



## F-35 Joint Strike Fighter: Costs & Challenges

### What Is It?

The F-35, known as the Lightning II, is a *Joint* Strike Fighter (JSF, emphasis added) because contracts exist for the United States Air Force, Marine Corps, and Navy, as well as [eight NATO countries and five non-NATO partners](#). The fighter has three variants, one of which (F-35A) will have a nuclear weapons capability. The F-35 was designed to utilize stealth technology and systems integration to give the U.S. advantages for decades to come. Although the plane has demonstrated many capabilities, its effectiveness has been undermined by runaway costs and a number of serious challenges.

The F-35 was designed to be a jack of all trades, created to execute multiple missions and replace multiple specialized aircraft. However, it struggles to achieve its promise. Its multi-role design, although helpful for foreign sales, means it does not perform any one role as well as other aircraft in the U.S. inventory. In addition, supply chain issues and other factors mean the U.S. F-35 fleet did not meet the Department of Defense's (DoD) 70% "mission capable" rate for 2020 – meaning nearly a third of the fleet was incapable of flying any kind of combat mission. "Full mission capable" rates, meaning missions against threats requiring the full capabilities of the aircraft, lagged even further behind DoD targets.

Lockheed Martin has already delivered 283 F-35s to the United States Air Force, making the F-35 fleet the second largest in the Air Force inventory after the F-16. A total of 655 jets have been delivered to the United States and other international partners as of June 2021.

The F-35 was designed to replace the Air Force's A-10, F-16 and possibly F-15, the Navy's F/A-18, and the Marine Corp's F/A-18 and AV-8. However, production delays and deficiencies identified during testing have forced all three services to buy additional legacy aircraft and push back retirement of their current legacy fleets, adding to the overall cost of the program.

### Challenges

To date the F-35s have exhibited multiple faults.

#### *Mannequin Tests*

Tests in July and August of 2015 demonstrated a 23% probability of death and a 100% probability of neck injury upon ejection for pilots weighing between 136 and 165 pounds, and a 98% probability of death for pilots under 136 pounds. Design modifications to the ejection seat allegedly lowered the risk of injury or death to the same levels as ejection seats for other aircraft, but an internal Air Force report from 2017 said unresolved F-35 ejection seat flaws could still kill [up to two dozen pilots](#) over the lifetime of the program.

#### *Structural and Software Problems*

Despite having planes in rotation, the F-35 has been plagued by structural and software issues that limit the aircraft's time at top speed, maneuverability at certain angles of attack, and stealth capabilities. The machine gun on the F-35A variant used by the Air Force [cannot even shoot straight](#). The F-35 Joint Program Office has implemented stopgap fixes for some of these problems, while quietly changing flight protocols to sidestep others – such as [reducing the time](#) pilots are allowed to use their afterburner. The planes also break more often and take longer to fix than expected, failing to meet the DoD's reliability and maintainability requirements.

#### *ALIS*

The Autonomic Logistics Information System (ALIS) is a software suite that interacts with nearly every aspect of the F-35. ALIS is used to plan and debrief missions, schedule maintenance, walk crews through repairs, and

more. It is also oversized, can display inaccurate data, and has proven so difficult to fix that the DoD scrapped it in 2020 for a new cloud-based system called Operational Data Integrated Network (ODIN). ODIN's development ran into similar problems and has since stalled after funding for it was cut in the DoD's FY21 budget.

ALIS also could have several unresolved cybersecurity vulnerabilities, partially because Lockheed Martin started shipping F-35s before ALIS was complete and partially because the company opted against conducting testing in real-world conditions. The potential fragility of the F-35's critical systems to cyberattack, alongside recurring lags in software stability between updates, has generated concern for systemic weaknesses in the F-35's advanced network.

### *Gen III Helmet*

The Gen III helmet combines a heads-up display, helmet-mounted display, and night vision goggles into one piece of equipment, improving integration between the pilot and the plane. Previous versions of the helmet experienced information glitches during training exercises and obscured pilots' vision during night landings. While those problems have supposedly been solved, [similar issues with the helmet display](#) contributed to a 2020 crash at Eglin Air Force Base.

## **How Much Does It Cost?**

The F-35's [price per unit](#), including ancillary costs like depot maintenance, ground support equipment, and spare parts is \$110.3 million per F-35A, \$135.8 million per F-35B, and \$117.3 million per F-35C. Those totals do not include the nearly \$1.3 trillion in life cycle costs to operate and sustain the aircraft over its 66-year life cycle, making it the most expensive weapons system in U.S. history.

A 2021 Government Accountability Office report said there is a [widening gap](#) between projected life cycle costs for the F-35 and what the services say they can afford. In 2018 the Air Force determined it could spend \$4.1 million per year per F-35A, when the real operating cost is closer to \$7.1 million. The Marine Corps and Navy similarly underestimated their costs, meaning all three services face multi-million dollar budget shortfalls each year that will grow with each new F-35 added to the force.

## **Recommendations**

Congress should reduce or suspend procurement plans until all major problems with the F-35 identified by the DoD are resolved, life cycle costs are properly budgeted for, and the aircraft is able to perform the missions for which it is designated.

Until the the Department of Defense resolves ongoing problems, it should not move forward with plans to make the fighter nuclear capable. The air leg of the nuclear triad is already fully operational, with the new B-21 stealth bomber slated to roll off the production line in early 2022.

*Sources: Lockheed Martin, Government Accountability Office, Office of the Director of Operational Test and Evaluation, House Armed Services Committee, Defense News, Project on Government Oversight*