

F-35 Sustainment: Costs Continue to Rise While Planned Use and Availability Have Decreased

GAO-24-106703 (Accessible Version)
Q&A Report to Congressional Committees

April 15, 2024

Why This Matters

The F-35 Lightning II aircraft (F-35) is the Department of Defense's (DOD) most ambitious and costly weapon system and its most advanced fighter aircraft. DOD operates and sustains about 630 F-35 aircraft and plans to procure about 2,500 total by the mid-2040s. The F-35 program includes three variants: F-35A, used by the Air Force; F-35B, used by the Marine Corps; and F-35C, used by the Marine Corps and the Navy (see fig. 1). DOD plans to use the F-35 aircraft through 2088 and plans to spend over \$2 trillion on acquisition and sustainment.

Figure 1: F-35 Aircraft



Source: U.S. Air Force/Senior Airman Zachary Rufus (photo). | GAO-24-106703

The National Defense Authorization Act for Fiscal Year 2022 includes a provision for us to conduct an annual review of F-35 sustainment efforts, including DOD's ability to reduce sustainment costs or otherwise maintain the affordability of the F-35 fleet. (Pub. L. No 117-81, § 357 (2021)) This report provides information on the F-35's sustainment cost estimates over the life of the program, actions taken by the F-35 Joint Program Office to reduce sustainment costs, and the extent to which the F-35 fleet has met performance goals.

Key Takeaways

- DOD's projected costs for sustaining the F-35 fleet through 2088 continue to increase. Specifically, sustainment cost estimates have increased 44 percent, from about \$1.1 trillion in 2018 to about \$1.58 trillion in 2023. One reason for the increase in cost estimates is the extension of the service life of the aircraft.
- The Air Force, Navy, and Marine Corps project they will fly the F-35 aircraft less than originally estimated on an annual basis. In part because of this reduction in flight hours, the services are now projecting they will meet most

of their affordability targets (i.e., the amount of money they project they can afford to spend per aircraft per year for operating the aircraft).

- DOD currently estimates the Air Force will pay \$6.6 million annually to operate and sustain each individual aircraft. This continues to be well above the \$4.1 million original target. In 2023, the Air Force increased the amount of money it can afford to spend per F-35 aircraft to \$6.8 million per year.
- DOD has pursued cost savings efforts and continues to look for new ways to reduce costs. However, DOD officials generally agree that these efforts are not likely to fundamentally change the estimated costs to operate the aircraft.
- The F-35 fleet's overall availability has trended downward considerably over the past 5 years, and none of the variants are meeting availability goals (i.e., the percentage of time the aircraft can perform one of its tasked missions).
- Since 2014, we have made 43 recommendations to improve the department's operation and sustainment of the F-35 program. While DOD concurred with many of these recommendations and has implemented some of them, 30 (about 70 percent) remain unimplemented.

How does DOD manage the F-35 program?

The F-35 program is managed as a joint, multinational program. Program participants include the Air Force, Navy, Marine Corps, seven international partners, and multiple foreign military sales customers.¹ Several offices and organizations in DOD are involved in managing the F-35 program.

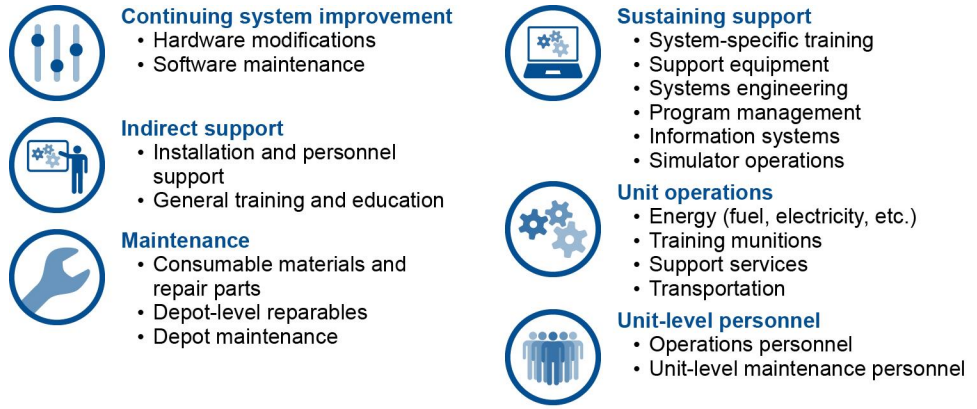
- The Office of the Under Secretary of Defense (Acquisition and Sustainment) oversees the entire F-35 program.
- The F-35 Joint Program Office manages and oversees the support functions required to field and maintain the readiness and operational capability of the F-35 aircraft across the enterprise.
- The Air Force, Navy, and Marine Corps have each established an F-35 integration office or similar construct focused on how the services will operate and afford the F-35 fleet, among other things.
- Lockheed Martin, the prime contractor for the aircraft, manages the heavy maintenance of the aircraft (i.e., the air vehicle) and conducts the work primarily under annual contracts.
- Pratt & Whitney, the contractor that designs and builds the engines, manages the maintenance of the engines.

As part of its program management activities, the F-35 Joint Program Office produces an annual cost estimate that projects program costs throughout the program's lifetime. In addition, DOD's Cost Assessment and Program Evaluation Office periodically conducts an independent cost estimate and completed one most recently in March 2024 to support the full-rate production decision.²

What are the main costs associated with the F-35 program?

DOD estimates the F-35 program will cost over \$2 trillion to buy, operate, and sustain over its lifetime. Acquisition costs—largely made up of development and procurement costs—comprise about \$442 billion, while operating and support costs, also referred to as sustainment costs, comprise the other \$1.58 trillion. As shown in figure 2, sustainment includes costs for operations and maintenance personnel, maintenance to repair the aircraft and its parts, and system modifications, among others.

