



# Availability and Use of F-35 Fighter Aircraft: An Update



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# At a Glance

In April 2022, the Congressional Budget Office published *Availability and Use of F-35 Fighter Aircraft*. That report used data through September 2021, the last month of fiscal year 2021. This update incorporates data for fiscal year 2022 and employs CBO’s recently developed approach for measuring the effects of aging on aircraft.

- **Availability and Use in Fiscal Year 2022.** In 2022, F-35Cs’ availability and flying hours per aircraft exceeded those of F-35As and F-35Bs. F-35Cs’ availability increased in 2022; F-35As’ and F-35Bs’ availability decreased. Flying hours per aircraft increased slightly for all three fleets.
- **Full Mission Availability Rates.** F-35As have had greater full mission availability rates than F-35Bs and F-35Cs. Full mission availability rates reflect aircraft’s ability to perform all—not just one or more—of their designated missions.
- **Effects of Aging.** All three F-35 variants have experienced generally declining availability and use with age. However, all three fleets are composed of mostly new aircraft, so estimates of the effects of aging on F-35s are tentative and are subject to change as those aircraft mature.

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# Notes

All years referred to in this document are federal fiscal years, which run from October 1 to September 30 and are designated by the calendar year in which they end.

On the cover: From left to right, a U.S. Navy F-35C, a U.S. Marine Corps F-35B, and a U.S. Air Force F-35A participate in a training sortie together on May 21, 2014, near Eglin Air Force Base in Florida. Photo by Staff Sgt. Katerina Slivinske, courtesy of the U.S. Air Force.

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# Availability and Use of F-35 Fighter Aircraft: An Update

Intended to replace older models of fighter aircraft, the F-35 has stealth capabilities that reduce the chance of detection by radar and heat-seeking missiles. The Department of Defense (DoD) has three variants of the aircraft: the F-35A, operated by the Air Force; the F-35B, operated by the Marine Corps; and the F-35C, operated primarily by the Navy.

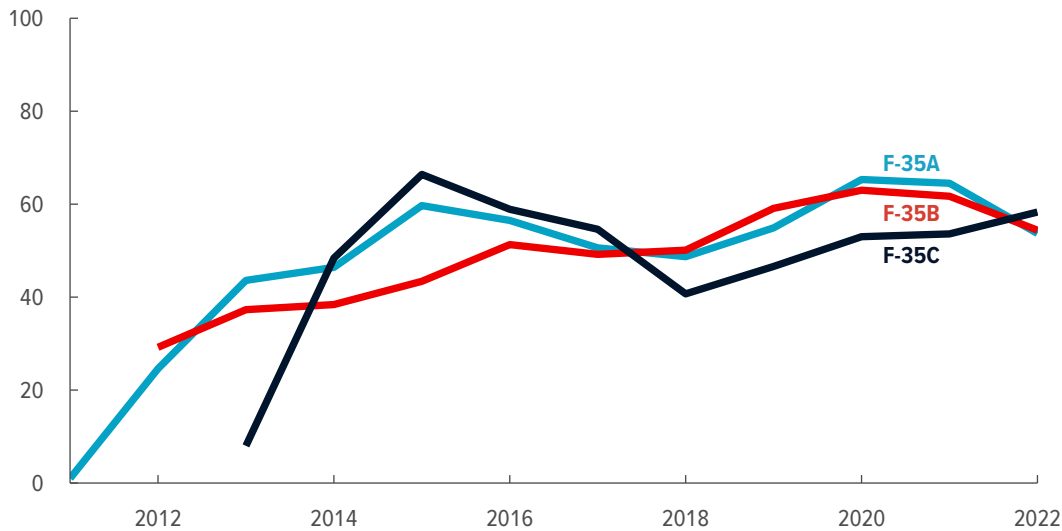
In April 2022, the Congressional Budget Office published *Availability and Use of F-35 Fighter Aircraft*.<sup>1</sup> That report analyzed the availability and use of F-35s using data through September 2021, the last month of fiscal year 2021. This update incorporates data for fiscal year 2022 and employs CBO's recently developed approach for measuring the effects of aging on aircraft. However, because most of the F-35s in each fleet are quite new, and because early results with new types of aircraft can change significantly as those aircraft mature, the aging effects that CBO reports here are tentative.

