United States Government Accountability Office

Testimony

Before the Subcommittee on Readiness and Management Support, Committee on Armed Services, U.S. Senate

MILITARY READINESS

Improvement in Some Areas, but Sustainment and Other Challenges Persist

Accessible Version

Statement of Diana Maurer, Director, Defense Capabilities and Management

For Release on Delivery Expected at 2:30 p.m. ET
Tuesday, May 2, 2023

GAO-23-106673

GAO Highlights

Highlights of GAO-23-106673, a testimony before the Subcommittee on Readiness and Management Support, Committee on Armed Services, U.S. Senate

May 2, 2023

MILITARY READINESS

Improvement in Some Areas, but Sustainment and Other Challenges Persist

Why GAO Did This Study

Nearly 2 decades of conflict has degraded military readiness. To maintain the U.S. military's advantage across all domains in a new security environment characterized by great-power competition, DOD is working to rebuild and restore readiness while also modernizing its forces. DOD's readiness rebuilding efforts are occurring in a challenging context that requires the department to make difficult decisions regarding how best to address continuing operational demands while preparing for future challenges.

This statement (1) describes how readiness has changed from fiscal year 2017 through fiscal year 2021 in the ground, sea, air, and space warfighting domains and (2) provides information on readiness challenges in the ground, sea, air, and space domains.

This statement is based on published work primarily since 2020 that examined military readiness, operations, and sustainment, among others, in the ground, sea, air, and space domains. To perform this prior work, GAO analyzed Army, Air Force, Navy, Marine Corps, and Space Force readiness, maintenance, personnel, and training data and interviewed cognizant officials.

What GAO Recommends

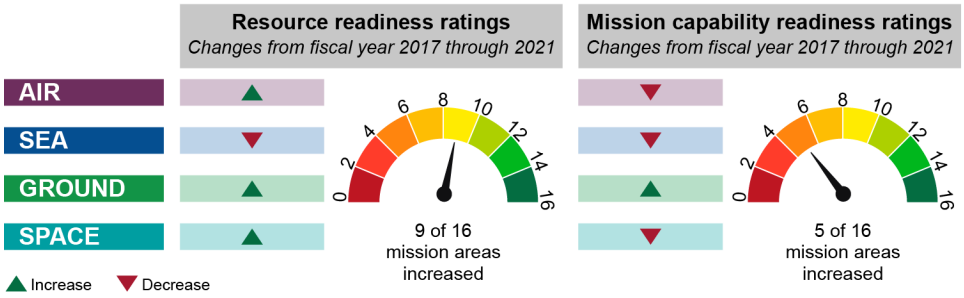
GAO has made dozens of recommendations in its prior reports to help improve readiness in each of the domains. Some of the recommendations remain unimplemented, as discussed in the testimony.

View GAO-23-106673. For more information, contact Diana Maurer at (202) 512-9627 or maurerd@gao.gov.

What GAO Found

Readiness ratings increased in the ground domain and declined in the sea domain from fiscal year 2017 through fiscal year 2021—the most recent data at the time of GAO's analysis—with mixed changes in the air and space domains.

Change in Domain Resource and Mission Capability Readiness Ratings from Fiscal Years 2017-2021



Source: GAO analysis of Department of Defense readiness data. | GAO-23-106673

Note: The ratings are based on GAO's analysis of Department of Defense readiness data for selected mission areas—groups of similar capabilities from across the services, such as fighter jets—and force elements—subsets of units within each mission area, such as F-35s—within each of the domains. Resource readiness ratings measure the status of personnel, equipment, supplies, and training. Mission capability readiness ratings measure whether a unit can accomplish its designed missions.

GAO's prior work has identified a wide range of persistent challenges in each domain as the Department of Defense (DOD) seeks to improve readiness.

Readiness Challenges Identified by GAO in Air, Sea, Ground, and Space Domains

Source: GAO analysis of Department of Defense information; U.S. Air Force/ Senior Airman T. Gordnier; U.S. Navy; U.S. Marine Corps/Master Sgt. C. Matt; NASA (photos). | GAO-23-106673

Looking to the future, DOD will have to balance rebuilding the readiness of its existing force with its desire to modernize. DOD is developing and deploying new weapon systems and considering new approaches for how its units organize and operate. However, DOD will depend on much of today's force for decades to come, requiring continued focus on the readiness of its existing forces.

Chair Hirono, Ranking Member Sullivan, and Members of the Subcommittee:

Thank you for the opportunity to be here today to discuss Department of Defense (DOD) readiness.

For decades, the United States has enjoyed unchallenged or dominant military advantage, according to DOD. DOD could generally deploy forces when it wanted, assemble them where it wanted, and operate how it wanted. In the 2018 *National Defense Strategy*, however, DOD noted that every warfighting domain—ground, sea, air, space, and cyberspace—was and continues to be contested. Potential adversaries, most notably China and Russia, have developed and enhanced their own capabilities. At the same time, our work has shown that nearly 2 decades of conflict has degraded U.S. military readiness. To maintain the U.S. military's advantage across all domains in a new security environment characterized by great-power competition, DOD is working to rebuild and restore readiness while also modernizing its forces.

DOD's readiness rebuilding efforts are occurring in a challenging context that requires the department to make difficult decisions regarding how best to address continuing operational demands while preparing for future challenges. An important aspect of this, across all of the military services, is determining an appropriate balance between maintaining and upgrading weapon systems currently in operational use and acquiring platforms able to overcome rapidly advancing future threats.

This testimony (1) describes how readiness has changed from fiscal year 2017 through fiscal year 2021 in the ground, sea, air, and space domains, and (2) provides information on readiness challenges in these domains.

This statement is based primarily on reports—cited throughout this statement—that we issued from 2020 to March 2023 examining military readiness, operations, and sustainment, among others, in the ground, sea, air, and space domains. To perform our prior work, we analyzed Army, Air Force, Navy, Marine Corps, and Space Force readiness; maintenance, personnel, and training information; and interviewed cognizant officials. The reports cited throughout this statement contain more details on the scope of the work and the methodology we used to

carry it out. Also, we have issued several classified reports since 2020 examining these issues. However, this statement does not include that work.

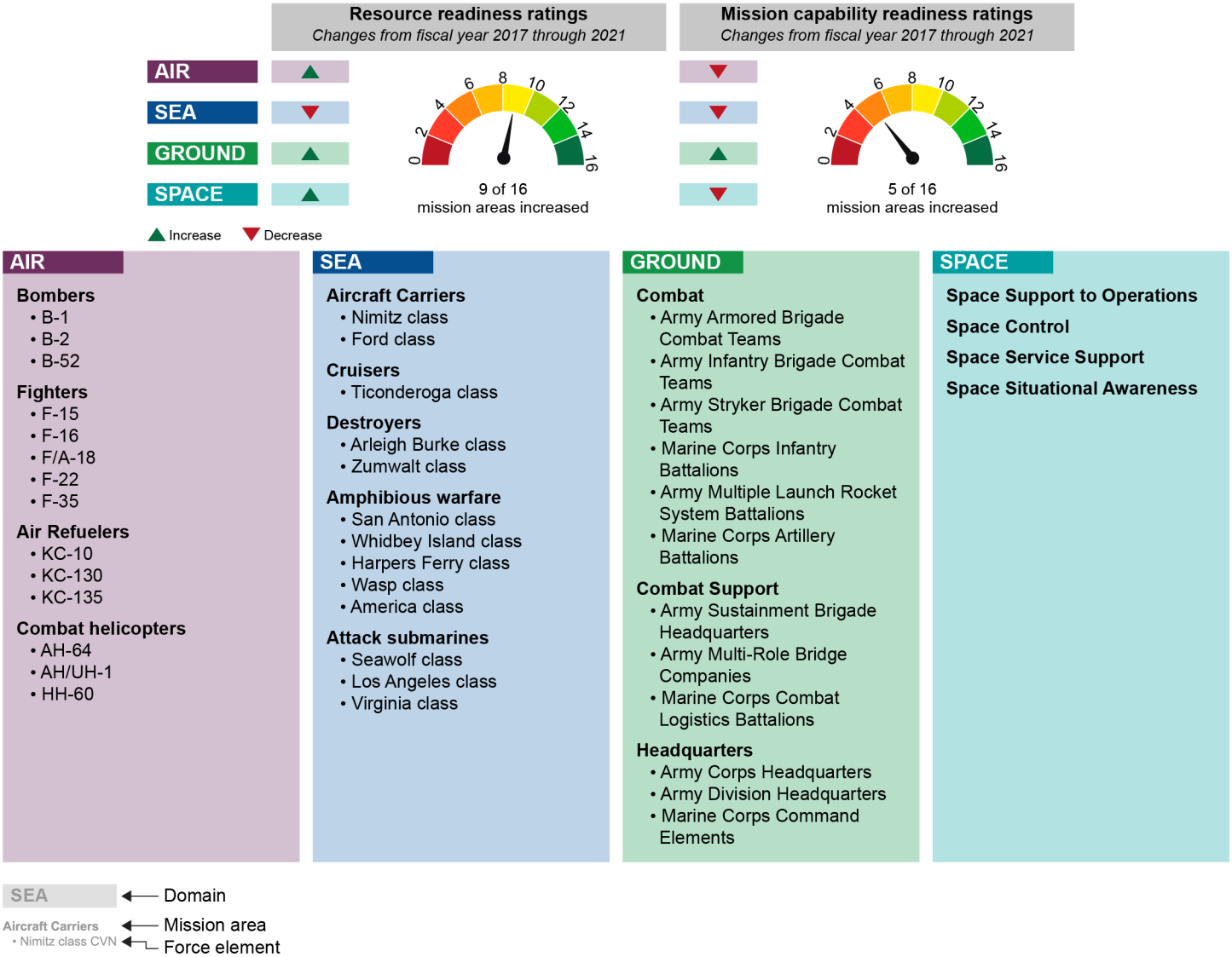
We conducted the work on which this statement is based in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our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

Ground Domain Readiness Increased While Sea Domain Readiness Declined during Fiscal Year 2017 through 2021, with Mixed Changes in Air and Space Domains

Readiness increased in the ground domain and declined in the sea domain from fiscal year 2017 through fiscal year 2021, and rating changes were mixed in the air and space domains.[1] The ratings are based on our analysis of readiness data over this 5-year period for selected mission areas, which are groups of similar capabilities from across the services, such as fighter jets. We also analyzed readiness data for force elements—subsets of units within each mission area—within each of the domains. See figure 1.

[1]GAO, *Military Readiness: DOD Domain Readiness from Fiscal Year 2017 through Fiscal Year 2021*, GAO-22-105279C (Washington, D.C.: May 18, 2022).

Figure 1: Change in Domain Resource and Mission Capability Readiness Ratings from Fiscal Years 2017 through 2021



Source: GAO analysis of Department of Defense (DOD) readiness data and information. | GAO-23-106673

Note: Resource readiness ratings measure the status of personnel, equipment, supplies, and training. Mission capability readiness ratings measure whether a unit can accomplish its designed missions.

We have reported on DOD historic readiness levels for many years, observing a decline in readiness as overall demand for the joint force remains high and is likely to remain high to support global needs. In September 2016, we found that the military services had reported persistently low readiness levels, which they attributed to emerging and continued demands on their forces, reduced force structure, and

increased frequency and length of deployments. In that report, we reviewed DOD and the military services' plans to rebuild readiness, finding that those efforts could have been at risk without a comprehensive plan.[2]

In 2018, DOD developed a plan for readiness recovery, which included goals and metrics to assess progress in addressing identified primary readiness issues for the military services. DOD officials noted at the time that the department revised its readiness recovery goals and metrics to continue to align with the 2018 *National Defense Strategy* and DOD priorities. DOD most recently revised its readiness recovery goals and metrics in December 2020, according to officials. While DOD continues to evaluate readiness progress by military service, section 333 of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 required the Secretary of Defense to identify and establish metrics for measuring readiness to conduct full-spectrum operations in the ground, sea, air, space, and cyber domains.[3]

In May 2019, we found that DOD was not measuring or reporting readiness to perform full-spectrum operations by domain.[4] We recommended that DOD identify and establish metrics for measuring readiness to conduct full-spectrum operations in the ground, sea, air, space, and cyber domains or propose to Congress alternative approaches for measuring readiness across these domains. DOD partially concurred with our recommendation. However, since 2019, officials in the Office of the Secretary of Defense have expressed that the DOD readiness recovery plan captures the ground, sea, and air domains. Officials also stated that instead of developing separate metrics for measuring readiness in the domains, the department has been focused

[2]GAO, *Military Readiness: DOD's Readiness Rebuilding Efforts May Be at Risk without a Comprehensive Plan*, GAO-16-841 (Washington, D.C.: Sept. 7, 2016). We made five recommendations relating to implementation and oversight of readiness rebuilding efforts, which DOD has implemented.

[3]Pub. L. No. 115-232, § 333(c) (2018). Section 333 required the Secretary of Defense to identify and establish the metrics for purposes of certain GAO reviews.

[4]GAO, *Military Readiness: Update on DOD's Readiness Recovery and Domain Readiness Assessment*, GAO-19-390C (Washington, D.C.: May 6, 2019).

on tracking readiness recovery by military service and implementing various readiness reporting reforms.[5]

We continue to believe that our recommendation is valid because cross-domain operations include capabilities from all five domains that are no longer owned by any single military service. Each service operates across multiple domains. For example, each of the services uses cyberspace. All conduct or depend on space operations. Army and Marine Corps forces operate from the air, Navy forces can influence land battles, and Air Force operations routinely have an effect on multiple domains. By monitoring readiness recovery only at the service level, DOD may miss key readiness issues in the capabilities of the joint force. We have previously reported that examining force structure and readiness-related issues through a service-centric lens has many limitations. For example, in March 2019, we found that there was no mechanism in place for DOD to routinely assess joint force needs and force structure tradeoffs across the military services.[6] Instead, force structure analyses were generally done by the services, largely reflected the programmed force structure, and had not resulted in any significant changes to force structure and resource allocations.

DOD Faces a Range of Persistent Readiness Challenges in the Air, Sea, Ground, and Space Domains

Our prior work has identified a wide range of persistent challenges in each domain as DOD seeks to improve readiness.