Figure 2: F-35 Sustainment Cost Elements



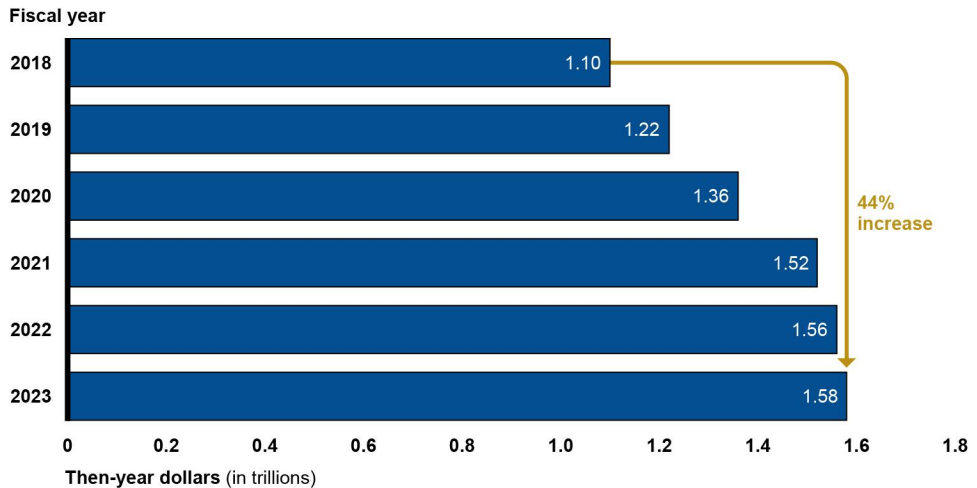
Source: GAO analysis of Department of Defense information; GAO (icons). | GAO-24-106703

Annual costs are growing as the size of the F-35 fleet increases. In 2018, DOD spent about \$2.2 billion on sustainment costs for 220 aircraft. DOD sustainment costs grew to about \$4.7 billion in 2022—the most recent year DOD could provide annual costs—for 520 aircraft. For additional information about F-35 sustainment costs from fiscal years 2018 through 2022, see appendix I.

How have the F-35 Joint Program Office’s estimated lifetime sustainment costs for the F-35 program changed over time?

DOD’s estimated F-35 program lifetime sustainment costs—costs that occur throughout the life of the system—have increased by 44 percent since 2018, as shown in figure 3.

Figure 3: Growth in the F-35 Joint Program Office’s F-35 Lifetime Sustainment Cost Estimates, Fiscal Years 2018 – 2023



Source: GAO analysis of Department of Defense data. | GAO-24-106703

Accessible Data for Figure 3: Growth in the F-35 Joint Program Office’s F-35 Lifetime Sustainment Cost Estimates, Fiscal Years 2018 – 2023

Fiscal year	Then-year dollars (in trillions)
2018	1.10
2019	1.22
2020	1.36
2021	1.52
2022	1.56
2023	1.58

Note: Then-year dollars account for costs in the years they are spent, including the effects of inflation. Prior to 2022, the F-35 Joint Program Office produced two cost estimates per year. In this figure, we have included the second cost estimate only, as that represents the most updated estimate for that year.

One key input that the F-35 Joint Program Office uses to estimate lifetime sustainment costs is the planned life of the aircraft. However, DOD continues to adjust how long it plans to use the F-35 aircraft. For example, in fiscal year 2018, the services were planning to utilize the F-35 aircraft through 2077, while in fiscal year 2023 the services were planning to use the system through 2088.

In addition, according to F-35 Joint Program Office officials, other key factors in determining future costs for the program are the number of planned aircraft procurements, where and when new aircraft will enter the services' fleets, the planned retirement dates of aircraft, and inflation cost factors. Program officials stated that each year the military services provide the information on the planned number, use, and location of aircraft to the F-35 Joint Program Office. Additionally, the prime contractors, Lockheed Martin and Pratt & Whitney, provide information about contract-related costs. Officials stated that they determine future program costs after adjusting for inflation and other future price increases. The result is a point cost estimate. Based on our analysis of the F-35 Joint Program Office's cost estimate, the program does not generally consider risk and uncertainty in its sustainment estimate for the program.

According to F-35 Joint Program Office officials, the Annual Cost Estimate for sustainment only considers approved modernization and upgrades to the aircraft that are part of the program of record. Specifically, the 2023 cost estimate included the Block 4 and F-35 engine modernization efforts. The Block 4 \$16.5 billion modernization effort is aimed at upgrading the F-35 aircraft's hardware and software systems.³ DOD intends for Block 4 to help the aircraft address new threats that have emerged since DOD established the aircraft's original requirements in 2000. The engine modernization effort aims to upgrade the engine and thermal management system to reduce sustainment costs, improve engine life, and enable future F-35 capabilities.

Does the F-35 Joint Program Office project that it will meet military service affordability targets for F-35 sustainment?

The F-35 program is projected to meet affordability targets for the Air Force, Navy, and the Marine Corps' F-35B, but not for the Marine Corps' F-35C, according to the F-35 Joint Program Office's 2023 cost estimate. Each service has set a target for the amount of money it projects it can afford per aircraft per year for the F-35 when its fleet is at steady state (roughly the mid-2030s for each of the services).⁴ Specifically, based on the current targets and program cost estimates at steady state:

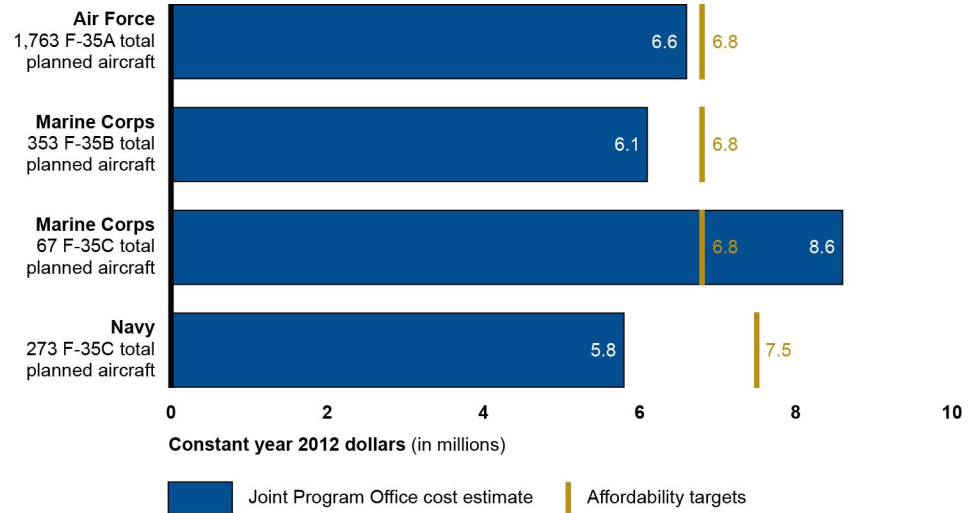
- the Air Force is projected to spend \$0.2 million less per F-35A per year than its target,
- the Marine Corps is projected to spend \$0.7 million less per F-35B per year than its target, and \$1.8 million more per F-35C per year than its target, and
- the Navy is projected to spend \$1.7 million less per F-35C per year than its target.