## Availability and Flying Hours per Aircraft

CBO calculates aircraft availability rates by dividing the number of hours that aircraft are both mission capable and in the possession of operational squadrons by the total number of aircraft hours for the entire fleet, including aircraft undergoing depot-level maintenance.<sup>2</sup> (An aircraft is considered mission capable if it can accomplish at least one of its designated missions.)

### Availability Rates of F-35s

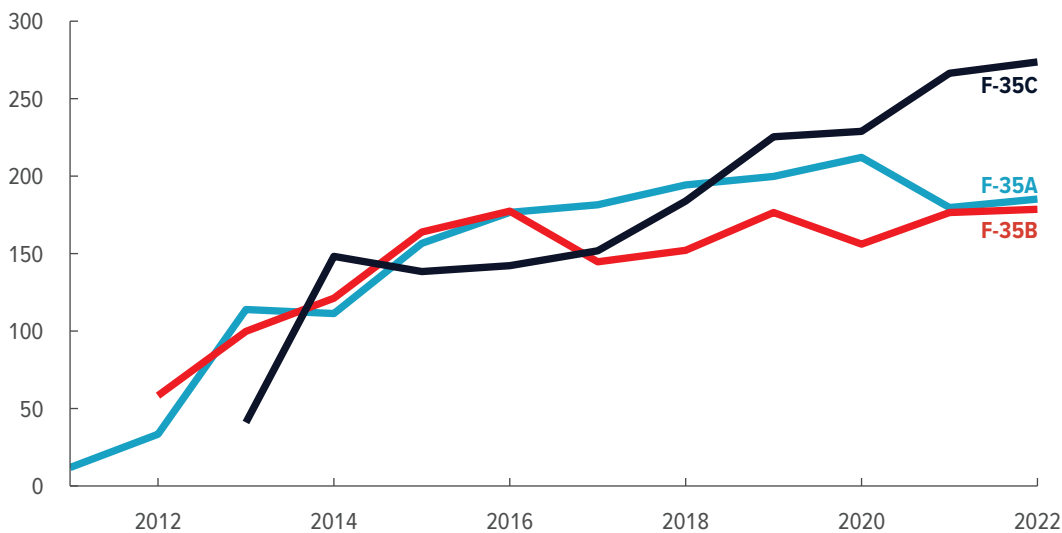
Percent



Between 2021 and 2022, F-35As' availability fell by 11 percentage points. F-35Bs' availability also fell, by 7 percentage points, and F-35Cs' availability rose by 5 percentage points. In 2022, availability rates ranged from 54 percent for the F-35A and F-35B to 58 percent for the F-35C.

### Annual Flying Hours per Aircraft

Number of Hours



Since 2019, F-35Cs have flown more hours, on average, than F-35As or F-35Bs. For all three variants, flying hours per aircraft increased slightly between 2021 and 2022.



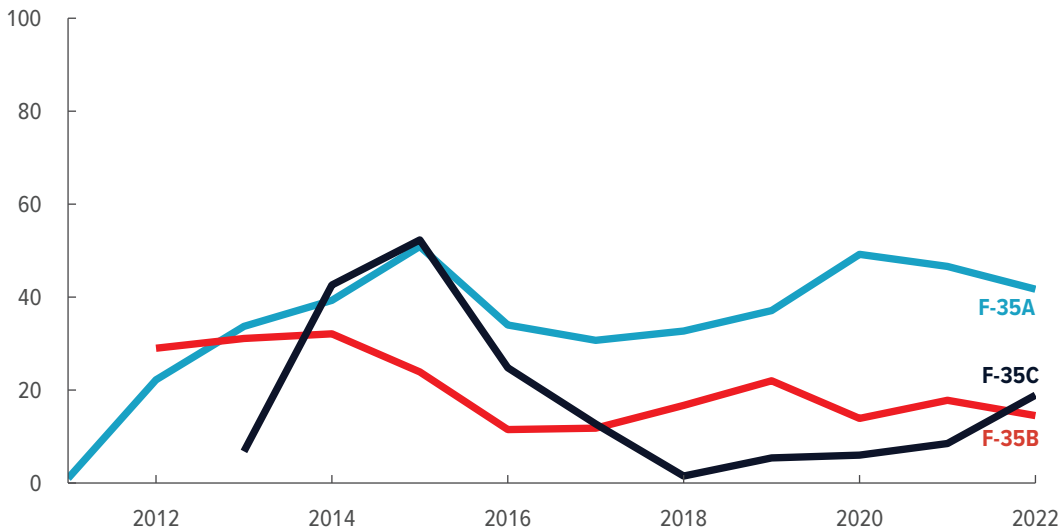
## Full Mission Availability Rates

CBO’s measure of aircraft availability is derived from mission capable rates. However, the Government Accountability Office has suggested that *full* mission capable rates “provide a clearer picture of the aircraft’s capabilities and the services’ return on investment.”<sup>3</sup> The full mission capable rate is a more stringent measure of readiness than the mission capable rate because it reflects an aircraft’s ability to perform all—not just one or more—of its tasked missions.