[5]In March 2023, DOD officials reported that they had recently begun implementing Strategic Readiness, which the department describes as the ability to build, maintain, and balance warfighting capabilities and competitive advantages that ensure DOD can achieve strategic objectives across threats and time horizons. Officials reported the department will issue formal guidance on Strategic Readiness by the summer of 2023.

[6]GAO, *Defense Strategy: Revised Analytic Approach Needed to Support Force Structure Decision-Making*, GAO-19-385 (Washington, D.C.: Mar. 14, 2019).

Air Domain

Maintenance and Supply Challenges Limit Availability of Aging Aircraft

We found in November 2022 that DOD did not meet its mission capable goals for fiscal year 2021 for 47 of the 49 aircraft we reviewed, with most aircraft more than 10 percentage points below the goal.[7] The mission capable rate—the percentage of total time when the aircraft can fly and perform at least one mission—is used to assess the health and readiness of an aircraft fleet. For fiscal year 2021:

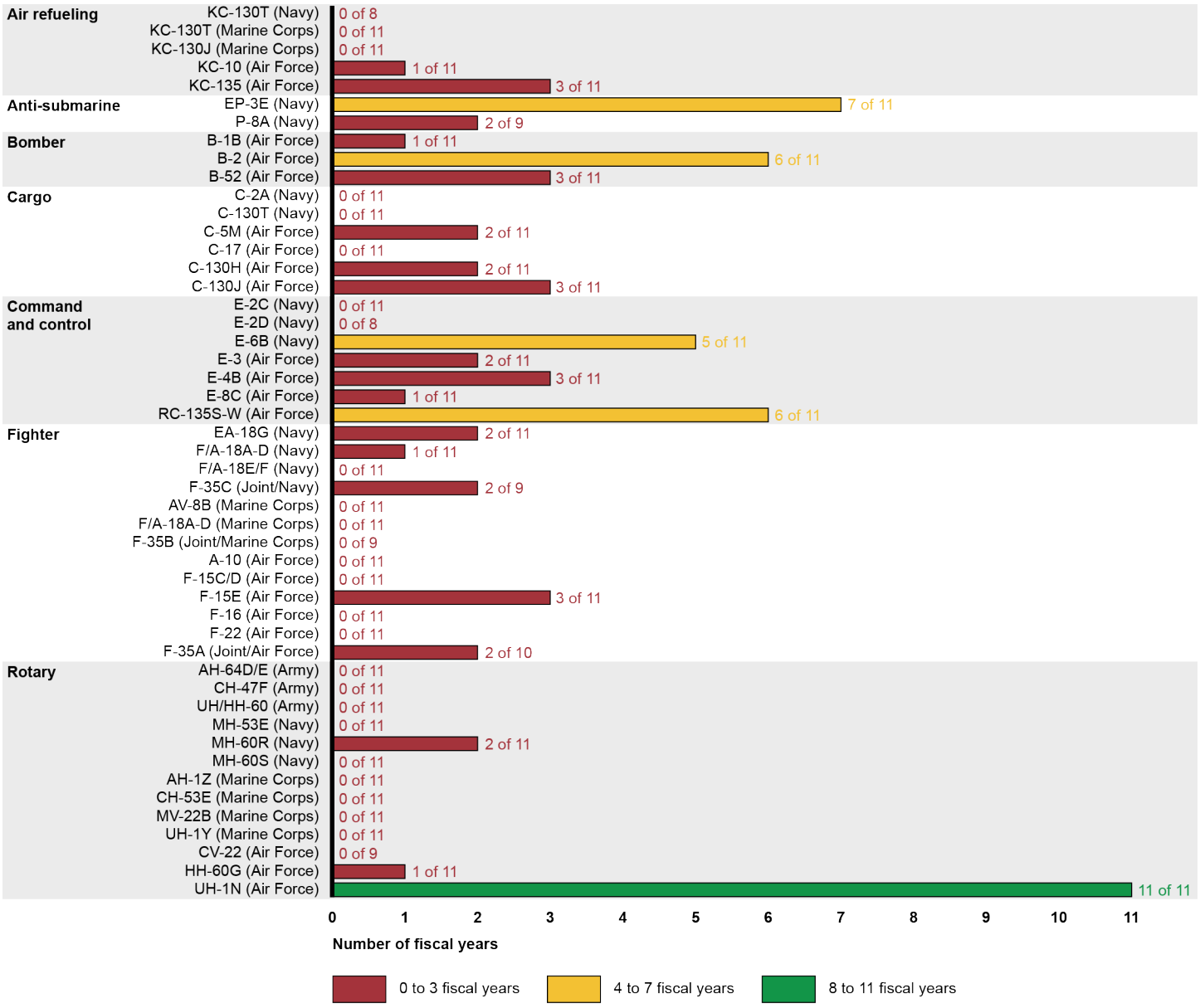
- 30 aircraft were more than 10 percentage points below the mission capable goal, and
- 17 aircraft were 10 percentage points or less below the mission capable goal.

Further, mission capable rates for most aircraft decreased from fiscal years 2011 through 2021.

As shown in figure 2, from fiscal years 2011 through 2021 only four aircraft met their annual mission capable goal in a majority of those years: the Air Force's B-2, RC-135S-W, UH-1N, and the Navy's EP-3.

[7]GAO, *Weapon System Sustainment: Aircraft Mission Capable Goals Were Generally Not Met and Sustainment Costs Varied by Aircraft*, GAO-23-106217 (Washington, D.C.: Nov. 10, 2022). We reported separately on the Army's combat helicopters—the AH-64 Apache, CH-47 Chinook, and UH/HH-60 Black Hawk—examining materiel readiness goals, maintenance challenges, and sustainment plans. See GAO, *Combat Helicopters: Actions Needed to Fully Review Readiness Goals and Address Long-Standing Maintenance Challenges*, GAO-22-104607SU (Washington, D.C.: Feb. 15, 2022).

Figure 2: Number of Years That Selected Aircraft Met Their Annual Mission Capable Goal, Fiscal Years 2011 through 2021



Source: GAO analysis of Army, Navy, and Air Force data. | GAO-23-106673

Accessible Data for Figure 2: Number of Years That Selected Aircraft Met Their Annual Mission Capable Goal, Fiscal Years 2011 through 2021

Aircraft	Number of years
KC-130T (Navy)	0
KC-130T (Marine Corps)	0
KC-130J (Marine Corps)	0
KC-10 (Air Force)	1
KC-135 (Air Force)	3
EP-3E (Navy)	7
P-8A (Navy)	2
B-1B (Air Force)	1
B-2 (Air Force)	6
B-52 (Air Force)	3
C-2A (Navy)	0
C-130T (Navy)	0
C-5M (Air Force)	2
C-17 (Air Force)	0
C-130H (Air Force)	2
C-130J (Air Force)	3
E-2C (Navy)	0
E-2D (Navy)	0
E-6B (Navy)	5
E-3 (Air Force)	2
E-4B (Air Force)	3
E-8C (Air Force)	1
RC-135S-W (Air Force)	6
EA-18G (Navy)	2
F/A-18A-D (Navy)	1
F/A-18E/F (Navy)	0
F-35C (Joint/Navy)	2
AV-8B (Marine Corps)	0
F/A-18A-D (Marine Corps)	0
F-35B (Joint/Marine Corps)	0
A-10 (Air Force)	0
F-15C/D (Air Force)	0
F-15E (Air Force)	3
F-16 (Air Force)	0

Aircraft	Number of years
F-22 (Air Force)	0
F-35A (Joint/Air Force)	2
AH-64D/E (Army)	0
CH-47F (Army)	0
UH/HH-60 (Army)	0
MH-53E (Navy)	0
MH-60R (Navy)	2
MH-60S (Navy)	0
AH-1Z (Marine Corps)	0
CH-53E (Marine Corps)	0
MV-22B (Marine Corps)	0
UH-1Y (Marine Corps)	0
CV-22 (Air Force)	0
HH-60G (Air Force)	1
UH-1N (Air Force)	11

[a]The military department did not provide a mission capable goal for some of the 11 years for this aircraft.

Many of the aircraft we reviewed are facing one or more sustainment challenges related to maintenance constraints, supply support, and the age of the aircraft. According to program officials, these challenges affect mission capable rates and the costs required to sustain those aircraft. Figure 3 shows the sustainment challenges that we determined were affecting each of the aircraft that we reviewed.

Figure 3: Sustainment Challenges Affecting Selected Aircraft

	Aging aircraft			Maintenance				Supply support		
	Delays in acquiring replacement aircraft	Service life extension[a]	Unexpected replacement of parts and repairs	Access to technical data	Delays in depot maintenance	Shortage of trained maintenance personnel	Unscheduled maintenance	Diminishing manufacturing source[b]	Parts obsolescence[c]	Parts shortage and delay
Air refueling										
KC-130T (Navy/Marine Corps)					●					●
KC-130J (Marine Corps)				●	●					●
KC-10 (Air Force)	●									
KC-135 (Air Force)		●	●	●		●	●	●	●	●
Anti-submarine										
EP-3E (Navy)			●				●	●	●	●
P-8A (Navy)			●		●					●
Bomber										
B-1B (Air Force)			●				●	●	●	●
B-2 (Air Force)	●		●	●	●	●	●	●	●	●
B-52 (Air Force)			●		●	●	●	●	●	●
Cargo										
C-2A (Navy)						●			●	
C-130T (Navy)					●					●
C-5M (Air Force)			●		●	●	●	●	●	●
C-17 (Air Force)		●	●	●	●		●	●	●	●
C-130H (Air Force)					●	●		●	●	
C-130J (Air Force)					●	●		●	●	
Command and control										
E-2C (Navy)						●			●	
E-2D (Navy)						●	●	●	●	●
E-6B (Navy)			●	●	●		●	●	●	●
E-3 (Air Force)			●		●		●	●	●	●
E-4B (Air Force)	●	●	●		●	●	●	●	●	●
E-8C (Air Force)					●		●	●	●	●
RC-135S-W (Air Force)		●			●	●	●	●	●	●
Fighter										
EA-18G (Navy)		●	●	●		●	●	●	●	●
F/A-18A-D (Navy/Marine Corps)						●	●		●	
F/A-18E/F (Navy)		●	●	●		●	●	●	●	●
F-35A/B/C (Joint)		●	●	●	●	●	●	●		●
AV-8B (Marine Corps)			●		●	●		●	●	●
A-10 (Air Force)			●		●	●	●	●	●	●
F-15C/D (Air Force)		●	●		●	●	●	●	●	●
F-15E (Air Force)			●		●	●	●	●	●	●
F-16 (Air Force)		●	●	●	●	●	●	●	●	●
F-22 (Air Force)			●	●				●	●	●
Rotary										
AH-64D/E (Army)	●		●	●	●	●	●	●	●	●
CH-47F (Army)					●	●		●	●	●
UH/HH-60 (Army)						●				●
MH-53E (Navy)			●		●			●	●	●
MH-60R (Navy)				●	●	●		●	●	●
MH-60S (Navy)				●	●	●		●	●	●
AH-1Z (Marine Corps)			●		●	●	●	●	●	●
CH-53E (Marine Corps)			●		●			●	●	●
MV-22B (Marine Corps)				●			●	●	●	●
UH-1Y (Marine Corps)			●		●	●	●	●	●	●
CV-22 (Air Force)				●	●		●	●	●	●
HH-60G (Air Force)					●					
UH-1N (Air Force)	●				●					

Source: GAO analysis of Army, Navy, and Air Force information. | GAO-23-106673

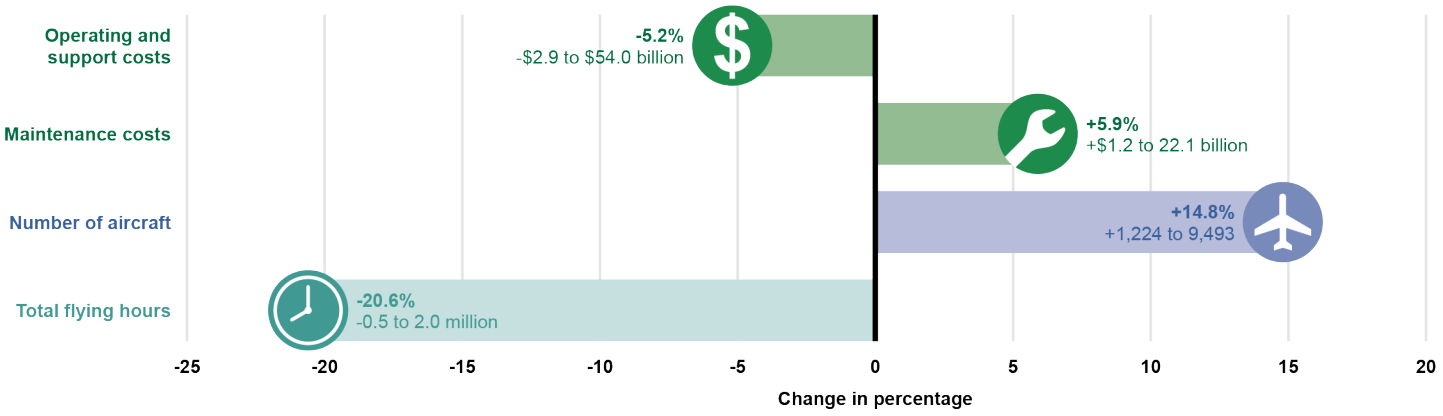
[a]A service-life extension refers to a modification to extend the service life of an aircraft beyond what was planned.

[b]Diminishing manufacturing sources refers to a loss or impending loss of manufacturers or suppliers of items.

[c]Obsolescence refers to a lack of availability of a part due to its lack of usefulness or it no longer being current or available for production.

We also analyzed operating and support costs across the selected aircraft and found that total operating and support costs decreased slightly from fiscal year 2011 through fiscal year 2020 while maintenance costs have increased, becoming a larger portion of total costs.[8] Operating and support costs totaled about $54 billion in fiscal year 2020 for the aircraft we reviewed—a decrease of about $2.9 billion since fiscal year 2011 after factoring in inflation using constant fiscal year 2020 dollars. Maintenance costs became a larger portion of O&S costs—increasing by $1.2 billion since fiscal year 2011 (see fig. 4). Based on our analysis of cost data provided by the departments and information provided by the system program offices, factors affecting the cost to operate and support each aircraft included the number of aircraft in the inventory, the number of flying hours flown, and the age of the fleet.