However, given that the F-35 Program Office's annual cost estimate is informed by updated assumptions from the military services, the degree to which the affordability targets are projected to be met can vary. Key assumptions updated annually include the latest approved planned life of the aircraft, where and when new aircraft will enter the services' fleets, annual flight hour projections, and the

planned retirement dates of aircraft. Each of these can alter the projected costs of operating and sustaining the F-35 fleet.

Figure 4 shows the differences between the services' affordability targets and the 2023 annual sustainment cost estimate at steady state.

Figure 4: Differences between Service F-35 Affordability Targets and 2023 Cost Estimates for Annual Sustainment Costs per Aircraft, at Program Steady State



Source: GAO analysis of Department of Defense and Lockheed Martin information. | GAO-24-106703

Accessible Data for Figure 4: Differences between Service F-35 Affordability Targets and 2023 Cost Estimates for Annual Sustainment Costs per Aircraft, at Program Steady State

	Joint Program Office cost estimate (Constant year 2012 dollars (in millions))	Affordability targets (Constant year 2012 dollars (in millions))
Air Force 1,763 F-35A total planned aircraft	6.6	6.8
Marine Corps 353 F-35B total planned aircraft	6.1	6.8
Marine Corps 67 F-35C total planned aircraft	8.6	6.8
Navy 273 F-35C total planned aircraft	5.8	7.5

Source: GAO analysis of Department of Defense and Lockheed Martin information. | GAO-24-106703

Note: According to program officials, the steady state period for each service is the period in which it intends to be operating the F-35 at its maximum capability, roughly the mid-2030s for each variant.

What factors have contributed to the military services' progress toward meeting their affordability targets?

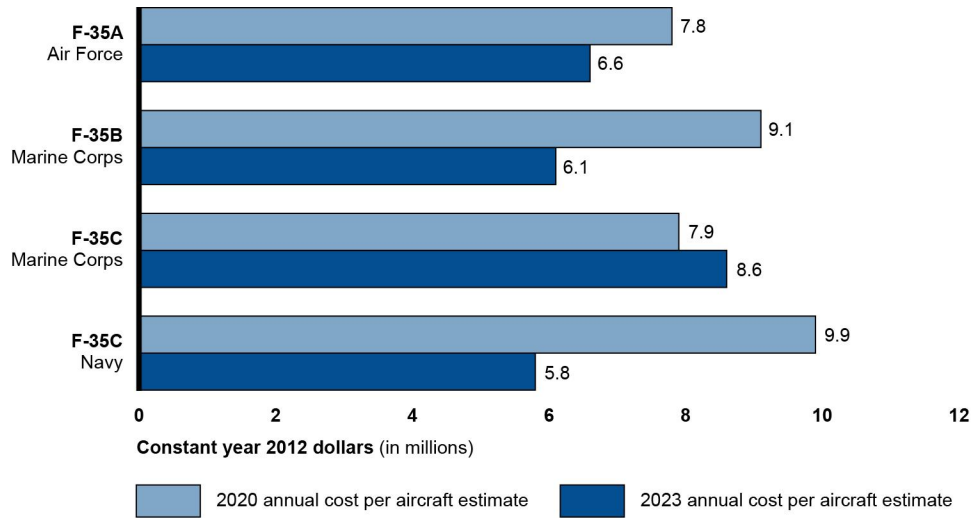
The military services have made progress meeting their affordability targets largely because of two factors: (1) reducing the amount of time the services estimate they will fly the aircraft each year and (2) increasing the Air Force's affordability target.

Progress Made by the F-35 Joint Program Office in Reducing Cost Estimates

In 2021, we reported that the cost per aircraft per year at steady state in the 2020 Annual Cost Estimate would be \$7.8 million for the F-35A, \$9.1 million for the F-35B, \$7.9 million for the Marine Corps F-35C, and \$9.9 million for the Navy F-35C in constant year 2012 dollars.⁵ However, the 2023 F-35 Joint Program Office cost estimate projects costs per aircraft to be less, except for the Marine Corps

F-35C. Figure 5 shows the change in the estimated annual cost per aircraft per year from 2020 to 2023.

Figure 5: Change in the Cost per Aircraft per Year Estimate, 2020 – 2023



Source: GAO analysis of Department of Defense and Lockheed Martin information. | GAO-24-106703

Accessible Data for Figure 5: Change in the Cost per Aircraft per Year Estimate, 2020 – 2023

	2020 annual cost per aircraft estimate (Constant year 2012 dollars (in millions))	2023 annual cost per aircraft estimate (Constant year 2012 dollars (in millions))
F-35A Air Force	7.8	6.6
F-35B Marine Corps	9.1	6.1
F-35C Marine Corps	7.9	8.6
F-35C Navy	9.9	5.8

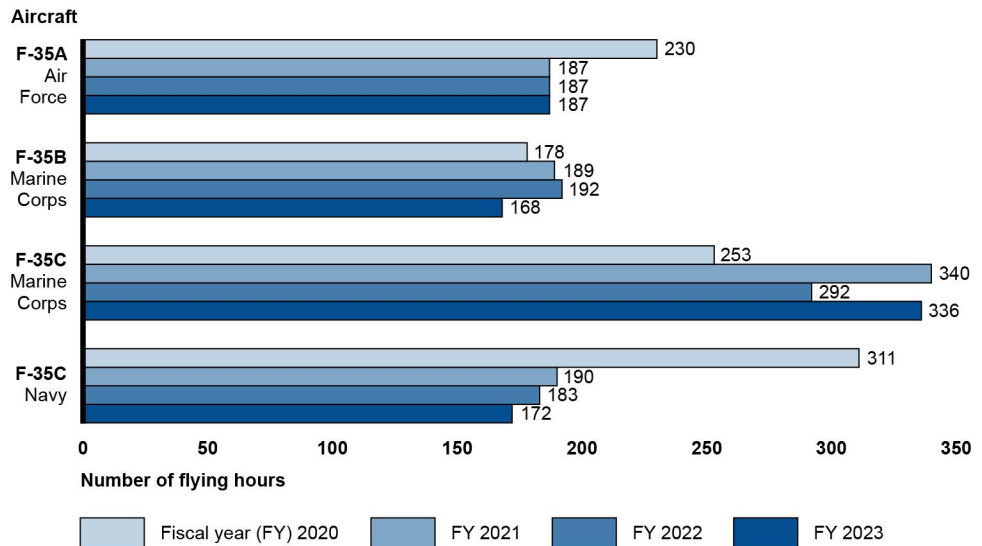
Source: GAO analysis of Department of Defense and Lockheed Martin information. | GAO-24-106703

Reduced Number of Flying Hours

The military services have lowered the number of hours each aircraft is estimated to fly, which has contributed to reduced cost estimates and the services' ability to meet their affordability targets. In the 2020 Annual Cost Estimate, the F-35 Joint Program Office reported that the F-35 fleet would fly 382,376 hours per year at steady state—roughly the mid-2030s. In the 2023 Annual Cost Estimate, the F-35 Joint Program Office reported revised estimated steady state flight hours of 300,524—a reduction of almost 82,000 flight hours per year, or 21 percent. F-35 Joint Program Office and military service officials told us that this reduction in planned flight hours reflects lower than anticipated use up to this point and evolving projections about future use of the aircraft.