CBO calculated full mission availability rates by dividing the number of hours that aircraft were both fully mission capable and in the possession of operational squadrons by the total number of aircraft hours for the entire fleet. By construction, an aircraft’s full mission availability rate is less than or equal to its availability rate.

### Full Mission Availability Rates of F-35s

Percent



Since 2016, full mission availability rates have been considerably greater for F-35As than for F-35Bs or F-35Cs. It has been common for F-35Bs and F-35Cs to be capable of performing one or more, but not all, of their tasked missions.

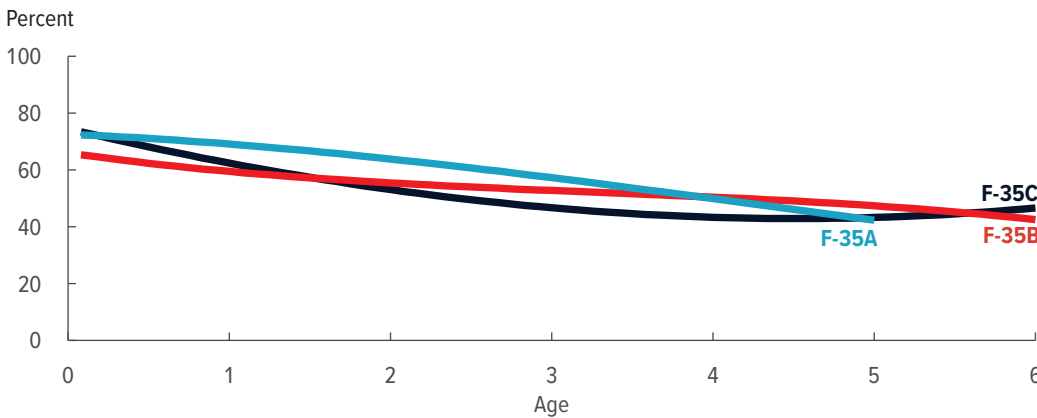
## Effects of Aging

In a recent report, CBO analyzed how the availability and use of other DoD aircraft have evolved as those aircraft have aged.<sup>4</sup> Compared with those aircraft, DoD’s F-35 fleet is very new: 87 of the aircraft began operation during fiscal year 2022, and as of September 2022, more than half of the 532 F-35s in DoD’s possession had operated for less than four full years. Only 44 aircraft were in their 10th or later year of operation.

As in its earlier analysis, for each F-35 variant, CBO estimated the relationships between aircraft’s age (measured in months since the aircraft commenced operation) and their availability and use. The resulting best-fit curves, below, show smoothed portrayals of the observed relationships. CBO used a flexible functional form (including squared and cubed terms) that allowed estimated rates to increase or decrease with the aircraft’s age.

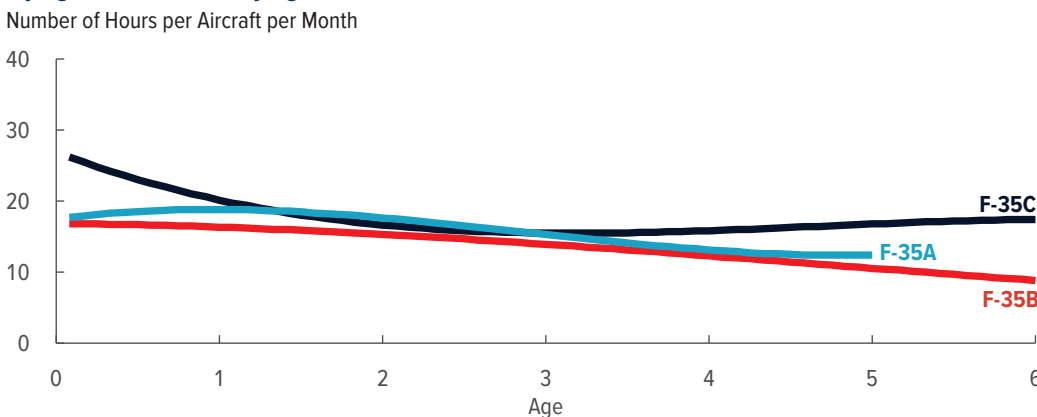
In its earlier analysis, to reduce the potential for unrepresentative results and other problems associated with small sample sizes, CBO generally analyzed aircraft only at ages (in years) at which at least 70 percent of the fleet had been observed. However, the youth of the F-35 fleet precluded the use of such a stringent standard. Instead, for F-35s, CBO constrained its analysis to ages at which at least 30 percent of the fleet had been observed. Using that relaxed constraint, CBO was able to estimate five-year aging curves for F-35As and six-year aging curves for F-35Bs and F-35Cs.