Figure 4: Changes in Total Costs, Number of Selected Aircraft, and Flying Hours, Fiscal Years 2011 through 2020 (rounded, in constant fiscal year 2020 dollars)



Source: GAO analysis of Army, Navy, and Air Force data. | GAO-23-106673

[8]Operating and support (O&S) costs historically account for approximately 70 percent of an aircraft's total life-cycle cost—costs to operate and sustain the weapon system from initial operations through the end of its life—and include costs for repair parts, depot and field maintenance, contract services, engineering support, and personnel, among other things. GAO, *Weapon System Sustainment: Aircraft Mission Capable Goals Were Generally Not Met and Sustainment Costs Varied by Aircraft*, GAO-23-106217 (Washington, D.C.: Nov. 10, 2022).

Accessible Data for Figure 4: Changes in Total Costs, Number of Selected Aircraft, and Flying Hours, Fiscal Years 2011 through 2020 (rounded, in constant fiscal year 2020 dollars)

Category	Change percentage
Operating and support costs	-5.2
Maintenance costs	5.9
Number of aircraft	14.8
Total flying hours	-20.6

In June 2022, we reported on Air Force and Navy field-level aircraft maintenance challenges and found that neither service had mitigated persistent fixed-wing aircraft sustainment risks.[9] In 2016, the National Defense Authorization Act for Fiscal Year 2017 included a provision requiring the military departments to conduct sustainment reviews for major weapon systems to assess their product support strategy, performance, and operating and support costs.[10] In 2021, the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 amended this sustainment review provision to require the secretaries of the military departments to annually provide the sustainment reviews conducted on a weapon system to the congressional defense committees, among other things.[11] DOD recognizes regular

[9]GAO, *Air Force and Navy Aviation: Actions Needed to Address Persistent Sustainment Risks*, GAO-22-104533 (Washington, D.C.: June 15, 2022).

[10]Pub. L. No. 114-328, § 849(c) (2016). The requirement was initially codified as section 2441 of title 10, U.S. Code. The William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 recodified the provision, as amended, as section 4323 of title 10, U.S. Code, effective January 1, 2022. Pub. L. No. 116-283, §§ 1801(d), 1848(c) (2021).

[11]Pub. L. No. 116-283, § 802(c) (2021) (codified, as amended, at 10 U.S.C. § 4323(d)). The statute as amended requires the secretary of each military department to conduct sustainment reviews of each covered system within 5 years of declaring initial operational capability and every 5 years thereafter throughout the life cycle of the system. § 4323(a). The Air Force conducted nine sustainment reviews during fiscal year 2021 and submitted documentation of these reviews. The Army completed four sustainment reviews during fiscal year 2021 and submitted documentation of those reviews. The Navy did not submit any sustainment reviews completed during fiscal year 2021, but rather issued guidance and a schedule to complete the required sustainment reviews in future years. See GAO, *Weapon System Sustainment: The Army and Air Force Conducted Reviews and the Army Identified Operating and Support Cost Growth*, GAO-23-106341 (Washington, D.C.: Mar. 30, 2023).

sustainment reviews as a critical tool to assess and address performance shortcomings and to identify maintenance and other risks to readiness.

In our June 2022 report, we recommended that the Air Force and Navy prioritize the completion of required sustainment reviews and update their schedules to complete the reviews in a timelier manner. The Air Force concurred and the Navy partially concurred with the recommendations. In its comments on the recommendation, the Navy stated that it needed to balance the workload required to conduct the sustainment reviews and that completing the sustainment reviews more expeditiously would not increase the implementation rate of readiness initiatives. While we acknowledge the need to balance workload and to generate considerable information and data to complete sustainment reviews, we continue to believe that the Navy should complete its statutorily required sustainment reviews with a greater sense of urgency.

In addition, we recommended in the June 2022 report that the Air Force and Navy develop mitigation plans with specific milestones to remedy maintenance challenges, risks, or related effects on aircraft availability identified in completed sustainment reviews. The Air Force and Navy concurred with this recommendation.

We also recommended to Congress that it consider amending section 4323 of title 10, U.S. Code, to require the Air Force and Navy to submit to Congress mitigation plans related to identified maintenance challenges and risks to aircraft availability found in sustainment reviews based on a specific sustainment threshold. Such thresholds could include aircraft falling below their mission capable-rate goal for consecutive years, an aircraft's mission capable rate declining by a specified percentage, or some other sustainment metric or metrics.

We have an ongoing review examining fighter aircraft sustainment best practices and the department's approach to resourcing sustainment requirements for its fighter aircraft and plan to report on the results of that work in 2024.

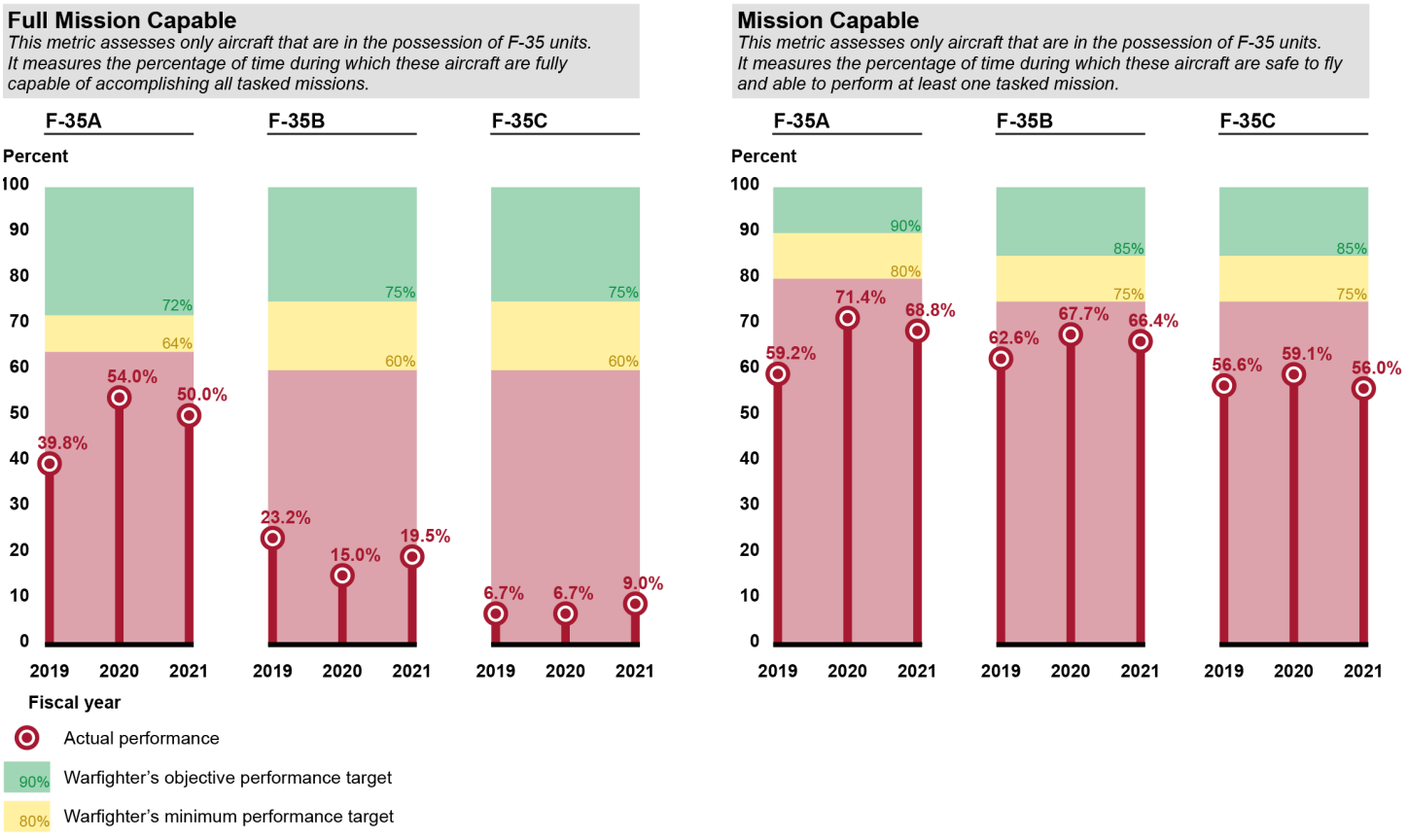
F-35 Aircraft Face Sustainment and Operational Challenges

Sustainment challenges are not just an issue for older aircraft. They represent a significant challenge for the F-35 Lightning II aircraft—a growing portion of the tactical aviation fleet for DOD. The F-35 is DOD's most ambitious and costly weapon system in history. Current DOD plans call for procuring 2,470 F-35s at an estimated total acquisition cost of just

under $400 billion, leaving the majority of the estimated program costs, approximately $1.3 trillion, associated with sustainment of the aircraft.

We found in April 2022 that the F-35 continues to not meet its targets for mission capable rates or its reliability and maintainability metrics.[12] For example, in fiscal year 2021, the F-35A and F-35B were below the full mission-capable minimum-performance target by 14 and 41 percentage points, respectively. Furthermore, each F-35 variant in fiscal year 2021 did not meet its target for mission-capable minimum performance by at least about 9 percentage points. See figure 5.

Figure 5: U.S. F-35 Fleet's Rates for Full Mission Capable and Mission Capable, Fiscal Years 2019 through 2021



Source: GAO analysis of Department of Defense and Lockheed Martin information. | GAO-23-106673

[12]GAO, *F-35 Sustainment: DOD Faces Several Uncertainties and Has Not Met Key Objectives*, GAO-22-105995 (Washington, D.C.: Apr. 28, 2022).

Accessible Data for Figure 5: U.S. F-35 Fleet's Rates for Full Mission Capable and Mission Capable, Fiscal Years 2019 through 2021

		2019	2020	2021
FMC	**F-35A**	39.8	54.0	50.0
	F-35B	23.2	15.0	19.5
	F-35C	6.7	6.7	9.0
MC	**F-35A**	59.2	71.4	68.8
	F-35B	62.6	67.7	66.4
	F-35C	56.6	59.1	56.0

Note: The warfighter's minimum and objective performance targets are those requirements established for non-deployed F-35 aircraft by the U.S. Air Force for the F-35A; by the U.S. Marine Corps for the F-35B; and by the U.S. Navy for the F-35C, in their respective Performance Based Arrangements.

Our prior work has shown that two key challenges—spare parts availability and maintenance—have resulted in the F-35 program not being able to meet its performance targets. While some improvements have been made, these challenges continue to prevent the program from meeting its minimum-performance targets, much less its performance objectives.

- **Spare parts availability**: Spare parts availability is measured by rate of not mission capable due to supply—the percentage of time during which aircraft in the possession of F-35 units are unable to fly or conduct any of their tasked missions due to a lack of spare parts. The rate of not mission capable due to supply was about 25 percent in fiscal year 2019 and this rate decreased further, hovering around 17 percent in fiscal years 2020 and 2021. As we reported in July 2021, the F-35 Joint Program Office stated that the program plans to fund enough spare parts to achieve an approximately 15 percent rate of not mission capable due to supply.[13] According to program officials, achieving a lower rate of not mission capable due to supply was not affordable, and would provide only near-term benefits. Therefore, the program has focused on other priorities, such as improving depot repair capacity.

  As of September 2021, the average depot-level repair time for an F-35 part had improved to 131 days, from 188 days in November 2018. However, this figure remains well above the program's 30-day

[13]GAO, *F-35 Sustainment: DOD Needs to Cut Billions in Estimated Costs to Achieve Affordability*, GAO-21-439 (Washington, D.C.: July 7, 2021).

program objective. In January 2022, the Director, Operational Test and Evaluation, reported that the limited component-level depot repair capacity contributes to the shortfalls in the supply of spares. According to program officials, part repair times continue to lag because the depots do not yet have the capacity to meet program goals for repair time, and they are years away from having sufficient capacity to achieve these goals. F-35 officials stated that mitigation plans are in place to accelerate component depot repair capacity. The officials said that this is imperative because an unintended consequence of delayed depot activation is the procurement of more spares to make up for the lack of components in repair coming back into the supply system for the warfighter.

- **Maintenance**: In July 2021, we found that DOD officials and all of the F-35 locations that responded to our survey identified two specific challenges that negatively affected organizational-level maintenance on the F-35: (1) flight line maintainers' lack of access to technical data (i.e., details about how the aircraft should perform and how to maintain its continued performance) to conduct certain maintenance activities and (2) the availability of support equipment to conduct maintenance efficiently.[14] During our visits to three F-35 installations and two F-35 maintenance depots from December 2021 through March 2022, maintenance officers and maintainers continued to report that these issues negatively affected performance.[15]

In recent years, we made a number of recommendations to address F-35 spare parts and maintenance challenges. For example, in April 2019, we recommended that DOD clearly define the strategy by which DOD will manage the F-35 supply chain in the future and update key strategy documents accordingly, including any additional actions and investments necessary to support that strategy.[16] In October 2021, DOD published a business case analysis that assessed its supply chain strategy, but has not updated its strategy. Further, in July 2022, we recommended that DOD assess and make changes to the F-35 engine sustainment strategy,

[14]GAO, *F-35 Sustainment: DOD Needs to Cut Billions in Estimated Costs to Achieve Affordability*, GAO-21-439 (Washington, D.C.: July 7, 2021).

[15]GAO, *F-35 Sustainment: DOD Faces Several Uncertainties and Has Not Met Key Objectives*, GAO-22-105995 (Washington D.C.: April 28, 2022).