The F-35 Joint Program Office's estimated flight hours are based on the services' individual estimates, which have mostly decreased and resulted in a reduction of total flight hours for the program. For example, in the 2020 Annual Cost Estimate, the Air Force estimated that it would fly each F-35A 230 hours per year at steady state. In the 2023 Annual Cost Estimate, the Air Force estimated that it would fly each F-35A 187 hours per year at steady state. On the other hand, the Marine Corps increased the number of hours the F-35C will fly from 253 hours per year at steady state in the 2020 Annual Cost Estimate to 336 hours per year at steady state in the 2023 Annual Cost Estimate. Figure 6 shows the changes in estimated flight hours for each variant.

Figure 6: Changes in Estimated Flight Hours per F-35 Variant, Fiscal Years 2020 – 2023



Source: GAO analysis of Department of Defense data. | GAO-24-106703

Accessible Data for Figure 6: Changes in Estimated Flight Hours per F-35 Variant, Fiscal Years 2020 – 2023

	FY 2020 (Number of flying hours)	FY 2021 (Number of flying hours)	FY 2022 (Number of flying hours)	FY 2023 (Number of flying hours)
F-35A Air Force	230	187	187	187
F-35B Marine Corps	178	189	192	168
F-35C Marine Corps	253	340	292	336
F-35C Navy	311	190	183	172

Source: GAO analysis of Department of Defense data. | GAO-24-106703

Increased Affordability Targets

In June 2023, the Air Force increased its affordability target from \$4.1 million per aircraft per year to \$6.8 million per aircraft per year. Although we previously reported that the Air Force would have to cut costs to achieve affordability, the Air Force instead increased its target.⁶ As of 2023, the Air Force projects it will spend \$6.6 million per aircraft per year at steady state—just under its \$6.8 million target but above the previous target of \$4.1 million.⁷

The Marine Corps and Navy have not updated their affordability targets since 2018 but are required by law to do so by October 1, 2025.⁸

What efforts is DOD making to reduce F-35 sustainment costs?

DOD has had several cost savings efforts over the past 10 years and continues to look for new ways to reduce costs. For example:

- In September 2014, we reported that DOD had begun some cost-savings efforts, such as establishing a Cost War Room in 2013.⁹ The Cost War Room was a collaboration between DOD and the contractors looking for cost reductions.
- In July 2021, we reported that the F-35 Joint Program Office restructured and created a Directorate of Affordability to increase attention on reducing total ownership costs of the F-35 fleet.¹⁰ According to program officials, this effort was intended to help achieve the services' respective affordability constraints.

The F-35 Joint Program Office continues to pursue cost savings initiatives. For example, in 2023, the F-35 Joint Program Office started a new initiative called the War on Cost, with the goal of delivering an affordable F-35 aircraft. The F-35 Joint Program Office is pursuing numerous cost-saving actions, including efforts to:

1. improve the reliability and maintainability of components on the aircraft, in part to reduce or avoid costs;
2. reduce the incidents of foreign object debris entering the aircraft engine and damaging it; and
3. improve engine reliability and availability to increase the time an engine can remain in an aircraft so that overall cost of engine sustainment can be decreased.

The Joint Program Office estimates that these initiatives have reduced sustainment costs by about \$84 billion over the lifetime of the program.

However, DOD officials stated that these efforts will not fundamentally change the estimated lifetime sustainment costs. These DOD officials told us that significant F-35 program cost reductions will only come from flying the aircraft less or reducing the number of aircraft in the fleet. Furthermore, in January 2020, we found that a weapon system's reliability directly affects how much DOD must spend to operate and support it over its lifetime. Specifically, according to leading reliability engineers, the earlier a change is made to a design, the less costly it will be to the program. As we reported, however, the F-35 program deferred key reliability engineering activities intended to improve system designs until later in development, missing opportunities that could have reduced sustainment-related costs.¹¹ Similarly, in 2021, we reported that DOD's ongoing efforts to reduce costs had not mitigated rising F-35 sustainment cost estimates.¹²

Of the various cost saving efforts, we found that DOD's ongoing action to upgrade the engine is likely to save the most money for the program. The current F-35 propulsion system does not have enough power or cooling capabilities to support both current and future capabilities. Because of this current deficiency, the engine needs to be overhauled more often than originally anticipated. By upgrading the engine, the F-35 Joint Program Office estimates that it can save about \$25.6 billion in sustainment costs over the life of the aircraft. However, in May 2023 we reported that the F-35 Joint Program had not fully defined the power and cooling requirements the engine and related components will need to support capabilities beyond those planned through 2035. Furthermore, the F-35 Joint Program Office has not fully assessed the costs and some of the technical risks of the different engine and thermal management system upgrade options. We noted that DOD risks underestimating the total cost for implementing this modernization effort, including some sustainment costs. We made recommendations to address these issues, including capturing and reporting all lifetime costs for the engine and thermal management system upgrade.¹³ DOD concurred and is in the process of taking actions to implement these recommendations.

What are DOD's plans for managing the sustainment of the F-35 fleet, and how could they affect sustainment costs?