### Availability Rates of F-35s, by Age



All three variants have experienced generally declining availability with age, though F-35Cs have exhibited a roughly 3 percentage-point upturn in availability between age 5 and age 6.

### Flying Hours of F-35s, by Age



Use has also trended downward as F-35s have aged, with some upturn for F-35Cs toward age 6.

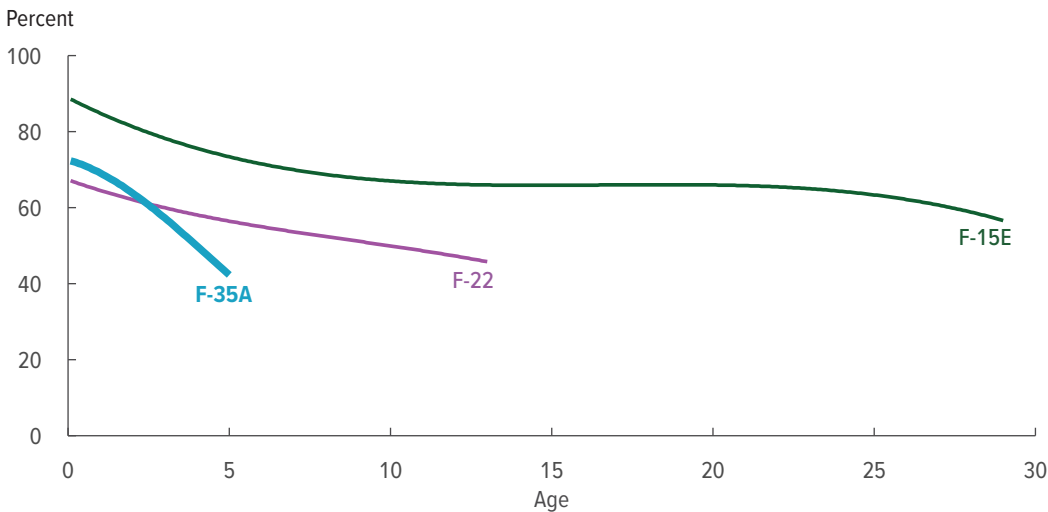


**Effects of Aging on the F-35A and Other Air Force Fighter Aircraft**

CBO compared the F-35A’s estimated aging effects with those of the two most recent Air Force fighters preceding the F-35A, the F-15E and the F-22. Because those aircraft have been in service for more years, CBO was able to analyze a longer span of F-22 operations (13 years) and an even longer span of F-15E operations (29 years).