[16]GAO, *F-35 Aircraft Sustainment: DOD Needs to Address Substantial Supply Chain Challenges*, GAO-19-321 (Washington, D.C.: Apr. 25, 2019).

and DOD concurred.[17] DOD has begun work on a new sustainment strategy with plans to complete it in 2024. DOD is also evaluating options for upgrading the F-35's engine to improve performance to counter emerging threats. As DOD considers engine modernization options, it will need to consider how these different designs will affect sustainment.[18]

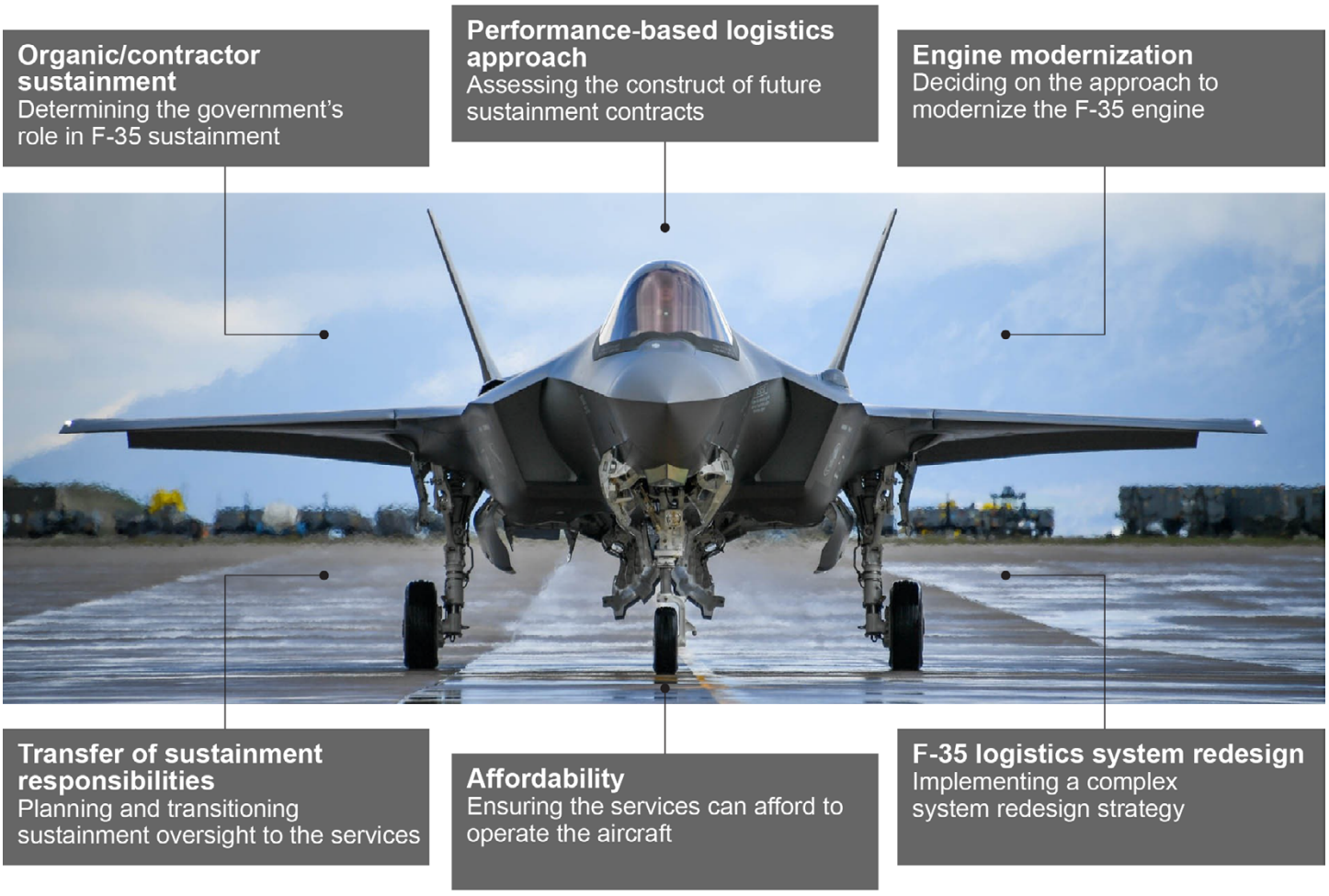
More broadly, since 2014, we have reported on several operational and affordability challenges associated with sustainment of the F-35.[19] DOD officials are aware of these challenges and agreed that changes must be made to F-35 sustainment to improve both aircraft readiness and program affordability. The department is taking encouraging steps with its increased focus on F-35 sustainment and its ongoing assessments to determine how to achieve improved sustainment-related outcomes. However, our work shows that DOD still faces several uncertainties as it works to determine the future of F-35 sustainment, as shown in figure 6. These uncertainties, all of which are independently complex, are also inherently connected. This will require DOD to address them concurrently, further complicating DOD's efforts to plan for the future of F-35 sustainment.

[17]GAO, *F-35 Aircraft: DOD Should Assess and Update Its Engine Sustainment Strategy to Support Desired Outcomes*, GAO-22-104678 (Washington, D.C.: July 19, 2022).

[18]For more details on the F-35 engine modernization issues, see GAO, *Tactical Aircraft: Technical, Delivery, and Affordability Challenges Complicate DOD's Ability to Upgrade Its Aging Fleet*, GAO-23-106694 (Washington, D.C.: Mar. 29, 2023).

[19]GAO, *F-35 Sustainment: Need for Affordable Strategy, Greater Attention to Risks, and Improved Cost Estimates*, GAO-14-778 (Washington, D.C.: Sept. 23, 2014); *F-35 Sustainment: DOD Needs a Plan to Address Risks Related to Its Central Logistics System*, GAO-16-439 (Washington, D.C.: Apr. 14, 2016); *F-35 Aircraft Sustainment: DOD Needs to Address Challenges Affecting Readiness and Cost Transparency*, GAO-18-75 (Washington, D.C.: Oct. 26, 2017); *F-35 Aircraft Sustainment: DOD Needs to Address Substantial Supply Chain Challenges*, GAO-19-321 (Washington, D.C.: Apr. 25, 2019); *Weapon System Sustainment: DOD Needs a Strategy for Re-Designing the F-35's Central Logistics System*, GAO-20-316 (Washington, D.C.: Mar. 6, 2020); and *F-35 Sustainment: DOD Needs to Cut Billions in Estimated Costs to Achieve Affordability*, GAO-21-439 (Washington, D.C.: July 7, 2021).

Figure 6: Uncertainties Shaping the Future of F-35 Sustainment



Source: GAO analysis of Department of Defense information; U.S. Air Force/R. Nial Bradshaw (photo). | GAO-23-106673

We have an ongoing review examining F-35 maintenance with plans to report on the results of that work in summer 2023.

Sea Domain

Sustainment Challenges Have Worsened over Last Decade, with Surface Ship Maintenance Backlog Estimated at $1.8 Billion

We found in January 2023 that sustainment challenges worsened from fiscal year 2011 through 2021 for 10 ship classes we reviewed. Examples of issues in three areas were:

- depot maintenance delays (days beyond the scheduled end date for depot maintenance),
- growing numbers of cannibalizations (working parts removed and reused elsewhere due to parts shortages), and
- casualty reports (reports of events that impair ships' ability to conduct a primary mission).

See figure 7.[20] Over the same time frame, there was a decrease in steaming hours, which are the number of hours a ship is generally in an operating or training status.

Figure 7: Changes in Sustainment Metrics per Ship for Selected Navy Ship Classes, Fiscal Years 2011 through 2021

Ship class	Maintenance cannibalizations[a]	Category 3 and 4 casualty reports	Days of maintenance delay
Ticonderoga-class cruiser (CG-47)	+3 ▲	-1 ▼	+7 ▲
Nimitz-class aircraft carrier (CVN-68)	+4 ▲	+2 ▲	+7 ▲
Arleigh Burke-class destroyer (DDG-51)	+7 ▲	+19 ▲	+20 ▲
Freedom-class littoral combat ship (LCS-1)	+15 ▲	+26 ▲	0 ●
Independence-class littoral combat ship (LCS-2)	+3 ▲	+26 ▲	+19 ▲
America-class amphibious assault ship (LHA-6)[b]	-1 ▼	+13 ▲	0 ●
Wasp-class amphibious assault ship (LHD-1)	+9 ▲	+43 ▲	+10 ▲
San Antonio-class amphibious transport dock (LPD-17)	+3 ▲	+10 ▲	+33 ▲
Whidbey Island-class dock landing ship (LSD-41)	+6 ▲	+24 ▲	+19 ▲
Harpers Ferry-class dock landing ship (LSD-49)	+7 ▲	-11 ▼	-16 ▼
Fleetwide	**+6** ▲	**+15** ▲	**+14** ▲

● No change (neutral) ▲ Increase (negative) ▼ Decrease (positive)

Source: GAO analysis of U.S. Navy data. | GAO-23-106673

Note: The numbers above are not percentages and are rounded to the nearest whole number.

[20]GAO, *Weapon System Sustainment: Navy Ship Usage Has Decreased as Challenges and Costs Have Increased*, GAO-23-106440 (Washington, D.C.: Jan. 31, 2023).

[a]Cannibalization data for fiscal years 2011 through 2014 is incomplete. Therefore, cannibalization trends reflect fiscal years 2015 through 2021.

[b]The first America-class amphibious assault ship was commissioned in 2014, so readiness trends for this class reflect fiscal years 2015 through 2021.

- **Depot maintenance delays**: The average days of depot maintenance delay per ship among the 10 ship classes we examined increased about 5 days to about 19 days per ship in fiscal years 2011 through 2021. The highest number of days of depot maintenance delay per ship was incurred in fiscal year 2019, with an average of 40 days per ship that year. The average fell in fiscal years 2020 and 2021. The *San Antonio* class averaged more than 30 days of depot maintenance delay per ship—the equivalent of about a month of delay—in fiscal year 2021. By comparison, the Navy has the most ships in the *Arleigh Burke* class, and those ships averaged 26 days of depot maintenance delay in that fiscal year. According to Navy officials, the Navy's goal was to incur zero days of depot maintenance delay. However, the average number of days delayed per ship increased from 5 days in 2011 to 19 days in 2021.
- **Maintenance cannibalizations**: Officials from program offices for nine of the 10 ship classes we reviewed indicated they faced challenges obtaining spare parts, which has resulted in an increase in ship maintainers reusing parts because new parts are not available. We found that the average number of maintenance cannibalizations per ship rose by about six cannibalizations across the ship classes we examined from fiscal year 2015 through 2021.[21] With the exception of fiscal year 2017, the average number of cannibalizations per ship increased every year from 2015 to 2021. Navy officials told us that ship cannibalizations often occur due to supply chain shortfalls for specific parts. According to these officials, decisions to move parts from one ship to another are made when the supply of a specific part will not meet the operational commitments of a ship.
- **Casualty reports**: We found that the average number of category 3 and 4 casualty reports per ship increased by 15 from fiscal years 2011 through 2021. Eight of the 10 ship classes we examined experienced an increase in category 3 and 4 casualty reports over this time

[21]We did not report cannibalization rates for fiscal years 2011 through 2014 because Navy officials told us that their data for these years were incomplete.

frame.[22] The most significant increase in casualty reports were experienced by the *Wasp* class, which saw an increase of about 43 from fiscal year 2011 to fiscal year 2021. Additionally, Littoral Combat Ships—both the *Freedom* and *Independence* classes—saw an increase of about 26 from fiscal year 2011 to fiscal year 2021. We have reported that the Navy has faced significant challenges operating and maintaining its Littoral Combat Ship fleet.[23] We found that engine failures occurred on 10 of 11 deployments, among other design, navigation, and engine propulsion problems. Navy officials said that they did not have goals for casualty report rates for each ship class, but officials noted that the Navy is continually working to minimize them.

The 10 ship classes we reviewed face a litany of maintenance and supply challenges related to the age of the ship, shortages of trained maintenance personnel, and diminished manufacturing sources for parts, among others. According to program officials, these challenges affect operational availability and the costs required to sustain those ships. Figure 8 shows key sustainment challenges that we determined were affecting each of the ship classes we reviewed.

[22]Casualty reports are used to record events that impair, to varying degrees, a ship's ability to accomplish its primary mission. Navy casualty reports fall into three categories of increasing severity: category 2, category 3, and category 4, with category 4 indicating a deficiency in mission-essential equipment that causes a loss of at least one primary mission. We chose to combine category 3 and category 4 casualty reports in our analysis because both indicate problems that could affect mission capability. While category 4 casualty reports fell across most ship classes from fiscal years 2011 through 2021, they were offset by larger increases in category 3 casualty reports—leading to significantly more casualty reports overall.

[23]GAO, *Littoral Combat Ship: Actions Needed to Address Significant Operational Challenges and Implement Planned Sustainment Approach*, GAO-22-105387 (Washington, D.C.: Feb. 24, 2022).

Figure 8: Sustainment Challenges Affecting Selected Navy Ship Classes

	Ticonderoga-class cruiser (CG-47)	*Nimitz*-class aircraft carrier (CVN-68)	*Arleigh Burke*-class destroyer (DDG-51)	*Freedom*-class littoral combat ship (LCS-1)	*Independence*-class littoral combat ship (LCS-2)	*America*-class amphibious assault ship (LHA-6)	*Wasp*-class amphibious assault ship (LHD-1)	*San Antonio*-class amphibious transport dock (LPD-17)	*Whidbey Island*-class dock landing ship (LSD-41)	*Harpers Ferry*-class dock landing ship (LSD-49)
Service life longer than anticipated	●	●							●	●
Unexpected replacement of parts and repairs		●	●	●	●		●	●		●
Access to technical data		●								
Delays in depot maintenance	●	●	●	●	●	●	●	●	●	●
Delays in intermediate maintenance	●		●		●		●			
Shortage of trained maintenance personnel	●		●	●	●	●	●	●	●	●
Unscheduled maintenance	●	●	●	●	●	●	●	●		
Diminishing manufacturing sources	●	●	●		●		●			
Parts obsolescence	●	●	●	●	●		●	●		●
Parts shortages and delays	●	●	●	●	●		●	●	●	●

● Applicable maintenance issue

Source: GAO analysis of Navy information. | GAO-23-106673

Note: Diminishing manufacturing sources refers to the loss, or impending loss, of manufacturers or suppliers of items, raw materials, or software.

We also analyzed operating and support costs, finding that the Navy's total operating and support costs for the 10 ship classes we examined increased by about $2.5 billion from fiscal years 2011 through 2020 while the Navy added 33 ships to its fleet for these classes. To enable comparisons across ship classes, which varied greatly based on the number of ships, we analyzed both total costs for each of the 10 reviewed ship classes as well as costs per ship for each of the ship classes. Even though there was an increase in the number of ships, steaming hours for the examined ship classes declined. Therefore, the cost per steaming hour for the ship classes we examined increased with some variation across the examined ship classes. Generally, the increase in cost per steaming hour for the ship classes we examined means the Navy is spending more to operate and sustain the ships for each hour of operational activity.