DOD has explored a few options to manage F-35 sustainment more efficiently; however, it is unclear how any potential changes would affect sustainment costs. In September 2023, we reported that DOD relies heavily on Lockheed Martin to lead and manage F-35 sustainment.¹⁴ DOD is seeking expanded government control over the program to reduce program costs and improve program performance. The sustaining support cost element, which captures most

sustainment costs associated with the contractor, is a large portion of F-35 sustainment costs. For example, sustaining support accounted for approximately one-third of total sustainment costs, on average, during each year from 2018 to 2021.¹⁵

However, DOD has neither (1) determined the desired mix of government and contractor roles over key aspects of sustainment, nor (2) identified and obtained the technical data needed to support its desired mix. In September 2023, we recommended that DOD reassess F-35 sustainment elements to determine government and contractor responsibility, identify any required technical data, and make final decisions on changes to F-35 sustainment to address performance and affordability. DOD officials told us they are currently working to do this as part of its efforts to transfer all functions relating to the management, planning, and execution of sustainment activities for the F-35 fleet from the F-35 Joint Program Office to the Secretary of the Air Force and the Secretary of the Navy. Section 142 of the National Defense Authorization Act for Fiscal Year 2022 requires this transfer to occur by October 1, 2027.¹⁶

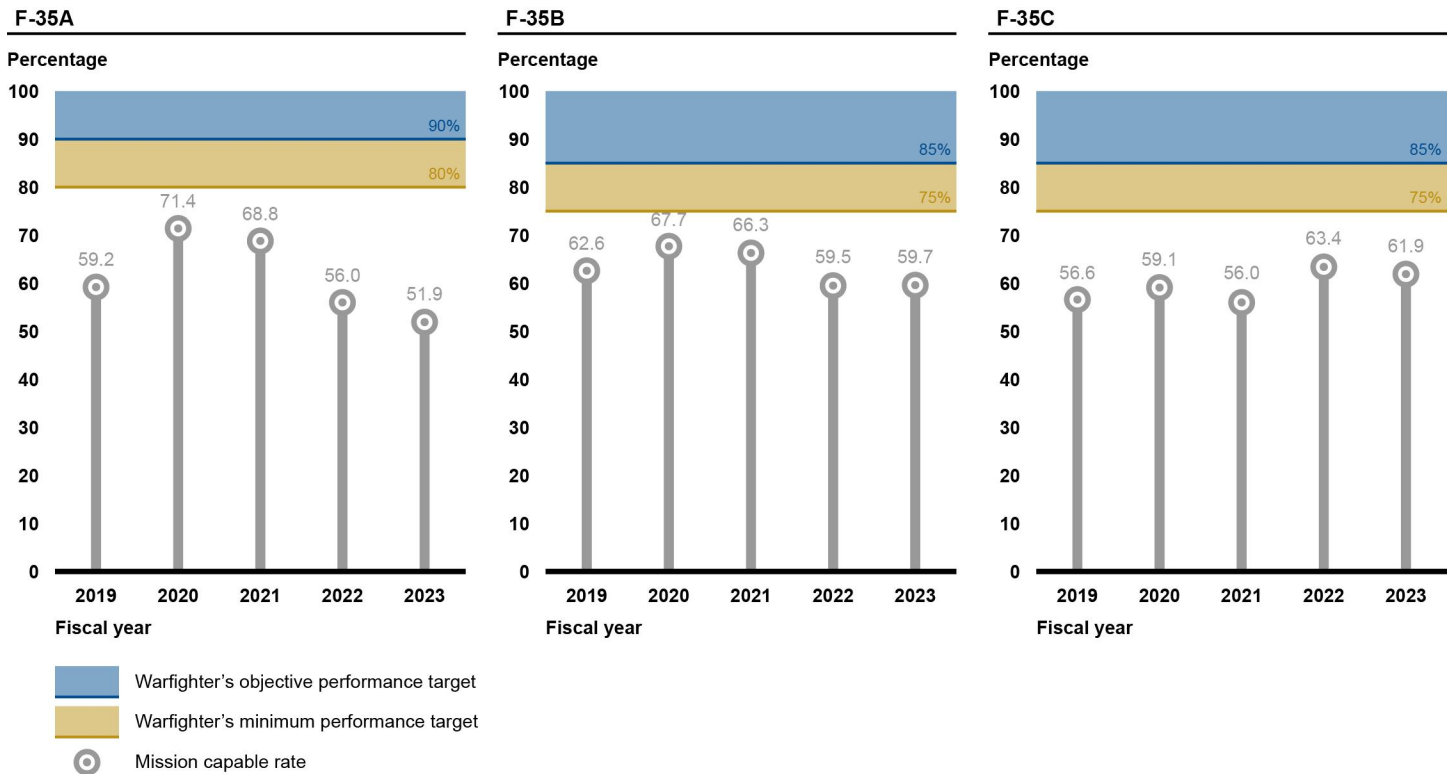
DOD's efforts to implement section 142 include establishing a governance structure that incorporates working groups to develop implementation plans in specific sustainment areas, such as supply support, maintenance planning, and technical data. DOD officials believe this will help transition the program from contractor-led sustainment to sustainment led by the military services. As of February 2024, DOD officials told us that DOD is in the process of identifying resources to support the integration of F-35 sustainment requirements within DOD's working capital funds to transition supply support to the military services. These funds are used by DOD to provide goods (e.g., spare parts) and services (e.g., depot maintenance) to consumers within the department.¹⁷

DOD had been exploring the option of a performance-based logistics contract.¹⁸ However, in November 2023, officials announced that DOD would not move forward with a performance-based logistics contract and would instead continue with annual sustainment contracts. According to the F-35 Joint Program Office, DOD made this decision based on several factors, including data quality issues and cost and performance certifications. As of December 2023, the F-35 Joint Program Office plans to consider pursuing a performance-based logistics contract or alternative sustainment strategies after the next annualized sustainment contract is finalized in July 2024.

To what extent is the F-35 fleet meeting its performance goals?

The F-35 fleet is not meeting most of its performance goals, including those for availability and for reliability and maintainability, according to DOD and contractor data. We have reported on the performance of the F-35 fleet, especially aircraft availability, across several GAO reports. We have consistently found that the F-35 fleet is not meeting its availability goals, which are measured by mission capable rates (i.e., the percentage of time the aircraft can perform one of its tasked missions), despite increasing projected costs. No F-35 variant met its performance goals for mission capable rates from fiscal years 2019 through 2023 (see fig. 7).