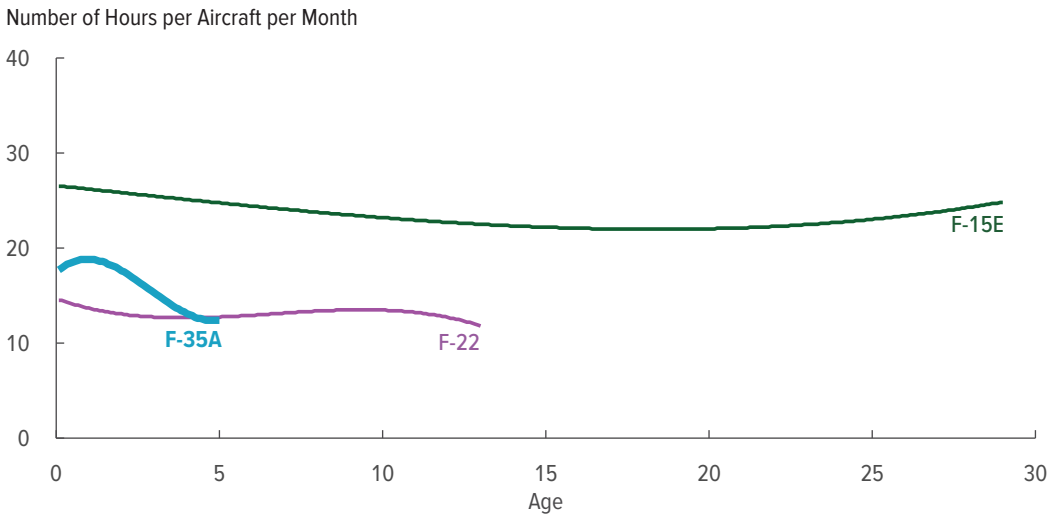
The F-22, like the F-35A, is a stealthy fighter aircraft; the F-15E is not. Stealthy aircraft can be more challenging to maintain. For example, some types of maintenance require the removal of stealthy material to undertake repairs, followed by the stealthy material’s reinstallation once repairs are complete. Such additional tasks may lengthen periods in maintenance, adversely affecting an aircraft’s availability.

**Availability Rates of Air Force Fighters, by Age**



To date, F-35As’ availability rates have been considerably below those of comparably aged F-15Es but more similar to those of F-22s.

**Flying Hours of Air Force Fighters, by Age**



F-22s and F-35As have been flown less than F-15Es were at the same ages.

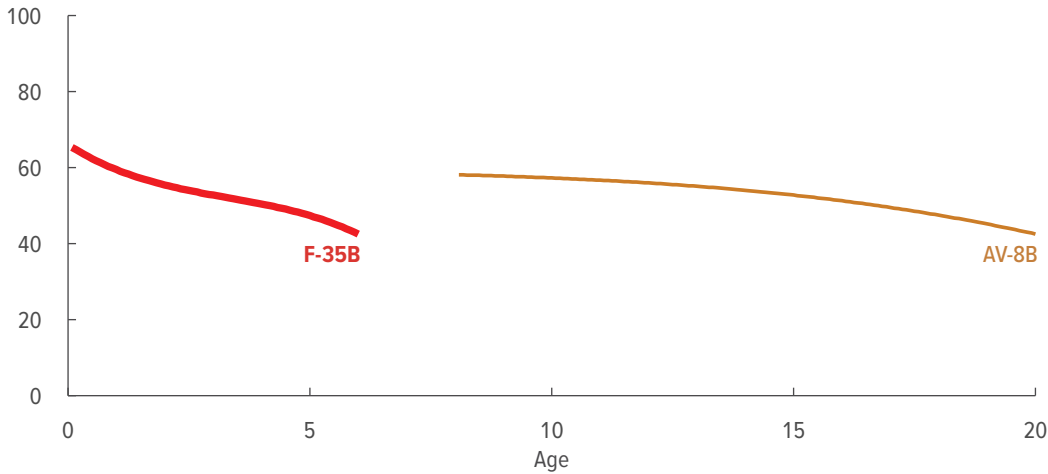


### Effects of Aging on the F-35B and the Marine Corps' AV-8B Harrier

CBO compared the F-35B's estimated aging effects with those of the AV-8B Harrier—the Marine Corps' fighter jet that the F-35B is replacing. Like the F-35B, the Harrier can take off and land vertically. Direct comparisons of the two aircraft are difficult to make, however, because CBO does not have data on availability or flying hours in the earliest years of the Harrier's life. Also, whereas the F-35B is a stealthy aircraft, the Harrier is not.