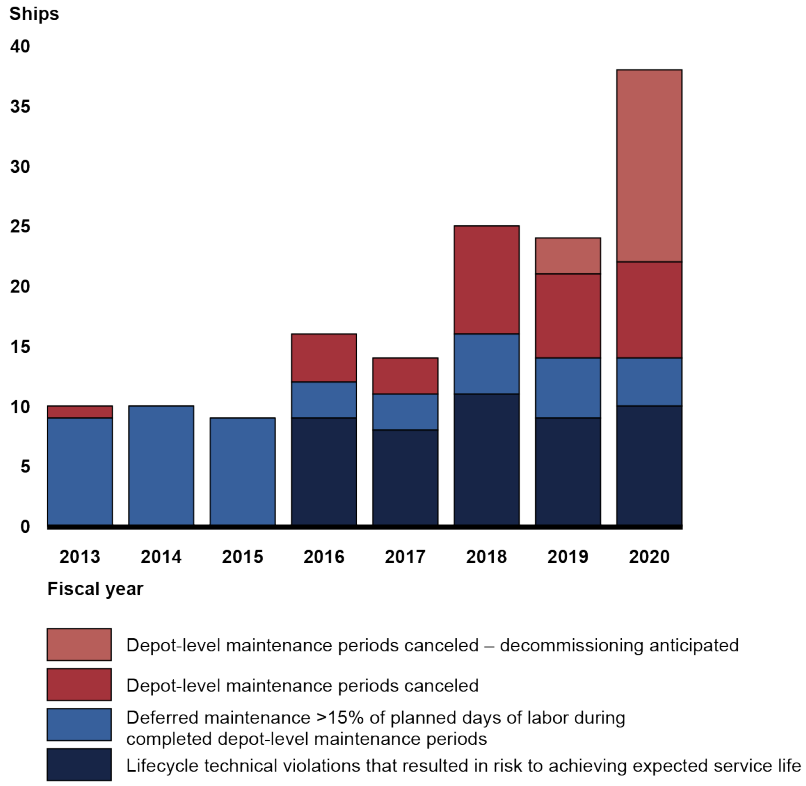
Ship sustainment challenges will likely be exacerbated by a growing maintenance backlog on Navy surface ships. We found in May 2022 that over the past decade, surface ships have accounted for nearly all of the

Navy's deferred depot maintenance backlog.[24] By contrast, aircraft carriers have experienced minimal increases in backlog, and maintenance is rarely deferred for submarines. At our request, the Navy developed an estimate of its maintenance backlog, and it totaled nearly $1.8 billion. The total, comprised nearly $1.7 billion for surface ships and nearly $100 million for aircraft carriers. This estimate is the amount of funding the Navy estimates it would need to complete all of the deferred maintenance.

The Navy in recent years has increasingly deferred maintenance on critical systems or canceled depot-level maintenance periods altogether for surface ships. According to a Navy report, deferred maintenance on critical systems—referred to as life-cycle technical violations—increases the likelihood that the ship's future maintenance periods will take longer and cost more than expected. Deferred and canceled maintenance may also affect a ship's ability to reach the expected service life. According to the Navy report, in fiscal year 2018 through fiscal year 2020, the Navy canceled 16 more maintenance periods than it did in the 5 preceding fiscal years combined (see fig. 9).

[24]GAO, *Navy Ships: Applying Leading Practices and Transparent Reporting Could Help Reduce Risks Posed by Nearly $1.8 Billion Maintenance Backlog*, GAO-22-105032 (Washington, D.C.: May 9, 2022).

Figure 9: Number of Surface Ships with Critical Maintenance Violations Reported in the Navy's Fiscal Year 2020 Surface Ship Engineered Operating Cycle Report



Source: Navy Surface Ship Engineered Operating Cycle Report for FY2020. | GAO-23-106673

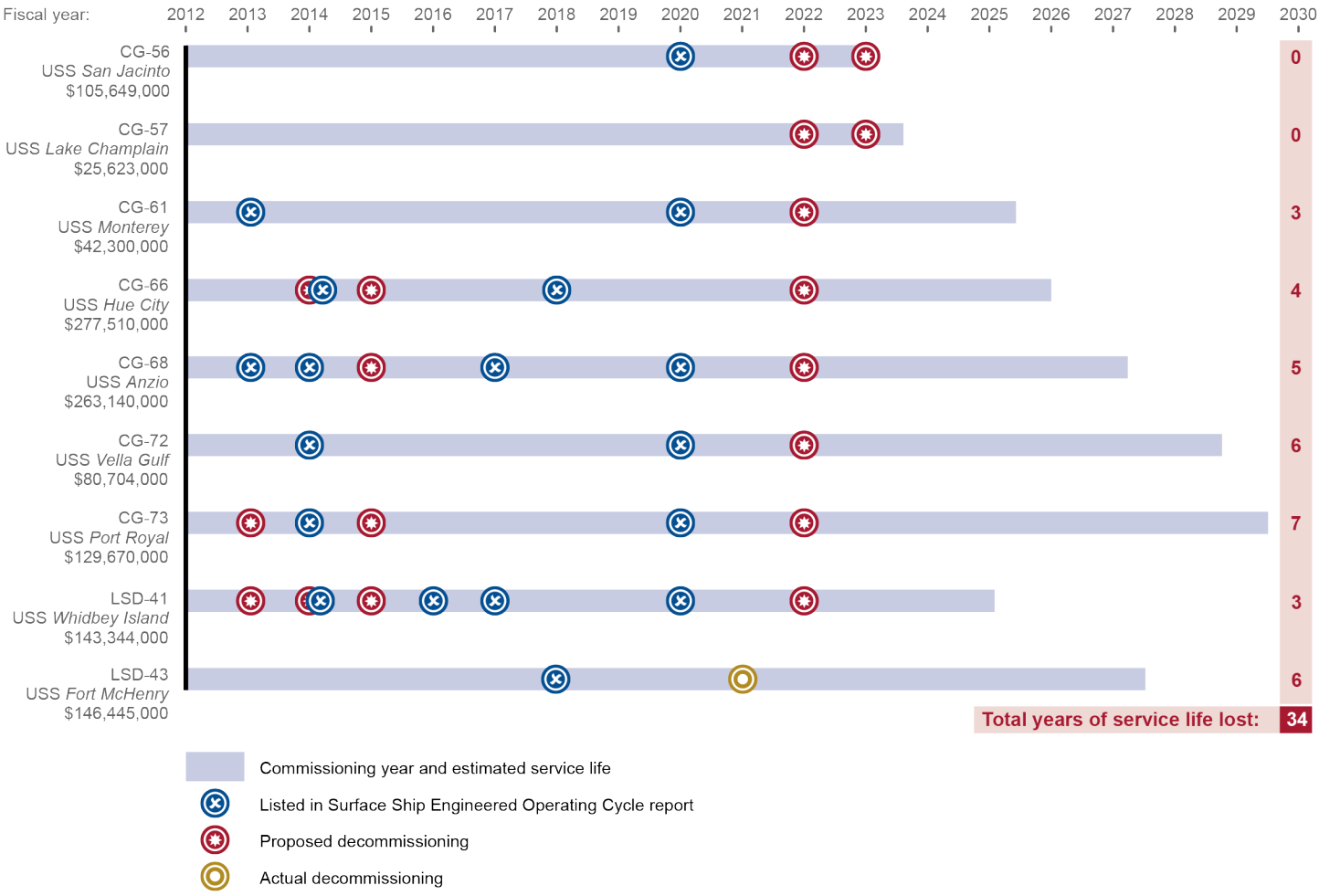
Accessible Data for Figure 9: Number of Surface Ships with Critical Maintenance Violations Reported in the Navy's Fiscal Year 2020 Surface Ship Engineered Operating Cycle Report

	LTV	Reprog	AC	AC DA
2013	0	9	1	0
2014	0	10	0	0
2015	0	9	0	0
2016	9	3	4	0
2017	8	3	3	0
2018	11	5	9	0
2019	9	5	7	3
2020	10	4	8	16

Note: Critical maintenance violations are canceled depot-level maintenance periods, deferred maintenance greater than 15 percent of planned days of labor during completed depot-level maintenance periods, and deferred maintenance tasks on critical systems.

The surface ship maintenance backlog included $1.2 billion for deferred maintenance on ships the Navy proposed to decommission early in its fiscal year 2022 budget request. The accumulated maintenance backlog contributed to the Navy decisions to propose decommissioning nine ships, according to officials, which would have resulted in the loss of 34 years of ship service life (see fig. 10). Early decommissioning could reduce operating and support costs, but also leads to a smaller fleet and could hinder efforts to meet operational and presence requirements.

Figure 10: Ships with an Accumulated Deferred Maintenance Backlog Proposed for Early Decommissioning in the Navy's FY2022 Budget



Source: GAO analysis of U.S. Navy information. | GAO-23-106673

We assessed the Navy's management of the surface fleet's depot maintenance backlog, finding that the Navy met six of the nine leading practices that we previously identified as effective strategies for managing deferred maintenance backlogs. Specifically, the Navy had not taken action in three areas: 1.) establish comprehensive performance measures for reducing the backlog, 2.) identify the full range of risks posed by a lack of timely investment, or 3.) identify the funding needed to address the backlog of deferred depot maintenance. We made nine recommendations to incorporate leading practices for managing deferred maintenance and to improve Navy reporting on the depot maintenance backlog. DOD generally concurred with the recommendations, but has not yet implemented any of them.

We have reported that sustainment challenges are not limited to surface ships. For example:

- In August 2020, we found that, from fiscal year 2015 to fiscal year 2019, the Navy was late in completing 75 percent of planned maintenance periods for aircraft carriers and submarines, with an average delay of 113 days for carriers and 225 days for submarines.[25] We also found that idle time for submarines waiting to start a maintenance period had grown from fiscal year 2015 to fiscal year 2019. Idle time occurs when the Navy's four shipyards do not have the facilities available to begin maintenance on submarines whose safety certifications have expired or will soon expire. Without the safety certification to submerge, submarines are unable to perform their operations. We found that idle time increased each year from 100 days in fiscal year 2015 to 1,019 days in fiscal year 2019—a 919 percent increase. There were 2,796 days of total idle time over this period.
- In October 2020, we found that from fiscal year 2014 to fiscal year 2020, Navy submarines had spent 9,563 more days in depot maintenance than expected and Navy aircraft carriers had spent 1,180 more days in depot maintenance than expected.[26]

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

[26]GAO, *Navy Maintenance: Navy Report Did Not Fully Address Causes of Delays or Results-Oriented Elements*, GAO-21-66 (Washington, D.C.: Oct. 29, 2020).

- In February 2022, we reported on intermediate maintenance periods—high-priority planned maintenance that happens pier-side in homeports, allowing the Navy to interrupt repairs and get ships underway quickly if needed. We found that from fiscal year 2015 through fiscal year 2020 the Navy reported 2,525 days of maintenance delay for intermediate maintenance periods for submarines.[27]

When depot and intermediate maintenance is not completed on time, fewer submarines and aircraft carriers are available for training or operations, which can hinder readiness.

We have a wide range of recent and ongoing reviews examining sustainment issues across the sea domain. On April 20, we issued a report on Navy ship fires during maintenance periods, and plan to issue reports on Navy organizational-level ship maintenance in 2024, and Army watercraft readiness in 2024.[28]

Navy's Four Public Shipyards Are in Poor Condition

Addressing ship and submarine maintenance delays, backlogs, and other sustainment challenges will be difficult given the poor condition of infrastructure at the Navy's four public shipyards.[29] The Navy's public shipyards are critical to maintaining the readiness of its fleet of nuclear aircraft carriers and submarines, and supporting ongoing operations around the world. The four shipyards are Norfolk Naval Shipyard in Virginia, Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility in Hawaii, Portsmouth Naval Shipyard in Maine, and Puget Sound Naval Shipyard and Intermediate Maintenance Facility in Washington.

[27]GAO, *Navy Ship Maintenance: Actions Needed to Monitor and Address the Performance of Intermediate Maintenance Periods*, GAO-22-104510 (Washington, D.C.: Feb. 8, 2022).

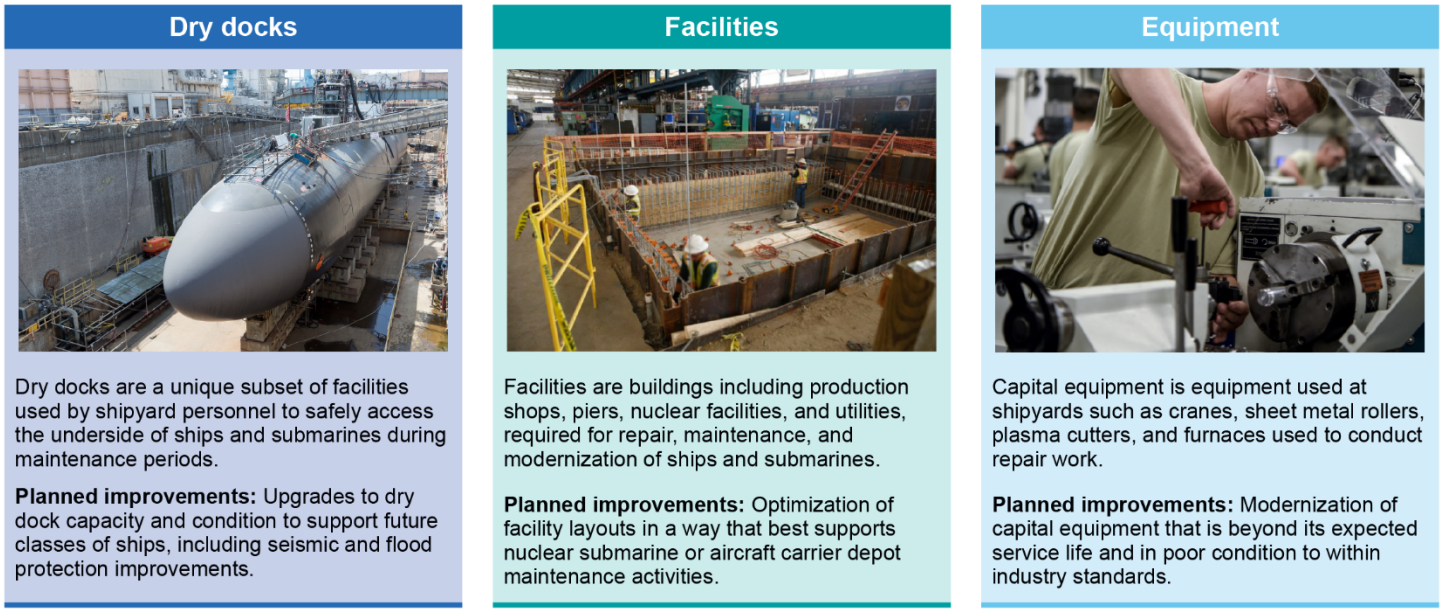
[28]GAO, *Navy Ship Fires: Ongoing Efforts to Improve Safety Should Be Enhanced*, GAO-23-105481 (Washington, D.C: Apr. 20, 2023).