Figure 7: F-35 Mission Capable Rates by Variant, Fiscal Years 2019 – 2023



Source: GAO analysis of Department of Defense and Lockheed Martin information. | GAO-24-106703

Accessible Data for Figure 7: F-35 Mission Capable Rates by Variant, Fiscal Years 2019 – 2023

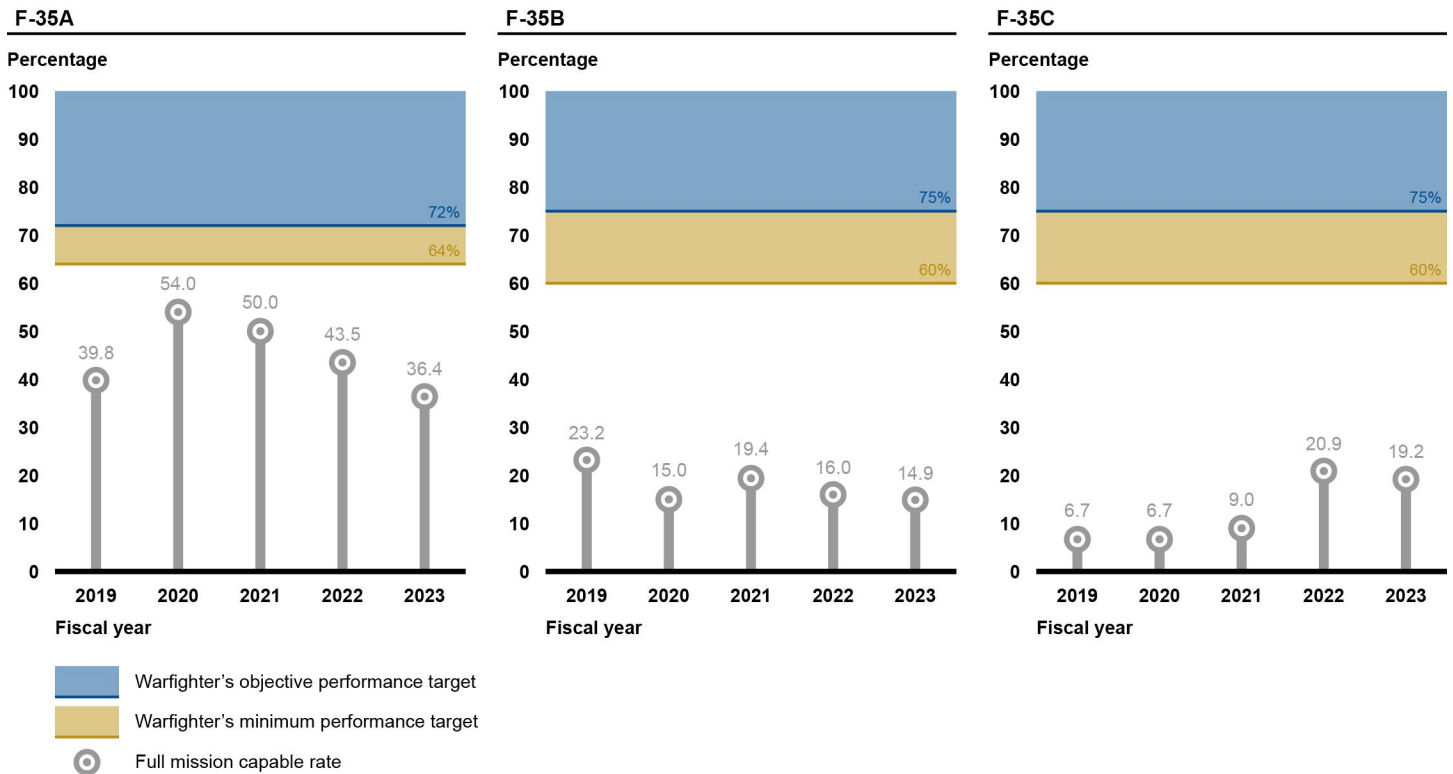
	FY 2019 (Percentage)	FY 2020 (Percentage)	FY 2021 (Percentage)	FY 2022 (Percentage)	FY 2023 (Percentage)	Warfighter's minimum performance target (Percentage)	Warfighter's objective performance target (Percentage)
F-35A	59.2	71.4	68.8	56	51.9	80	90
F-35B	62.6	67.7	66.3	59.5	59.7	75	85
F-35C	56.6	59.1	56	63.4	61.9	75	85

Source: GAO analysis of Department of Defense and Lockheed Martin information. | GAO-24-106703

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

Similarly, no F-35 variant met its performance goals for full mission capable rates—the percentage of time during which the aircraft can perform all tasked missions—over the same five-year period (see fig. 8).

Figure 8: F-35 Full Mission Capable Rates by Variant, Fiscal Years 2019 – 2023



Source: GAO analysis of Department of Defense and Lockheed Martin information. | GAO-24-106703

Accessible Data for Figure 8: F-35 Full Mission Capable Rates by Variant, Fiscal Years 2019 – 2023

	FY 2019 (Percentage)	FY 2020 (Percentage)	FY 2021 (Percentage)	FY 2022 (Percentage)	FY 2023 (Percentage)	Warfighter's minimum performance target (Percentage)	Warfighter's objective performance target (Percentage)
F-35A	39.8	54	50	43.5	36.4	64	72
F-35B	23.2	15	19.4	16	14.9	60	75
F-35C	6.7	6.7	9	20.9	19.2	60	75

Source: GAO analysis of Department of Defense and Lockheed Martin information. | GAO-24-106703

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

As of August 2023, the program was meeting or close to meeting 17 of its 24 reliability and maintainability goals, which are aimed at ensuring that the aircraft will be available for operations as opposed to out-of-service for maintenance.

Table 1 shows each F-35 variant's performance against those requirements DOD and the military services agreed the F-35 should meet. Those requirements are outlined in the F-35 Operational Requirements Document and, as of August 2023, are the most recently available metrics. In general, the program is meeting or close to meeting most of the metrics that are contractually required, and meeting half of the metrics that are not contractually required.