#### Availability Rates of Marine Corps Fighters, by Age

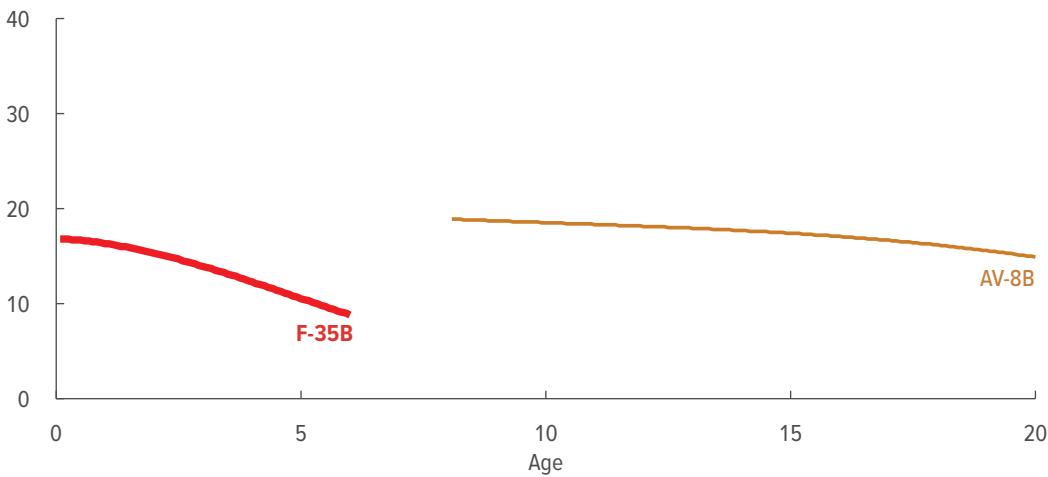
Percent



To date, F-35Bs have had availability rates that are roughly comparable to those of Harriers later in their life, but the F-35Bs' rates appear to be falling more quickly.

#### Flying Hours of Marine Corps Fighters, by Age

Number of Hours per Aircraft per Month



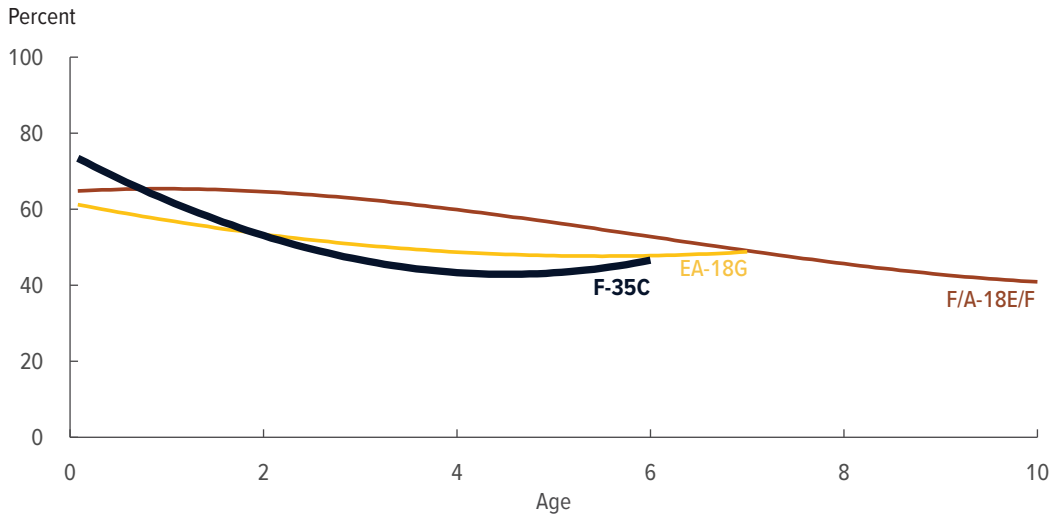
So far, the usage rates of F-35Bs have been below those of Harriers later in their life.



