



Source: © 2016 Lockheed Martin.

F-35 Lightning II (F-35)

DOD is developing and fielding a family of fifth generation strike fighter aircraft integrating stealth technologies with advanced sensors and computer networking capabilities for the United States Air Force, Marine Corps, and Navy, eight international partners, and four foreign military sales customers. The family is comprised of three aircraft variants. The Air Force's F-35A variant will complement its F-22A fleet and is expected to replace the air-to-ground attack capabilities of the F-16 and A-10. The Marine Corps' F-35B variant will replace its F/A-18 and AV-8B aircraft. The Navy's F-35C variant will complement its F/A-18E/F aircraft.



Program Essentials

Milestone decision authority level:

Under Secretary of Defense for Acquisition and Sustainment

Program office: Arlington, VA

Prime contractor: Lockheed Martin; Pratt & Whitney

Contract type: FPI/CPIF/CPFF (aircraft low-rate initial production)

FPI/CPIF (engine low-rate initial production)

Software development approach: Mixed

Next major milestone: F-35C initial capability (February 2019)

Program Performance (fiscal year 2019 dollars in millions)

	First full estimate (10/2001)	Latest (06/2018)	Percentage change
Development	\$43,642.80	\$66,227.30	+51.7%
Procurement	\$193,622.50	\$288,950.50	+49.2%
Unit cost	\$83.49	\$145.79	+74.6%
Acquisition cycle time (months)	175	237	+35.4%
Total quantities	2,866	2,470	-13.8%

Total quantities comprise 14 development quantities and 2,456 procurement quantities.

Funding and Quantities

(fiscal year 2019 dollars in millions)



Legend: ■ Funded to date, ■ To complete

Attainment of Product Knowledge

As of January 2019

	Status at	Current Status
Resources and requirements match	Development Start	
• Demonstrate all critical technologies are very close to final form, fit and function within a relevant environment	<input type="radio"/>	<input checked="" type="radio"/>
• Demonstrate all critical technologies in form, fit and function within a realistic environment	<input type="radio"/>	<input checked="" type="radio"/>
• Complete a system-level preliminary design review	<input type="radio"/>	<input checked="" type="radio"/>
Product design is stable	Design Review	
• Release at least 90 percent of design drawings	<input type="radio"/>	<input checked="" type="radio"/>
• Test a system-level integrated prototype	<input type="radio"/>	<input checked="" type="radio"/>
Manufacturing processes are mature	Production Start	
• Demonstrate Manufacturing Readiness Level of at least 9, or critical processes are in statistical control	<input type="radio"/>	<input checked="" type="radio"/>
• Demonstrate critical processes on a pilot production line	<input type="radio"/>	<input checked="" type="radio"/>
• Test a production-representative prototype in its intended environment	<input type="radio"/>	<input checked="" type="radio"/>

Legend: ● Knowledge attained, ○ Knowledge not attained, ■ Information not available, ■ Not applicable

F-35 Program

Technology Maturity and Design Stability

All of the F-35's critical technologies are mature and the baseline engineering drawings are complete for all three aircraft variants. The program office completed the final development test flights for the baseline program in April 2018, but continues to address over 900 deficiencies identified with the aircraft's performance prior to the end of development testing. For example, the program is developing a new helmet mounted display, which will resolve an existing green glow effect that can distort a pilot's vision during night time carrier landings. Program officials expect installation of some of the new displays in 2019. The program office is also testing and integrating software updates to resolve other deficiencies, but it did not fully resolve over 800 other deficiencies prior to the start of operational testing. The program obtained a waiver from the Under Secretary of Defense for Acquisition and Sustainment to start operational testing prior to fully resolving these deficiencies. Program officials stated that they expect to continue resolving these deficiencies through the start of full rate production in October 2019.

Program officials continue to identify and address technical risks, some of which are specific to individual variants of the F-35. For example, we reported last year that a problem with the F-35's main fuel throttle valve caused the aircraft to move suddenly and without stopping until the engine is shut down. In 2018, the program implemented software changes to fix this problem. Also, across all variants, pilots have reported experiencing extreme pressure in the cockpit during certain flight maneuvers. Contractor representatives told us they have identified the root cause of the excessive cockpit pressure and will implement a minor hardware change in 2019 to address the issue. Recently, following the crash of an F-35B in October 2018, the program grounded the F-35 fleet to inspect all of its engines. An investigation determined a manufacturing defect caused an engine fuel tube to rupture during flight, resulting in a loss of power to the engine. The program office reported that it identified 117 aircraft with the same type of fuel tubes that it must replace. According to program officials, the grounding generally did not impact the delivery of the aircraft, as the contractor has provided replacement fuel tubes that were installed on a majority of the affected aircraft by the end of 2018.

Production Readiness

As of December 2018, the prime contractor has delivered 264 production aircraft. Since the start of production, F-35 contractors have refined their production processes to improve manufacturing efficiency and quality. However, the prime contractor has identified quality control and late radar deliveries as the top production risks in the program. For example, because of supplier identified limitations, the prime

contractor continues to fix gaps between adjacent aircraft surface panels attached to the airframe. These fixes are needed to meet low observable (stealth) performance requirements. The contractor is working with its supplier to resolve the problem through improved production processes as the program approaches its full-rate production decision in October 2019.

Other Program Issues

Following our 2018 assessment, the program delayed the start of operational testing by up to 3 months, to December 2018. This delay stemmed from software upgrades needed to assess the aircraft's performance. To mitigate further delays, the program received authorization to complete certain operational tests in advance of the formal start of operational testing. For example, the program completed cold weather operational testing in January 2018.

Because of evolving threats, the program office continues to move forward with Block 4 modernization efforts, which will modernize current capabilities and develop and integrate new capabilities onto the aircraft. In October 2018, the program office updated its acquisition strategy, providing a general schedule for future technology development and integration. The program plans to field new capabilities starting in October 2019, but it has yet to complete its acquisition program baseline. As a result, the program is concurrently testing, producing, and modernizing aircraft, which increases the risk of future schedule and cost overruns.

Program Office Comments

We provided a draft of this assessment to the program office for review and comment. The office provided technical comments, which we incorporated where appropriate. Program officials stated that since the start of developmental testing in 2006, more than 2,200 deficiencies have been discovered and corrected. Further, officials reported that, in coordination with the warfighting community, they have resolved the highest-priority deficiencies and have mitigated the remaining deficiencies. Finally, officials commented that aircraft deliveries have increased as planned and operational testing remains on track for completion in fall 2019.

Joint DOD Program Assessment^{*} 2-page assessment

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***We abbreviate the following contract types in the individual assessment: cost-plus-fixed-fee (CPFF), cost-plus-incentive-fee (CPIF), and fixed-price incentive (FPI).**