Table 1: The F-35 Reliability and Maintainability Metrics' Performance, June 2023 – August 2023

Metrics	Contractually required	F-35A	F-35B	F-35C
Mission reliability measures the probability of successfully completing a mission of average duration	contractually required	at or above minimum targets	at or above current targets	at or above minimum targets
Mean flight hours between failure (design controlled) measures time between failures that are directly attributable to the design of the aircraft and are considered fixable with design changes	contractually required	at or above current targets	at or above current targets	at or above current targets
Mean time to repair measures the amount of time it takes a maintainer to repair a failed component or device	contractually required	at or above minimum targets	below minimum targets	below minimum targets
Maintenance labor hours per flight hour measures the average amount of time spent on scheduled and unscheduled maintenance per flight hour ^a	contractually required	at or above current targets	at or above current targets	at or above current targets
Mean flight hours between maintenance events also referred to as the logistics reliability metric, measures time between maintenance, unscheduled inspections, and servicing actions	na	at or above current targets	at or above current targets	at or above current targets
Mean flight hours between removals measures the time between part removals from the aircraft for replacement from the supply chain	na	at or above current targets	at or above current targets	at or above current targets
Mean flight hours between critical failure measures the time between failures that result in the loss of a capability to perform a mission-critical capability	na	below minimum targets	below minimum targets	at or above minimum targets
Mean corrective maintenance time for critical failure measures the amount of time it takes to correct critical failure events	na	below minimum targets	below minimum targets	below minimum targets

Legend:

- : Metric is at or above current targets
- ◐: Metric is at or above minimum targets
- : Metric is below minimum targets
- ✓: Metric is contractually required

Source: GAO analysis of contractor data. | GAO-24-106703

Note: Each metric is measured using a 3-month average.

^aMaintenance labor hours per flight hour (referred to in the Operational Requirements Document as maintenance man hours per flight hour) are tracked as unscheduled, scheduled, and total. We report the total metric in this table because it is an F-35 Operational Requirements Document requirement.

What are the key challenges affecting F-35 readiness?

Numerous challenges negatively affect F-35 readiness—the ability of forces to fight and meet the demands of assigned missions—as shown in figure 9. These challenges include a heavy reliance on contractors, inadequate training, lack of technical data, lack of spare parts, and lack of support equipment.

Figure 9: Key Challenges Negatively Affecting F-35 Readiness



Source: GAO analysis of Department of Defense information; U.S. Air Force/R. Nial Bradshaw (photo). | GAO-24-106703

We reported in September 2023 that the F-35 fleet mission capable rate, a measure of fleet readiness, was far below program goals. This is in part due to DOD being behind schedule on establishing depot maintenance capabilities for component repairs, part repairs, and modifications to the air vehicle.¹⁹ As a result, repair times have been slow, and there has been growing backlog of components needing repair.

DOD’s heavy reliance on contractors to manage F-35 sustainment contributes to challenges with sustaining F-35 aircraft. The prime contractor leads the following seven sustainment activities: information technology systems continuous support, maintenance planning and management, supply support, support equipment, sustaining engineering, technical data, and training and training support.

We have published a series of reports examining sustainment of the F-35 and how problems with sustainment affect readiness. Since 2014, we have made 43 recommendations designed to improve the department’s operation and sustainment of the F-35 program. While DOD concurred with many of these recommendations, and has implemented some of them, 30 (about 70 percent) of them remain unimplemented. For example:

- In 2022, we reported that the sustainment strategy for the F-35’s engine did not meet the desired outcomes of the military services and we made recommendations designed to improve that strategy.²⁰ However, DOD has not fully implemented these recommendations.
- In 2019, we reported that F-35 aircraft was not able to perform as many missions or fly as often as required largely due to spare parts shortages and difficulty in managing and moving parts around the world.²¹ We made several recommendations designed to improve the program’s management of its spare parts. However, many of these recommendations remain unimplemented. For example, we recommended that DOD develop a process to modify the spares packages for deploying F-35 units, including reviewing the parts within the packages to ensure they match deploying aircraft and account for updated parts demand, and aligning any necessary funding

needed for the parts updates. However, DOD has not taken actions to fully implement this recommendation.²²

Agency Comments

We provided a draft of this report to DOD for review and comment. DOD provided technical comments which we incorporated where appropriate.

How GAO Did This Study

We collected and analyzed information and data on sustainment cost estimates since 2020 from the F-35 Joint Program Office. We also collected and analyzed data from the F-35 Joint Program Office on historical sustainment costs, estimated and actual flight hours, and mission capable rates since 2018. We found these data to be sufficiently reliable by interviewing officials responsible for and knowledgeable about the collection of the data and production of cost estimates; by reviewing the data for errors and anomalies; and by reviewing previous GAO reports that included these metrics and other documentation, such as data definitions. We discussed trends in the data with DOD officials, including reasons for any changes in the trends.

We interviewed officials from the F-35 Joint Program Office; the Office of the Under Secretary of Defense (Acquisition and Sustainment); the Office of the Secretary of Defense, Cost Assessment and Program Evaluation office; and the military services about cost savings efforts and the development of cost estimates.

We conducted this performance audit from March 2023 to April 2024 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.

List of Addressees

The Honorable Jack Reed
Chairman

The Honorable Roger Wicker
Ranking Member
Committee on Armed Services
United States Senate

The Honorable Mike Rogers
Chairman

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

We are sending copies of this report to the appropriate congressional committees, the Secretary of Defense, the Under Secretary of Defense for Acquisition and Sustainment, the F-35 Program Executive Officer, the Secretaries of the Air Force and Navy, and the Commandant of the Marine Corps. In addition, the report is available at no charge on the GAO website at <https://www.gao.gov>.

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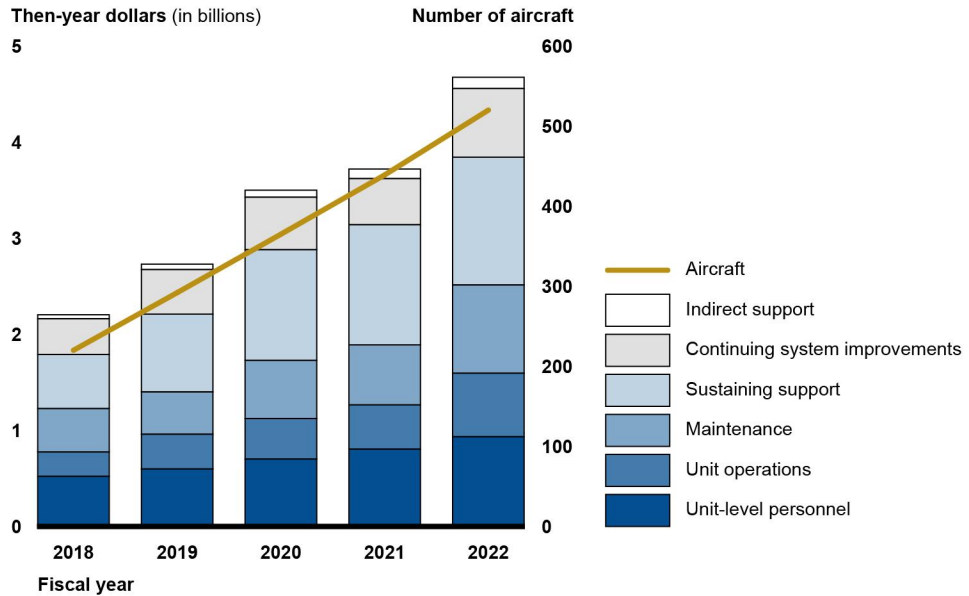
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Appendix I: F-35 Annual Actual Sustainment Costs