### Effects of Aging on the F-35C and Other Navy Fighter Aircraft

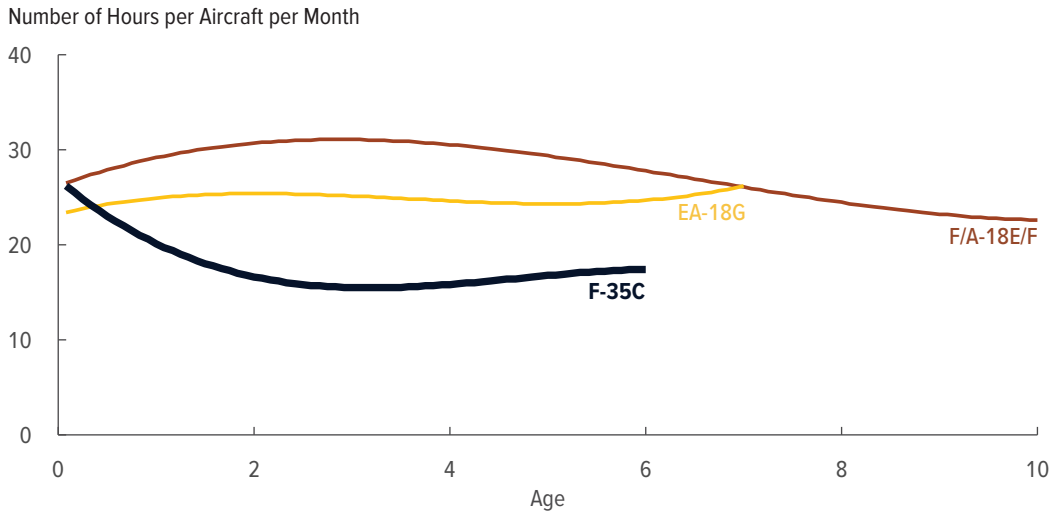
CBO compared the F-35C’s estimated aging effects with those of the two most recent Navy fighter aircraft preceding the F-35C, the F/A-18E/F Super Hornet and the EA-18G Growler. Of those three fighters, only the F-35C is a stealthy aircraft. The Growler is an electronic warfare aircraft with equipment that can present additional maintenance challenges relative to the Super Hornet.

#### Availability Rates of Navy Fighters, by Age



To date, F-35Cs’ availability rates have been similar, on average, to those of Growlers but have been lower, on average, than those of Super Hornets.

#### Flying Hours of Navy Fighters, by Age



So far, F-35Cs have flown considerably fewer hours than either Super Hornets or Growlers at the same ages.

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1. Congressional Budget Office, *Availability and Use of F-35 Fighter Aircraft* (April 2022), [www.cbo.gov/publication/57842](https://www.cbo.gov/publication/57842).
  2. For a discussion of how CBO calculates aircraft availability, see Congressional Budget Office, *Availability and Use of Aircraft in the Air Force and Navy* (January 2022), pp. 1–2, [www.cbo.gov/publication/57433](https://www.cbo.gov/publication/57433).
  3. Government Accountability Office, *F-35 Sustainment: DOD Needs to Cut Billions in Estimated Costs to Achieve Affordability*, GAO-21-439 (July 2021), p. 16, [www.gao.gov/products/gao-21-439](https://www.gao.gov/products/gao-21-439).
  4. For an explanation of CBO's regression method for estimating how an aircraft's availability and usage rates change with age, see Congressional Budget Office, *Availability and Use of F/A-18E/F Super Hornet Fighter Aircraft* (February 2023), [www.cbo.gov/publication/58687](https://www.cbo.gov/publication/58687).

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# Appendix: Data Sources for Figures

## **Availability Rates of F-35s**

### **Annual Flying Hours per Aircraft**

### **Full Mission Availability Rates of F-35s**

### **Availability Rates of F-35s, by Age**

### **Flying Hours of F-35s, by Age**

Congressional Budget Office, using data from Lockheed Martin's Sustainment Performance Management System.

## **Availability Rates of Air Force Fighters, by Age**

### **Flying Hours of Air Force Fighters, by Age**

Congressional Budget Office, using data from Lockheed Martin's Sustainment Performance Management System and the Air Force's Reliability and Maintainability Information System.

## **Availability Rates of Marine Corps Fighters, by Age**

### **Flying Hours of Marine Corps Fighters, by Age**

### **Availability Rates of Navy Fighters, by Age**

### **Flying Hours of Navy Fighters, by Age**

Congressional Budget Office, using data from Lockheed Martin's Sustainment Performance Management System and the Department of the Navy's Decision Knowledge Programming for Logistics Analysis and Technical Evaluation system.

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# About This Document

This report was prepared at the request of the Chairman and Ranking Member of the Subcommittee on Readiness of the House Armed Services Committee in the 117th Congress. In keeping with the Congressional Budget Office's mandate to provide objective, impartial analysis, the report makes no recommendations.

Edward G. Keating, Kathryn McGinnis, R. Derek Trunkey, Shannon Smith (formerly of CBO), and Hanna Willwerth (formerly of CBO) prepared the report with guidance from David Mosher. David Arthur, Ron Gecan, and Christina Hawley Anthony provided assistance. Adebayo Adedeji fact-checked the report.

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CBO seeks feedback to make its work as useful as possible. Please send comments to [communications@cbo.gov](mailto:communications@cbo.gov).



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