[29]We reported in May 2022 on the condition of 21 depots operated by the military services, including the four public shipyards. We found that, since fiscal year 2016, the condition of the depots' infrastructure—their facilities and equipment—generally has remained in the fair-to-poor range and has not improved, while backlogs of facility projects grew by $3.1 billion. We made two recommendations to improve the DOD strategy for addressing deteriorating facilities and equipment. GAO, *Military Depots: DOD Strategy for Addressing Deteriorating Facilities and Equipment Is Incomplete*, GAO-22-105009 (Washington, D.C.: May 9, 2022).

These shipyards provide the Navy with the capability to perform depot-level maintenance on ships, emergency repairs, ship modernization, and ship deactivations.

We found in May 2022 that the Navy has taken several actions to improve its public shipyards in recent years.[30] In 2018, the Navy began a 20-year effort to modernize and optimize its shipyards, known as the Shipyard Infrastructure Optimization Plan, that the Navy initially estimated would cost $21 billion. The plan includes efforts to address limitations with three major facets of the public shipyards' operations: dry docks, facilities, and capital equipment (see fig. 11).

Figure 11: Major Areas for Improvement Identified in the Navy's Shipyard Infrastructure Optimization Plan



Source: GAO analysis of Navy documents; Defense Visual Information Distribution Service (photos). | GAO-23-106673

The Navy has implemented some of our recommendations in its efforts to improve shipyards, such as creating a program office to manage the Shipyard Infrastructure Optimization Plan. In addition, we previously reported that the Navy invested in shipyard infrastructure above the minimum level set by statute and the average condition of facilities at

[30]GAO, *Naval Shipyards: Ongoing Challenges Could Jeopardize Navy's Ability to Improve Shipyards*, GAO-22-105993 (Washington, D.C.: May 10, 2022).

Navy shipyards has improved at three of the four shipyards from 2016 to 2020.[31]

However, we found that the Navy faces a number of remaining challenges to improving the infrastructure at the shipyards.

- The backlog of facility restoration and modernization projects—those intended to restore, renovate, or replace buildings or components—has increased by over $1.6 billion from 2017 to 2020.
- The average age of capital equipment has continued to increase. More than half the equipment at the shipyards is past its expected service life.
- The cost of dry dock projects has doubled and may grow further. In 2018, the Navy estimated that it would need $4 billion to modernize its 17 dry docks. However, the Navy reports that the cost of just the first three dry dock projects has grown by over $4 billion. This is on top of costs not included in the initial Shipyard Infrastructure Optimization Plan estimate—such as inflation, utilities, environmental remediation, and historical preservation—which could add billions.
- Initial Shipyard Infrastructure Optimization Plan schedule goals have slipped. Detailed shipyard investment plans will not be complete until fiscal year 2025, 3 years later than planned.
- Completely implementing the Shipyard Infrastructure Optimization Plan will involve funding well above the levels allocated in recent years for shipyard infrastructure, as well as significant planning and sustained management attention over 20 years.

We have made nine recommendations related to the Navy's public shipyards. The Navy concurred with these recommendations and has fully implemented five of them. Addressing our remaining recommendations could assist the Navy in reaching its goals of improved shipyard capacity and performance. For example, developing accurate cost estimates will help the Navy articulate its resource needs to fully implement the Shipyard Infrastructure Optimization Plan. This includes optimizing facilities and replacing aged equipment in addition to the dry dock improvements already underway.

[31]GAO, *Naval Shipyards: Ongoing Challenges Could Jeopardize Navy's Ability to Improve Shipyards*, GAO-22-105993 (Washington, D.C.: May 10, 2022).

We have an ongoing review examining the Navy's Shipyard Infrastructure Optimization Program cost and schedule and plan to report on the results of that work in summer 2023.

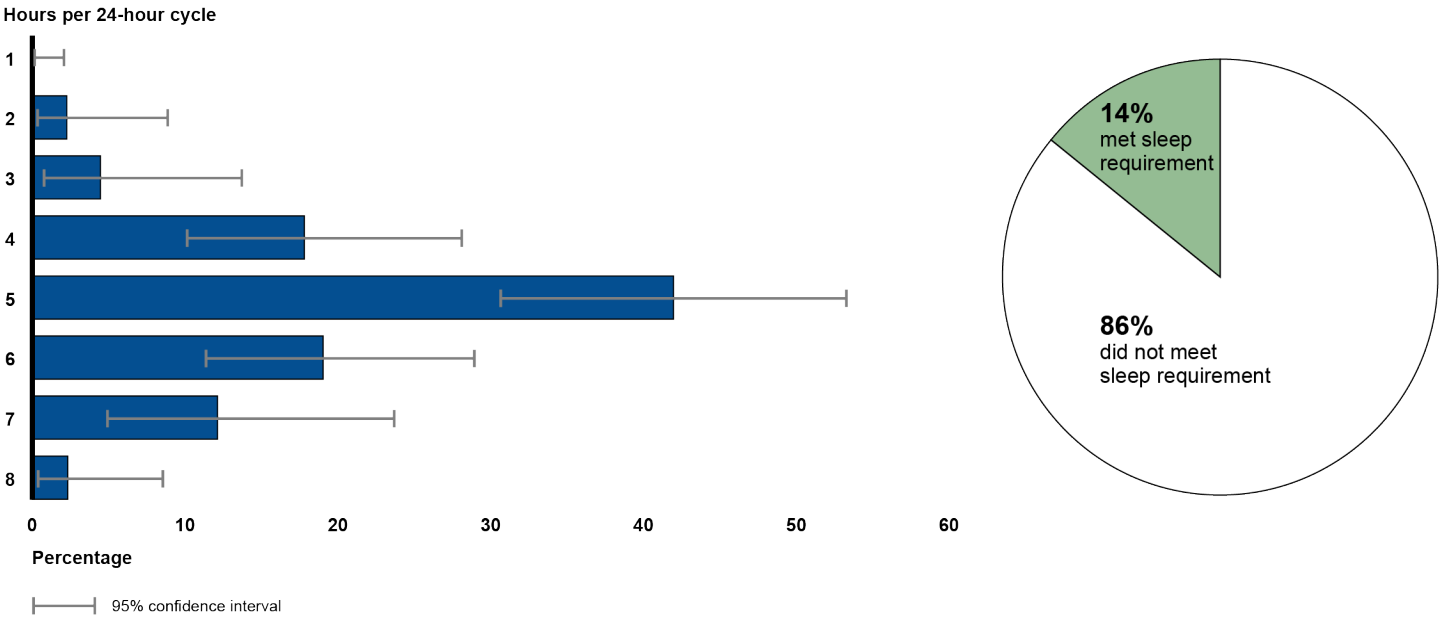
Fatigue and Crewing Shortfalls Affecting Navy Surface Fleet

In 2017, the Navy had four significant mishaps at sea, including two collisions that resulted in the loss of 17 sailors' lives and hundreds of millions of dollars in damage to Navy ships. The Navy has since acted to address sailor fatigue and resize surface ship crews to handle workload. Some steps it has taken include directing the implementation of more sustainable shift rotations on ships, which are intended to provide a better balance of work and sleep for sailors, and reevaluating workload and increasing crew size requirements.

We found in May 2021 that although the Navy had issued a fatigue management policy in 2017, the Navy had inconsistently implemented it and sailors were not receiving adequate sleep.[32] We conducted a survey that estimated that 86 percent of officers received less than the target 7 hours of uninterrupted sleep a day, and that most of these respondents were not able to supplement their lack of sleep with a 2-hour continuous nap, per Navy policy. Moreover, 67 percent of officers received 5 hours or less of sleep each day (see fig. 12). Navy data show that sailor effectiveness declines after prolonged periods without sleep, creating impairment levels comparable to intoxication. Our survey results were consistent with those of a Navy survey conducted in 2020, which found that respondents received an average of 5.4 hours of sleep a day.

[32]GAO, *Navy Readiness: Additional Efforts Are Needed to Manage Fatigue, Reduce Crewing Shortfalls, and Implement Training*, GAO-21-366 (Washington, D.C.: May 27, 2021).

Figure 12: Hours of Sleep Officers Received While Underway on Navy Ships



Source: GAO analysis of survey of Navy Surface Warfare Officers — Fatigue Management and Career Path. | GAO-23-106673

Accessible Data for Figure 12: Hours of Sleep Officers Received While Underway on Navy Ships

Hours	Response percentage
1	0
2	2.27
3	4.46
4	17.81
5	41.97
6	19.03
7	12.13
8	2.32

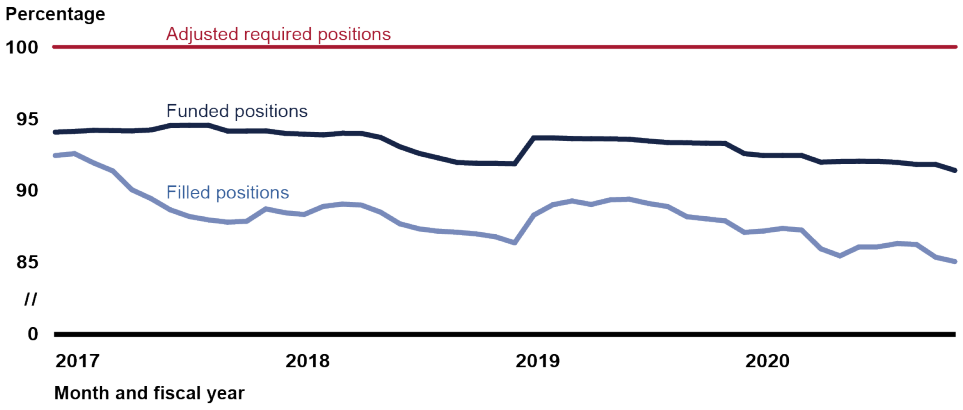
Note: Estimates included in this figure have a margin of error at the 95 percent confidence level of plus or minus 10 percentage points or fewer.

We estimated that nearly all officers sometimes or often experienced some fatigue-related conditions, such as lack of energy and high levels of stress, and that they rarely, if ever, neglected to perform their duties. In addition, survey respondents reported that they experienced other fatigue-related conditions, including forgetfulness and adverse health effects like sleep apnea. We found that the Navy was taking steps to improve its fatigue management program, but remains limited in its effort

to address the causes of fatigue and inadequate sleep. This is because they lack quality information upon which to base decisions in real time and address the causal factors. The Navy is testing efforts to collect data and use it to better manage fatigue. It expects to complete these efforts in 2024.

We also found in May 2021 that the Navy routinely assigned fewer crewmembers to its ships than its workload studies have determined are needed to safely operate them. Until recently, the Navy tracked and internally reported its crewing against the number of funded positions rather than against required positions, a practice which understated crewing shortfalls (see fig. 13).

Figure 13: Average Surface Fleet Enlisted Crew Positions Required, Funded, and Filled, Fiscal Years 2017 through 2020



Source: GAO analysis of U.S. Navy data. | GAO-23-106673

Accessible Data for Figure 13: Average Surface Fleet Enlisted Crew Positions Required, Funded, and Filled, Fiscal Years 2017 through 2020

Month	Funded percentage	Filled percentage
O 2017	0.940219	0.923986
N 2017	0.94072	0.925334
D 2017	0.941475	0.918889
J 2017	0.941268	0.91334
F 2017	0.941107	0.900287
M 2017	0.941695	0.894153
A 2017	0.944759	0.886413
M 2017	0.944973	0.881746
J 2017	0.944939	0.879392
J 2017	0.940973	0.87785

Month	Funded percentage	Filled percentage
A 2017	0.940973	0.878443
S 2017	0.941092	0.887022
O 2018	0.939343	0.884366
N 2018	0.938817	0.883122
D 2018	0.938297	0.888742
J 2018	0.939436	0.890369
F 2018	0.939302	0.889633
M 2018	0.936526	0.884707
A 2018	0.930105	0.876702
M 2018	0.925509	0.873208
J 2018	0.92235	0.87155
J 2018	0.919177	0.870846
A 2018	0.918648	0.869676
S 2018	0.91857	0.867696
O 2019	0.918268	0.863483
N 2019	0.936292	0.882701
D 2019	0.936254	0.889916
J 2019	0.935721	0.892501
F 2019	0.935575	0.890086
M 2019	0.935509	0.893304
A 2019	0.935277	0.8937
M 2019	0.934061	0.890763
J 2019	0.932994	0.888657
J 2019	0.932831	0.881604
A 2019	0.932561	0.88014
S 2019	0.932388	0.878726
O 2020	0.925338	0.870752
N 2020	0.923986	0.871684
D 2020	0.924013	0.873507
J 2020	0.924026	0.872326
F 2020	0.919368	0.859377
M 2020	0.919859	0.854443
A 2020	0.920001	0.860706
M 2020	0.919929	0.860756
J 2020	0.919231	0.862999
J 2020	0.917809	0.862342
A 2020	0.917809	0.853523

Month	Funded percentage	Filled percentage
S 2020	0.913714	0.850525

As a result, the Navy did not accurately measure the full extent of shortfalls, which almost doubled on average from 8 percent in October 2016 to 15 percent in September 2020. The Navy began tracking required positions in February 2021 and issued guidance accordingly in December 2021. The Navy also used funded positions, rather than requirements, to project its future personnel needs. Therefore, it was not accurately communicating to internal decision makers the number of personnel it will need as the fleet grows, which may have prevented it from effectively mitigating current crewing shortfalls. In 2022, the Navy calculated its future personnel needs using both funded positions and crew requirements. These projections show that the Navy needs 3,000 to 10,000 more personnel over the next 30 years when it uses the more accurate measure of crew requirements rather than funded positions.