Figure 10: F-35 Actual Annual Sustainment Costs by Category Compared with Number of Aircraft, Fiscal Years 2018 – 2022



Source: GAO analysis of Department of Defense information. | GAO-24-106703

Accessible Data for Figure 10: F-35 Actual Annual Sustainment Costs by Category Compared with Number of Aircraft, Fiscal Years 2018 – 2022

Fiscal year	Unit-level personnel (Then-year dollars (in billions))	Unit operations (Then-year dollars (in billions))	Maintenance (Then-year dollars (in billions))	Sustaining support (Then-year dollars (in billions))	Continuing system improvements (Then-year dollars (in billions))	Indirect support (Then-year dollars (in billions))	Number of aircraft (Then-year dollars (in billions))
2018	0.5218	0.253	0.4521	0.5626	0.3725	0.0406	220
2019	0.5987	0.3608	0.4407	0.8103	0.4634	0.0555	292
2020	0.7017	0.4217	0.6043	1.1518	0.547	0.073	365
2021	0.8044	0.46	0.6252	1.2511	0.4801	0.1	439
2022	0.9339	0.6614	0.9178	1.3297	0.7159	0.1166	520

Source: GAO analysis of Department of Defense information. | GAO-24-106703

Note: Fiscal year 2022 is the latest year for which sustainment cost data is available.

Endnotes

¹International partner nations are Australia, Canada, Denmark, Italy, Netherlands, Norway, and United Kingdom. Foreign military sales countries are Belgium, Czech Republic, Finland, Germany, Israel, Japan, Poland, Singapore, South Korea, and Switzerland.

²Full-rate production, or Milestone C, is a review led by the Milestone Decision Authority at the end of the Engineering and Manufacturing Development Phase of the Defense Acquisition Process. Its purpose is to make a recommendation or seek approval to enter the Production and Deployment Phase. Full-rate production generally is the point when a program has demonstrated an acceptable level of performance and reliability, and in the case of the F-35, is ready for higher manufacturing rates. DOD declared full-rate production in March 2024. In preparation for Milestone C, DOD prepared a new cost estimate. According to officials, this cost estimate had different assumptions, such as the number of flight hours to be flown by the aircraft annually as well as the estimated program life. We did not assess these costs estimates as part of our review.

³GAO, *F-35 Joint Strike Fighter: More Actions Needed to Explain Cost Growth and Support Engine Modernization Decision*, [GAO-23-106047](#) (Washington, D.C.: May 30, 2023).

⁴According to program officials, the steady state period for each service is the period in which it intends to be operating the F-35 at its maximum capability. Steady state years for the F-35 program are defined in each respective service's affordability analysis as follows: U.S. Air Force/F-35A; 2036–2041; U.S. Marine Corps/F-35B and F-35C: 2033–2037; U.S. Navy/F-35C: 2036–2043.

⁵Constant year dollars are costs normalized for inflation as though they occurred in a specific fiscal year. See GAO, *F-35 Sustainment: DOD Needs to Cut Billions in Estimated Costs to Achieve Affordability*, [GAO-21-439](#) (Washington, D.C.: July 7, 2021).

⁶[GAO-21-439](#).

⁷Air Force officials told us that as a part of the analysis to inform Milestone C and the associated independent cost estimate conducted by the Office of the Secretary of Defense, Cost Assessment and Program Evaluation, the Air Force increased its flight hour projections resulting in an increase in the estimated cost per tail per year to sustain the F-35 aircraft. As a result, Air Force officials told us that the new estimated cost per tail per year reflected in the 2024 Annual Cost Estimate will be \$7.5 million once it reaches steady state. This would be over the \$6.8 million target.

⁸Pub. L. No. 117-81, § 141 (2021).

⁹GAO, *F-35 Sustainment: Need for Affordable Strategy, Greater Attention to Risks, and Improved Cost Estimates*, [GAO-14-778](#) (Washington, D.C.: Sept. 23, 2014).

¹⁰[GAO-21-439](#).

¹¹GAO, *Defense Acquisitions: Senior Leaders Should Emphasize Key Practices to Improve Weapon System Reliability*, [GAO-20-151](#) (Washington, D.C.: Jan. 14, 2020) and [GAO-21-439](#).

¹²[GAO-21-439](#).

¹³[GAO-23-106047](#).

¹⁴GAO, *F-35 Aircraft: DOD and the Military Services Need to Reassess the Future Sustainment Strategy*, [GAO-23-105341](#) (Washington, D.C.: Sept. 21, 2023).

¹⁵Sustaining support is the cost of system support activities other than maintenance that can be attributed to a system and are provided by organizations other than the system's operating units. Office of the Secretary of Defense, Cost Assessment and Program Evaluation, *Operating and Support Cost-Estimating Guide* (September 2020).

¹⁶Pub. L. No. 117-81, § 142 (2021).

¹⁷Working capital funds operate as self-supporting entities that conduct regular cycles of businesslike activities. Working capital funds are designed to create a cost conscious environment for both customers and providers. DOD may establish working capital funds to finance inventories of designated supplies and provide working capital for industrial- and commercial-type activities that provide common services within or among DOD components. For example, the Navy and Air Force use working capital funds to finance the provision of goods and services, parts and supplies, transportation, research and development, and depot maintenance by their respective depots.

¹⁸In a performance-based logistics contract, outcomes are acquired through performance-based arrangements that deliver warfighter requirements and incentivize product support providers to reduce costs through innovation.

¹⁹[GAO-23-105341](#).

²⁰GAO, *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).

²¹GAO, *F-35 Aircraft Sustainment: DOD Needs to Address Substantial Supply Chain Challenges*, [GAO-19-321](#) (Washington, D.C.: Apr. 25, 2019).

²²We have an ongoing review examining F-35 operational deployments, including analysis of mission capable rates for F-35 units that are deployed and the effectiveness of the F-35 supply chain supporting these units. We plan to report on these issues in 2024. That review is one of several (including this product) intended to provide information in response to section 357 of the NDAA for Fiscal Year 2022.