

# The F-35A Is the World's Most Dominant, Cost-Effective Fighter: The Air Force Needs to Accelerate Its Acquisition Now

*John Venable*

## KEY TAKEAWAYS

The F-35 Lightning II is now the world's most dominant multi-role fighter. The aircraft provides the U.S. a significant competitive advantage over peer competitors.

The F-35A's capabilities and decreasing price tag make it both vital to the nation's defense and more cost-effective than fourth-generation fighters.

The U.S. Air Force should forgo plans to buy the F-15EX and accelerate acquisition of the F-35A—80 F-35As in FY21, 100 F-35As in FY22, and 120 F-35As in FY23.

**T**he F-35 Lightning II is now the world's most dominant multi-role fighter. Its detection range, geolocation, threat identification, and system response capabilities allow the jet to detect, find, precisely fix, and destroy the world's most advanced threats, including every element within the layered Russian SA-20 surface-to-air missile (SAM) system. While it still has several rough edges, the F-35 has crossed several thresholds that make it the most lethal and cost-effective fighter in or nearing production within the NATO Alliance. The U.S. Air Force should forgo plans to buy the F-15EX and accelerate the acquisition of the F-35A.

The first combat F-35A wing in the U.S. Air Force at Hill Air Force Base received the last of its full complement of 78 stealth fighters and began combat deployments to the Middle East in 2019.<sup>1</sup> The maneuvering restrictions the jet had when it was first

This paper, in its entirety, can be found at <http://report.heritage.org/ib5042>

The Heritage Foundation | 214 Massachusetts Avenue, NE | Washington, DC 20002 | (202) 546-4400 | [heritage.org](http://heritage.org)

Nothing written here is to be construed as necessarily reflecting the views of The Heritage Foundation or as an attempt to aid or hinder the passage of any bill before Congress.

introduced are now completely gone, and even with a complete internal weapons load-out and full internal fuel, pilots can fight without limitation. Thirty of the wing's fighter pilots were interviewed about the jet, and all 20 with previous experience in fourth-generation fighters would rather fly the F-35 in combat than their previous fighters, including in almost every dogfight scenario they could imagine.<sup>2</sup>

## Cost Below Government Targets

The price of the Lightning has fallen below the most optimistic government targets. In 2018, the Congressional Research Service estimated that F-35As produced in 2020 would cost \$77.5 million (using constant 2012 dollars).<sup>3</sup> Bringing that cost estimate up to current-year dollars would make the price of each F-35 \$87.1 million.<sup>4</sup> The actual cost of an F-35A in fiscal year (FY) 2021 is \$79.2 million, and the cost will fall to \$77.9 million in 2022,<sup>5</sup> or \$9.2 million cheaper than the government's best estimate using current-year dollars. That's the price of a new F/A-18 E/F, \$9.8 million below the \$87.7 million base price of an F-15EX, and \$40 million less than the \$118 million Eurofighter—jets that require additional equipment like multimillion-dollar targeting pods before they can employ in medium-threat combat environments. The F-15EX self-protection system is estimated to cost \$7.5 million,<sup>6</sup> and the Sniper Targeting pod costs more than \$1.7 million per jet,<sup>7</sup> making the total cost for a combat-configured F-15EX \$96.9 million—\$19 million more than a combat-configured F-35A. And neither the FA-18E/F, the F-15E(X), nor the Eurofighter would survive in a modern high-threat environment.

The total price of an F-35 is made up of the aircraft, assembled and produced by Lockheed Martin, and the F135 engine produced by Pratt and Whitney—plus profit. Competition within aircraft component suppliers has been an effective tool at increasing performance and driving down costs. When a Northrup Grumman-produced aircraft subcomponent called the Distributed Aperture System (DAS) failed to meet reliability thresholds, Lockheed Martin replaced that system with a [DAS produced by Raytheon](#) that delivers twice the performance and five times the reliability and reduced the cost per unit by 45 percent, saving the government \$3 billion over the life of the program.<sup>8</sup> But not all of the players have moved aggressively to reduce costs.