We made eight recommendations to the Navy that, among other things, it revise its guidance and practices to measure sailor fatigue and address the factors causing fatigue, use required positions when reporting crew sizes and projecting personnel needs, and factor training time into sailor workload. DOD concurred with our recommendations and has implemented four of them. Four recommendations have not yet been implemented, including those to address the factors causing sailor fatigue and inadequate sleep and to establish a process for assisting units with fatigue management.

We have ongoing reviews examining Navy crewing processes and naval force generation, and plan to report on the results of that work in fall 2023 and 2024, respectively.[33]

[33]We have also reported on the extent to which the Navy has met its goals and identified measures of success for the Optimized Fleet Response Plan—its cyclical process for building readiness and preparing ships for deployment. See GAO, *Navy Readiness: Actions Needed to Improve Process for Preparing Ships to Deploy*, GAO-23-105294SU (Washington, D.C.: Nov. 1, 2022).

Ground Domain

Shortfalls in Army Rail Support and Insufficient Sealift Training Affects Readiness

Rail transportation is the primary means of moving ammunition, tracked vehicles, and other items needed by deploying units from their bases to ports of embarkation within the United States in support of contingencies and exercises. Army officials have stated that during contingencies, approximately 67 percent of Army unit equipment moves by rail from its fort or base of origin to a shipping port (see fig. 14). In 2003, for example, nearly 1 million tons of unit equipment moved by rail in support of Operation Iraqi Freedom. This is the rough equivalent of moving more than twice the total number of M1-series tanks in the Army's current inventory.[34]

Figure 14: DOD Personnel Moving Equipment on Non-Restricted Track

Source: Department of Defense. | GAO-23-106673

The resources required to effect such a movement are sizeable as well. A 2020 simulation of deployment from a single fort in support of a large-scale combat operation demonstrated the need for more than 2,200 rail

[34]According to the Army, the latest M1 Abrams tank variant, the M1A2 SEPv2, weighs 71.2 tons. Commercial sources report that there are about 6,300 tanks in the U.S. inventory.

cars over a 3-day period.[35] More than 600 of those cars were required to move a single Armored Brigade Combat Team. This Army study also noted that such a movement would require a sufficient number of qualified rail operating crews to operate the trains in addition to well-maintained rail track over which the trains would travel.[36]

In August 2021, we found that the Army has acknowledged that aspects of rail operations and force structure have evolved and the Army has made efforts to identify and address shortfalls.[37] However, the Army has not determined the number of rail operating crews needed to support large-scale combat operations. Without such a determination and a quantifying of the risk of any shortfalls for combat operations, the Army and DOD may not be certain that they can fully support a large-scale combat operation and cannot fully understand the risks associated with their current operating environment.

The Army has undertaken several efforts to manage the condition of its rail track, such as inspections to monitor track conditions and repairs. However, the Army has not addressed a number of rail track challenges because it has not fully implemented a quality assurance program in its rail guidance, or in its processes to provide timely information on the condition or repairing of track. As a result, as of 2021, 59 percent of the track on Army installations (over 550 miles) was rated as “red track,” or track that is closed to traffic due to defects. If the Army does not require a quality assurance program for overseeing the management of rail track, the Army will not have a comprehensive approach for its rail track and will not have coordinated oversight in managing efforts such as inspections, funding for repairs, and ensuring up-to-date rail track conditions. Moreover, DOD may be unaware of Army rail track conditions and will not be able to fully inform decision makers with timely information so they

[35]In the 2-year period 2017 through 2018, the Army reported an increased operational tempo that included more than 135 opportunities to practice deployment or redeployment tasks including brigade-size unit movements.

[36]Rail operating crews include personnel such as locomotive engineers, brake operators, and conductors. Rail track refers to a structure composed of rail, ties, and ballast that support the loads of railroad cars and locomotives and guides their movements. Department of the Army Pamphlet 420-1-3, *Transportation Infrastructure and Dams* (Apr. 9, 2009).

[37]GAO, *Defense Transportation: The Army Should Take Action to Better Ensure Adequate Rail Support to Combatant Commanders*, GAO-21-411 (Washington, D.C.: Aug. 23, 2021).

may address any gaps to help support the missions of combatant commanders.

We made three recommendations to the Army to determine the requirement for trained rail operating crews, quantify the risk of any shortfall of crews, and require and implement a quality assurance program to inform decision-making in providing oversight of rail track conditions. The department concurred with all three recommendations, but has not yet implemented any of them.

DOD has also not updated surge sealift training to prepare for contested environments. We reported in February 2021 that China and Russia are strengthening their militaries to neutralize U.S. strengths, including mobility—the ability of U.S. military airlift and air refueling aircraft and sealift ships to rapidly move equipment and personnel from the United States to locations abroad to support DOD missions.[38] The *Commission on the National Defense Strategy* reported that it has serious reservations about the ability of DOD's mobility forces to support the department's global operations, particularly in the event of a high-intensity conflict or multi-theater operations.[39]

DOD and its think tanks have conducted a number of contested mobility-related studies in recent years, and DOD has used the studies to inform planning and decision-making, according to DOD officials. However, DOD cannot account for the implementation, as appropriate, of all the studies' recommendations. DOD may be missing opportunities to leverage existing studies to further mitigate threats before they contest DOD mobility in an actual military contingency. For example, DOD has updated aspects of war-game exercises and mobility training to prepare for a contested environment, but has not updated training for the surge sealift fleet—ships owned by DOD and the Department of Transportation's Maritime Administration and crewed by contracted mariners. Figure 15 shows examples of Military Sealift Command and Maritime Administration Sealift Ships.

[38]GAO, *Defense Transportation: DOD Can Better Leverage Existing Contested Mobility Studies and Improve Training*, GAO-21-125 (Washington, D.C.: Feb. 26, 2021).

[39]Commission on the National Defense Strategy for the United States, *Providing for the Common Defense: The Assessment and Recommendations of the National Defense Strategy Commission*, November 14, 2018.

Figure 15: Examples of Military Sealift Command and Maritime Administration Sealift Ships and Their Roles

As an operation progresses, sealift delivers heavy military units and their support equipment, such as tanks, as well as vital sustainment for deployed forces. In most operations, sealift accounts for the majority of the total cargo delivered to an operational area.

Source: (1. & 6.) Military Sealift Command/Jennifer Hunt; (2.) U.S. Navy/Grady T. Fontana; (3.) U.S. Navy/Photographer's Mate First Class Arlo K. Abrahamson; (4.) U.S. Air Force/Airman First Class Kristen Heller; (5.) U.S. Navy/Petty Officer Second Class Nicholas Bauer. | GAO-23-106673

Sealift is the means by which the majority of military equipment would be transported during a major conflict and is critical to supporting the U.S. military's global operation. It's important that DOD appropriately train crews for contested mobility. However, the training requirements for the U.S. citizen mariners who are contracted to crew surge-sealift ships that might have to operate in contested environments have not been evaluated and updated as appropriate. The crews are primarily trained and qualified to operate the ship and receive limited contested mobility training. While DOD has updated air mobility training and other aspects of mobility training, sealift crew training requirements have not been updated by DOD and the Maritime Administration to reflect contested environment concerns because DOD has not conducted an evaluation of such training.

We recommended that DOD designate an oversight entity to track the implementation of study recommendations, and that DOD and the Maritime Administration evaluate and update sealift training. DOD and the Department of Transportation generally concurred with each recommendation and have implemented one. U.S. Transportation Command compiled the recommendations from prior contested mobility studies and evaluated each one. As a result, DOD has leveraged existing

knowledge on contested mobility to address challenges before they inhibit DOD's ability to conduct mobility during major conflicts.

We have several ongoing reviews examining issues in the ground domain. We plan to report on our work on Marine Corps U.S. Indo-Pacific Command posture in spring 2023; DOD logistics in the European theater in summer 2023; Army and Marine Corps multi-domain units in 2024; and Army force generation in 2024.

Actions Needed to Prevent Army and Marine Corps Tactical Vehicle Accidents

The Army and Marine Corps are placing more of an emphasis on rebuilding training readiness for a full spectrum of operations for great power competition. The Army and Marine Corps use tactical vehicles, such as tanks and trucks, to achieve a variety of missions across a broad range of terrain and environmental conditions. The Army and Marine Corps have experienced tactical vehicle accidents that resulted in service member deaths during non-combat scenarios, such as training events.[40] Tactical vehicle accidents can be caused by human, environmental, and mechanical factors. Accidents take many forms including vehicle-to-vehicle collisions, vehicle-to-pedestrian collisions, and vehicle rollovers, for example (see fig. 16).[41]

[40]DOD uses the term "mishaps" to refer to accidents that occur outside of engagement with an adversary. A mishap is an unplanned event or series of events that results in damage to DOD property; occupational illness to DOD personnel, injury or death to on- or off-duty DOD military personnel, injury or death to on-duty DOD civilian personnel, damage to public or private property, or injury or death or illness to non-DOD personnel, caused by DOD activities. In this testimony, we use the term "accident" to mean mishap. Department of Defense Instruction 6055.07, *Mishap Notification, Investigation, Reporting, and Record Keeping* (June 6, 2011) (incorporating change 1, Aug. 31, 2018).

[41]We defined a vehicle "rollover" as any accident that causes the tactical vehicle to come into contact with the ground on any of its surfaces outside of its wheels or tracks.

Figure 16: A Tactical Vehicle Rollover Accident

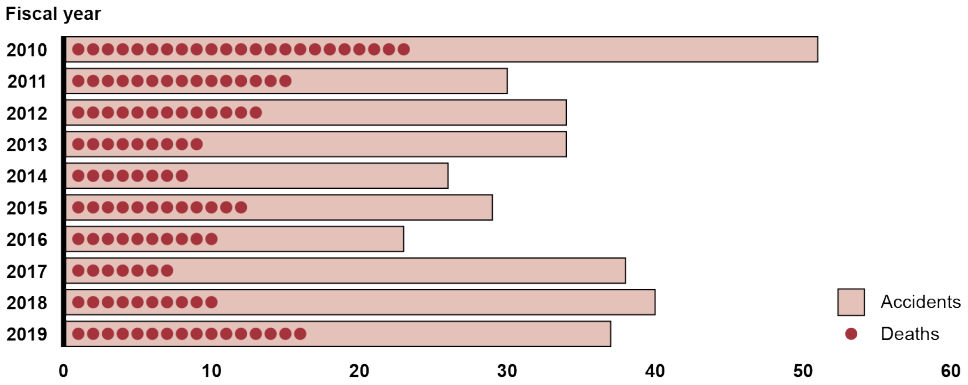
Source: U.S. Army/Defense Visual Information Distribution Service. | GAO-23-106673

In July 2021 we found that, from fiscal years 2010 through 2019, the Army and Marine Corps reported 3,753 tactical vehicle accidents from non-combat scenarios and 123 resulting military deaths, according to our analysis of Army and Marine Corps data.[42] Of the total, 342 were Class A and B accidents, which have the most serious injuries and financial costs (see fig. 17).[43] Driver inattentiveness, lapses in supervision, and lack of training were among the most common causes of these accidents, according to our analysis of Army and Marine Corps data.

[42]GAO, *Military Vehicles: Army and Marine Corps Should Take Additional Actions to Mitigate and Prevent Training Accidents*, GAO-21-361 (Washington, D.C.: July 7, 2021).

[43]DOD categorizes the severity of accidents by grouping them into classes. Class A accidents are the most serious and involve a death, permanent total disability, or, for the period of our analysis, damage greater than or equal to $2 million. Class B accidents result in a permanent partial disability, three or more personnel receiving inpatient hospital care, or, for the period of our analysis, $500,000 to under $2 million in damages. (DOD adjusted the cost thresholds for accident classes upward in October 2019, after the period of our analysis.) The Army had 289 Class A and B accidents in fiscal years 2010 through 2019, and the Marine Corps had 53 over the same time frame. The disparity in number of accidents between the two military services is likely due in part to the Army having 2.5 times as many active duty personnel as the Marine Corps.

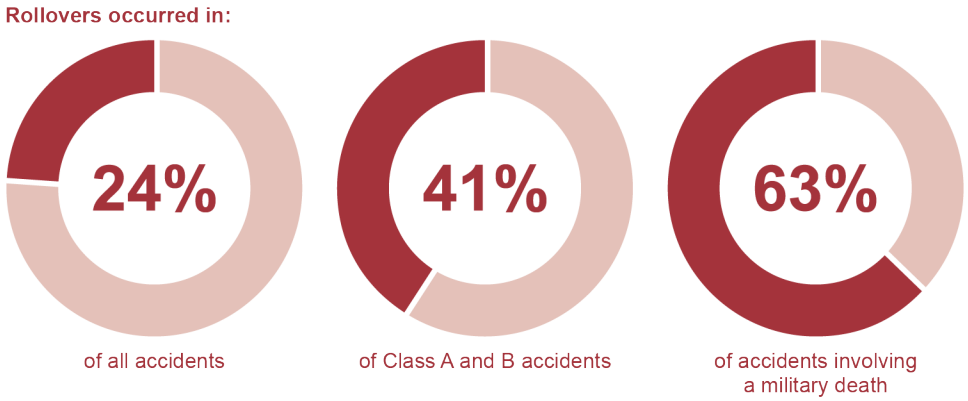
Figure 17: Number of Army and Marine Corps Class A and B Tactical Vehicle Accidents and Resulting Military Deaths, Fiscal Years 2010 through 2019



Source: GAO analysis of Department of Defense (DOD) data. | GAO-23-106673

Rollovers were associated with almost a quarter of all reported tactical vehicle accidents during fiscal years 2010 through 2019, but they were present in more than 40 percent of Class A and B accidents and 63 percent of accidents involving a military death, according to our analysis (see fig. 18).

