director) made key contributions to this report.

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## Related GAO Products

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

*F-35 Aircraft Sustainment: DOD Faces Challenges in Sustaining a Growing Fleet.* [GAO-20-234T](#). Washington, D.C.: November 13, 2019.

*Depot Maintenance: DOD Should Adopt a Metric That Provides Quality Information on Funded Unfinished Work.* [GAO-19-452](#). Washington, D.C.: July 26, 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 Initiatives to Maintain Critical Skills.* [GAO-19-51](#). Washington, D.C.: December 14, 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.

*Depot Maintenance: DOD Has Improved the Completeness of Its Biennial Core Report.* [GAO-19-89](#). Washington, D.C.: November 14, 2018.

*Air Force Readiness: Actions Needed to Rebuild Readiness and Prepare for the Future.* [GAO-19-120T](#). Washington, D.C.: October 10, 2018.

*Weapon System Sustainment: Selected Air Force and Navy Aircraft Generally Have Not Met Availability Goals, and DOD and Navy Guidance Need to Be Clarified.* [GAO-18-678](#). Washington, D.C.: September 10, 2018.

*F-35 Aircraft Sustainment: DOD Needs to Address Challenges Affecting Readiness and Cost Transparency.* [GAO-18-75](#). Washington, D.C.: October 26, 2017.

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

*Depot Maintenance: Executed Workload and Maintenance Operations at DOD Depots.* [GAO-17-82R](#). Washington, D.C.: February 3, 2017.

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*Army Working Capital Fund: Army Industrial Operations Could Improve Budgeting and Management of Carryover.* [GAO-16-543](#). Washington, D.C.: June 23, 2016.

*Defense Inventory: Further Analysis and Enhanced Metrics Could Improve Service Supply and Depot Operations.* [GAO-16-450](#). Washington, D.C.: June 9, 2016.

*Navy Working Capital Fund: Budgeting for Carryover at Fleet Readiness Centers Could Be Improved.* [GAO-15-462](#). Washington, D.C.: June 30, 2015.

*Army Industrial Operations: Budgeting and Management of Carryover Could Be Improved.* [GAO-13-499](#). Washington D.C.: June 27, 2013.

*Marine Corps Depot Maintenance: Budgeting and Management of Carryover Could Be Improved.* [GAO-12-539](#). Washington, D.C.: June 19, 2012.

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*Air Force Working Capital Fund: Budgeting and Management of Carryover Work and Funding Could Be Improved.* [GAO-11-539](#). Washington, D.C.: July 7, 2011.

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