Assuming it has stayed on track with Department of Defense (DOD) acquisition estimates, Pratt and Whitney is now delivering F-35 engines for \$11.8 million a copy. That price was planned to fall with production efficiencies to \$10.7 million by FY 2025 (in FY 2012 dollars), saving the taxpayer another \$1 million per fighter.<sup>9</sup> Unfortunately, without a competitive

motor available, Pratt and Whitney has made it clear that further savings are no longer in the cards.<sup>10</sup> The ability to reduce engine cost and improve performance competitively was lost when Congress killed funding for the F-35 alternative engine contract in 2011,<sup>11</sup> leaving Pratt and Whitney as a sole-source supplier with no incentive to reduce its profits.<sup>12</sup>

The F-35A cost per flying hour (CPFH) is falling, but one must wade through Mark Twain's "lies, damned lies and statistics" to find out how the jet is doing with this maligned metric. CPFH calculations vary significantly between evaluating agencies, but all of them add costs for the F-35 that they do not include for the fourth-generation fighters to which they seek to compare it. Electronic counter measures (ECM) and a precision infrared (IR) targeting system are built into the F-35, elevating the jet's maintenance requirements and ultimately its CPFH. Fighters like the F-15E and E(X), F-16C, and FA-18E require additional equipment like external pods to give them similar capabilities, but because they are not "built in" to those fourth-generation fighters, the pod's acquisition price is not factored into the jet's purchase price, and maintenance costs for those systems are not included in their CPFH calculations.

While DOD Selected Acquisition Reports (SARs) calculations still benefit fourth-generation systems, they are more balanced in their assumptions and show that the F-35A CPFH has dropped from \$32,554 an hour in 2014<sup>13</sup> to \$30,137 in 2018<sup>14</sup> (in FY 2012 dollars). When you consider that maintenance for the F-35's Targeting and ECM systems are included in that price, it begins to compare much more favorably with the F-16 CPFH of \$25,541 (in FY 2012 dollars) as well as the elusive CPFH for the F-15E and its sibling the F-15E(X). Time will tell whether the F-35 CPFH will make it down to the target of \$25,000, but if Lockheed Martin's work reducing the F-35A's cost can be used as a guide, the jet's CPFH may very well fall below the historic cost for the F-15E (and F-15EX)<sup>15</sup> and compete with the F-16C, even with CPFH calculations that favor those jets.

## Mission-Capable (MC) Rates

MC rates for the F-35 rose considerably over the past year but are still below the 80 percent threshold set for the fleet by the Secretary of Defense in 2018. According to Lieutenant General Eric Fick, director of the F-35 Joint Program Office (JPO), the MC rate increased from 55 percent in 2018 to 73.2 percent (an increase of 18.5 percent) in 2019. With priority for parts, forward-deployed F-35 combat squadrons were able to sustain an 89 percent MC rate,<sup>16</sup> which means that the availability of parts for the fleet is still an issue.

## Repair Depots, Parts, and Support Systems

When an F-35 component fails, it is replaced with an available spare, and the failed part is shipped to a depot for repair. It has been estimated that [68 depots](#) are necessary to sustain the F-35 weapons system,<sup>17</sup> but just 30 are up and running, and only 11 of those are fully operational.<sup>18</sup> Parts availability for the F-35 will continue to hold down MC rates until all depots are operating at capacity. Lockheed Martin and the F-35 JPO have accelerated their efforts to get depots operational and now project that all 64 depots will be operational by 2024, five years earlier than the estimated 2029.<sup>19</sup> Assuming that funding for parts remains consistent, the parts shortfall should end, allowing fleet-wide F-35 MC rates to meet or exceed 80 percent.

The Helmet Mounted Display System (HMDS) for the F-35A is still having problems. The HMDS gives pilots an unparalleled level of situational awareness in combat as it displays all critical flight and weapons systems data on the inside of the pilot's visor. The image from the system's built-in night vision camera is also projected onto the visor, as is the image from the DAS that automatically tracks and provides vivid cues on the location of friendly and enemy aircraft directly to the pilot. The HMDS is a game changer in combat, but interface issues with its display have caused pilots to become disoriented when refueling or while landing the jet at night.<sup>20</sup> Lockheed Martin went to work fixing this system just as soon as pilots flagged it as an urgent operational need, and that fix is currently being fielded for Navy F-35Cs. It may take several years before the HMDS fix makes its way to the Air Force.