Figure 18: Percentage of Army and Marine Corps Tactical Vehicle Accidents Involving Rollovers, Fiscal Years 2010 through 2019



Source: GAO analysis of Department of Defense data. | GAO-23-106673

Accessible Data for Figure 18: Percentage of Army and Marine Corps Tactical Vehicle Accidents Involving Rollovers, Fiscal Years 2010 through 2019

Rollovers occurred in:

- Twenty-four percent of all accidents
- Forty-one percent of class A and B accidents

- Sixty-three percent of accidents involving a military death

The number of accidents reported involving rollovers generally decreased over this time period, from 131 in fiscal year 2010 to 64 in fiscal year 2019. The number of Class A and B accidents involving rollovers fluctuated during these 10 years, though rollovers generally decreased as a percentage of all Class A and B accidents.

From fiscal years 2010 through 2019, 123 soldiers and marines lost their lives in accidents that were caused in most cases by operator and supervisory errors according to the data. Tactical vehicle accident prevention is a multifaceted effort that requires effective risk management practices, driver training programs, and methods to identify and communicate potential hazards on training ranges. A breakdown in planning, oversight, or implementation can lead to injuries to service members, including deaths, and damage to expensive vehicles.

For example, the Army and Marine Corps established practices to mitigate and prevent tactical vehicle accidents, but units did not consistently implement these practices. We found that issues affecting vehicle commanders and unit safety officers hindered Army and Marine Corps efforts to implement risk management practices. For example, the Army and Marine Corps had not clearly defined the roles or put procedures and mechanisms in place for first-line supervisors, such as vehicle commanders, to effectively perform their role. As a result, implementation of risk management practices, such as following speed limits and using seat belts, was ad hoc among units.

We made nine recommendations to DOD, including that the Army and Marine Corps more clearly define roles and establish procedures and mechanisms to help supervisors enhance tactical vehicle safety, and develop performance criteria and measurable standards for driver training programs. The department concurred with our recommendations; however, they have not yet been implemented.

We have ongoing work examining Special Operations Forces training accidents with plans to report on the results of that work in spring 2024.[44]

[44]We reported in March 2023 on National Guard helicopters accidents and the actions needed to improve safety, making 8 recommendations to the Army and Air Force. GAO, *National Guard Helicopters: Additional Actions Needed to Prevent Accidents and Improve Safety*, GAO-23-105219 (Washington, D.C.: Mar. 14, 2023).

Space Domain

Space Readiness Goals and Threat Standards Are Unclear

We found in April 2021 that the military services reported a variety of challenges regarding the space domain. These included (1) readiness reporting not being required of all space units resulting in DOD not tracking the readiness of units conducting unique space missions, (2) DOD not having clear readiness goals for space units, and (3) unit-level readiness reporting not accurately conveying the readiness of key space capabilities.[45]

We recommended in November 2021 that DOD incorporate space control—operations that ensure freedom of action in space for the United States and its allies and deny an adversary's freedom of action in space—into rebuilding readiness plans and identify milestones and metrics to assess progress toward addressing identified readiness issues. We also recommended that DOD establish uniform threat standards that units will use when assessing their readiness to conduct their mission in a contested space environment.[46]

We also recommended that DOD set specific measurable objectives and milestones for implementing DOD's space control goals over the next decade, as laid out in the *Defense Space Strategy.* DOD partially concurred, stating that it did not need a separate implementation plan and will rely on existing processes. However, we found that the strategy does not establish specific measures and milestones to assess progress to meeting its identified objectives. Further, while DOD stated that they intend to use the budget process to oversee implementation of the strategy, we previously found significant limitations to relying on the budget process for complex force structure decisions. The department's lack of specific measurable objectives or milestones could significantly impede its ability to understand if its efforts and investments are sufficient and timely.

[45]GAO, *Military Readiness: Department of Defense Domain Readiness Varied from Fiscal Years 2017 through 2019,* GAO-21-279 (Washington, D.C.: Apr. 7, 2021).

[46]The Department of Defense concurred with our recommendations, but as of April 2023 had not taken any actions. See, GAO, *Space Operations: DOD Efforts to Improve Space Control Shortfalls Underway but Longstanding Challenges Persist*, GAO-22-530C (Washington, D.C.: Nov. 8, 2021).

We have a range of ongoing reviews examining readiness and sustainment issues in the space domain. We plan to report on our work examining the integration and sharing of information at the National Space Defense Center in spring 2023; Satellite Control Network demands, sustainment challenges, and acquisition efforts in spring 2023; and efforts to address DOD space readiness challenges in 2024.

Looking to the future, DOD will need to continue to balance rebuilding the readiness of its existing force with its desire to modernize. We have examined this tension in specific capability areas. In December 2022, we reported on DOD's tactical aircraft investment plans, finding that the lack of a portfolio review of tactical aircraft platforms across the services leaves DOD and Congress with limited insight into interdependencies, risks, and related trade-offs among some of DOD's highest priority and most expensive investments.[47] Considering the significant cost of sustaining weapon systems, competing priorities within the military services, and quickly evolving threats, it is prudent that DOD and Congress both have the information they need to make well-informed investment decisions going forward. As DOD develops and deploys new weapons systems and considers new approaches for how its units organize and operate, it will depend on much of today's capabilities for decades to come. As a result, DOD will need continued focus on rebuilding the readiness of its existing forces.

Chair Hirono, Ranking Member Sullivan, and Members of the Subcommittee, this completes my prepared statement. I would be pleased to respond to any questions that you may have at this time.

GAO Contact and Staff Acknowledgments

If you or your staff have any questions about this testimony, please contact Diana Maurer, Director, Defense Capabilities and Management, at (202) 512-9627 or maurerd@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement. GAO staff who made key contributions to this testimony are Chris Watson (Assistant Director), Nicole Volchko (Analyst-in-Charge), Ava Bagley, Emily Biskup, John Bumgarner, Nicole Harris, Amie

[47]GAO, *Tactical Aircraft Investments: DOD Needs Additional Portfolio Analysis to Inform Future Budget Decisions*, GAO-23-106375 (Washington, D.C.: Dec. 20, 2022).

Lesser, Tobin McMurdie, Janine Prybyla, Michael Shaughnessy, Michael Silver, Matthew Thompson, and Emily Wilson.

Related GAO Products

Report numbers with a C or RC suffix are classified. Report numbers with a SU suffix are sensitive but unclassified. Classified and sensitive but unclassified reports are available upon request to personnel with the proper clearances and the need to know.

Navy Ship Fires: Ongoing Efforts to Improve Safety Should Be Enhanced. GAO-23-105481. Washington, D.C.: April 20, 2023.

Weapon System Sustainment: The Army and Air Force Conducted Reviews and the Army Identified Operating and Support Cost Growth. GAO-23-106341. Washington, D.C.: March 30, 2023.

Tactical Aircraft: Technical, Delivery, and Affordability Challenges Complicate DOD's Ability to Upgrade Its Aging Fleet. GAO-23-106694. Washington, D.C.: March 29, 2023.

National Guard Helicopters: Additional Actions Needed to Prevent Accidents and Improve Safety. GAO-23-105219. Washington, D.C.: March 14, 2023.

Weapon System Sustainment: Navy Ship Usage Has Decreased as Challenges and Costs Have Increased. GAO-23-106440. Washington, D.C.: January 31, 2023.

Tactical Aircraft Investments: DOD Needs Additional Portfolio Analysis to Inform Future Budget Decisions. GAO-23-106375. Washington, D.C.: December 20, 2022.

Military Readiness: Actions Needed to Further Implement Predictive Maintenance on Weapon Systems. GAO-23-105556. Washington, D.C.: December 8, 2022.

Weapon System Sustainment: Aircraft Mission Capable Goals Were Generally Not Met and Sustainment Costs Varied by Aircraft. GAO-23-106217. Washington, D.C.: November 10, 2022.

Navy Readiness: Actions Needed to Improve Process for Preparing Ships to Deploy. GAO-23-105294SU. Washington, D.C.: November 1, 2022.

National Security Snapshot: U.S. Support for the War in Ukraine. GAO-22-106079. Washington, D.C.: September 8, 2022.

F-35 Aircraft: DOD Should Assess and Update Its Engine Sustainment Strategy to Support Desired Outcomes. GAO-22-104678. Washington, D.C.: July 19, 2022.

Air Force and Navy Aviation: Actions Needed to Address Persistent Sustainment Risks. GAO-22-104533. Washington, D.C.: June 15, 2022.

Military Readiness: DOD Domain Readiness from Fiscal Year 2017 through Fiscal Year 2021. GAO-22-105279C. Washington, D.C.: May 18, 2022.

Naval Shipyards: Ongoing Challenges Could Jeopardize Navy's Ability to Improve Shipyards. GAO-22-105993. Washington, D.C.: May 10, 2022.

Military Depots: DOD Strategy for Addressing Deteriorating Facilities and Equipment Is Incomplete. GAO-22-105009. Washington, D.C.: May 9, 2022.

Navy Ships: Applying Leading Practices and Transparent Reporting Could Help Reduce Risks Posed by Nearly $1.8 Billion Maintenance Backlog, GAO-22-105032. Washington, D.C.: May 9, 2022.

F-35 Sustainment: DOD Faces Several Uncertainties and Has Not Met Key Objectives. GAO-22-105995. Washington, D.C.: April 28, 2022.

Littoral Combat Ship: Actions Needed to Address Significant Operational Challenges and Implement Planned Sustainment Approach. GAO-22-105387. Washington, D.C.: February 24, 2022.

Combat Helicopters: Actions Needed to Fully Review Readiness Goals and Address Long-Standing Maintenance Challenges. GAO-22-104607SU. Washington, D.C.: February 15, 2022.

Navy Ship Maintenance: Actions Needed to Monitor and Address the Performance of Intermediate Maintenance Periods. GAO-22-104510. Washington, D.C.: February 8, 2022.

Space Operations: DOD Efforts to Improve Space Control Shortfalls Underway but Longstanding Challenges Persist. GAO-22-530C. Washington, D.C.: November 8, 2021.

Defense Transportation: The Army Should Take Action to Better Ensure Adequate Rail Support to Combatant Commanders. GAO-21-411. Washington, D.C.: August 23, 2021.

F-35 Sustainment: DOD Needs to Cut Billions in Estimated Costs to Achieve Affordability. GAO-21-439. Washington, D.C.: July 7, 2021.

Military Vehicles: Army and Marine Corps Should Take Additional Actions to Mitigate and Prevent Training Accidents. GAO-21-361. Washington, D.C.: July 7, 2021.

Navy Readiness: Additional Efforts Are Needed to Manage Fatigue, Reduce Crewing Shortfalls, and Implement Training. GAO-21-366. Washington, D.C.: May 27, 2021.

Defense Logistics: Army Should Ensure New System Operates in All Situations and Soldiers Complete Training. GAO-21-313. Washington, D.C.: April 12, 2021.

Military Readiness: Department of Defense Domain Readiness Varied from Fiscal Year 2017 through Fiscal Year 2019. GAO-21-279. Washington, D.C.: April 7, 2021.

Defense Transportation: DOD Can Better Leverage Existing Contested Mobility Studies and Improve Training. GAO-21-125. Washington, D.C.: February 26, 2021.

Navy and Marine Corps: Services Continue Efforts to Rebuild Readiness, but Recovery Will Take Years and Sustained Management Attention. GAO-21-225T. Washington, D.C.: December 2, 2020.

Navy Maintenance: Navy Report Did Not Fully Address Causes of Delays or Results-Oriented Elements. GAO-21-66. Washington, D.C.: October 29, 2020.

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

Weapon System Sustainment: DOD Needs a Strategy for Re-Designing the F-35's Central Logistics System. GAO-20-316. Washington, D.C.: March 6, 2020.

Military Readiness: Update on DOD's Readiness Recovery and Domain Readiness Assessment. GAO-19-390RC. Washington, D.C.: May 6, 2019.

F-35 Aircraft Sustainment: DOD Needs to Address Substantial Supply Chain Challenges. GAO-19-321. Washington, D.C.: April 25, 2019.

Defense Strategy: Revised Analytic Approach Needed to Support Force Structure Decision-Making. GAO-19-385. Washington, D.C.: March 14, 2019.

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

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

F-35 Sustainment: DOD Needs a Plan to Address Risks Related to Its Central Logistics System. GAO-16-439. Washington, D.C.: April 14, 2016.

F-35 Sustainment: Need for Affordable Strategy, Greater Attention to Risks, and Improved Cost Estimates. GAO-14-778. Washington, D.C.: September 23, 2014.

GAO's Mission

The Government Accountability Office, the audit, evaluation, and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents at no cost is through our website. Each weekday afternoon, GAO posts on its website newly released reports, testimony, and correspondence. You can also subscribe to GAO's email updates to receive notification of newly posted products.

Order by Phone

The price of each GAO publication reflects GAO's actual cost of production and distribution and depends on the number of pages in the publication and whether the publication is printed in color or black and white. Pricing and ordering information is posted on GAO's website, https://www.gao.gov/ordering.htm.

Place orders by calling (202) 512-6000, toll free (866) 801-7077, or TDD (202) 512-2537.

Orders may be paid for using American Express, Discover Card, MasterCard, Visa, check, or money order. Call for additional information.

Connect with GAO

Connect with GAO on Facebook, Flickr, Twitter, and YouTube.
Subscribe to our RSS Feeds or Email Updates. Listen to our Podcasts.
Visit GAO on the web at https://www.gao.gov.

To Report Fraud, Waste, and Abuse in Federal Programs

Contact FraudNet:

Website: https://www.gao.gov/about/what-gao-does/fraudnet

Automated answering system: (800) 424-5454 or (202) 512-7700

Congressional Relations

A. Nicole Clowers, Managing Director, ClowersA@gao.gov, (202) 512-4400, U.S. Government Accountability Office, 441 G Street NW, Room 7125, Washington, DC 20548

Public Affairs

Chuck Young, Managing Director, youngc1@gao.gov, (202) 512-4800
U.S. Government Accountability Office, 441 G Street NW, Room 7149
Washington, DC 20548

Strategic Planning and External Liaison

Stephen J. Sanford, Managing Director, spel@gao.gov, (202) 512-4707
U.S. Government Accountability Office, 441 G Street NW, Room 7814,
Washington, DC 20548