F-35 simulators (sims) are finally coming up to expectations. The jet's software includes threat intelligence libraries that hold emissions and signals data that allow the F-35A to identify, precisely locate, and engage threats. Signals intelligence and other collection methods that feed those libraries are constantly at work gathering data on the spectrum of adversary systems, and getting those updates into the F-35 is obviously important. All too frequently, the version of software in the sims has been two updates behind what is in the jets.<sup>21</sup> While there is still a delay in getting software to the sims, it is now down to just six weeks.<sup>22</sup> Funding for simulator software updates must remain a high priority until the updates for the sim are simultaneous with those for the jet.

The Autonomic Logistics Information System (ALIS) is still too big, too slow, and suffering too many problems. Every aspect of the F-35A's maintenance, supply, and operations is managed through the F-35A ALIS. Much like an Apple iPhone Operating System (iOS), ALIS is a computer operating system that holds a conglomeration of 65 applications, subprograms, or modules. Some were built exclusively for the F-35A, and others are

commercial off-the-shelf (COTS) programs, and the problems arise when digital inputs from either the jet or a more modern ALIS application meet analog inputs or processing from another module. The DOD has elected to replace ALIS with a cloud-based operational data integrated network (ODIN). The new system is designed to decrease workload and increase mission capability rates for all F-35 variants and should begin fielding later this year.<sup>23</sup>

Overall, the F-35A fighter is flying exceptionally well and now provides the United States with a significant competitive advantage against peer competitors. Improvements are being fielded daily, but critical weapons system elements like repair depots and support systems like ALIS/ODIN are still years away from meeting established requirements for the weapons system.

## Conclusion

The capabilities that the F-35A provides the U.S. Air Force are vital to the nation's defense. That fact, coupled with the dramatic drop in price, makes this stealth platform not just more cost-effective than fourth-generation fighters, but actually a cheaper jet to buy while still dominating the field in combat effectiveness. Therefore:

- The Air Force should immediately end procurement efforts for the F-15EX and accelerate the acquisition of the F-35A as rapidly as possible. It should acquire 80 F-35As in FY 2021, 100 in FY 2022, and 120 in FY 2023.
- The Defense Department should continue to fund the accelerated stand-up of the 34 remaining F-35A depot repair facilities.
- The Joint Program Office should accelerate the fielding of the HMDS fix to U.S. Air Force F-35As to ensure that all combat-coded squadrons are fully equipped by the end of FY 2020.
- Lockheed Martin and the U.S. Air Force should continue to streamline maintenance practices and drive down the CPFH for the F-35A so that the \$25,000 threshold can be met by 2025.

**John Venable**, a graduate of the USAF Fighter Weapons Instructor Course with more than 3,300 hours in the F-16C, is Senior Research Fellow for Defense Policy in the Center for National Defense, of the Kathryn and Shelby Cullom Davis Institute for National Security and Foreign Policy, at The Heritage Foundation.

## Endnotes

1. "US Air Force's Hill Base Receives Final F-35 Lightning II Fighter," Air Force Technology, December 20, 2019, <https://www.airforce-technology.com/news/usaf-hill-afb-final-f-35-lightning-ii/> (accessed February 26, 2020).
2. John Venable, "The F-35A Fighter Is the Most Dominant and Lethal Multi-Role Weapons System in the World: Now Is the Time to Ramp Up Production," Heritage Foundation *Backgrounder* No. 3406, May 14, 2019, p. 10, <https://www.heritage.org/defense/report/the-f-35a-fighter-the-most-dominant-and-lethal-multi-role-weapons-system-the-world>.
3. Jeremiah Gertler, "F-35 Joint Strike Fighter (JSF) Program,": Congressional Research Service *Report for Members and Committees of Congress*, April 23, 2018, p. 22, <https://fas.org/sgp/crs/weapons/RL30563.pdf> (accessed February 26, 2020).
4. Compounding year over year, inflation of 12.36 percent would bring the price from \$77.5 million in 2012 to \$87.1 million in 2020—a price that includes airframe, engine, and profit. CPI Inflation Calculator, <https://www.in2013dollars.com/us/inflation/2012?amount=77.50> (accessed February 26, 2020).
5. Valarie Insinna, "In Newly Inked Deal, F-35 Price Falls to \$78 Million a Copy," *Defense News*, October 29, 2019, <https://www.defensenews.com/air/2019/10/29/in-newly-inked-deal-f-35-prices-fall-to-78-million-a-copy/> (accessed February 26, 2020).
6. The Air Force will buy 221 EPAWSS for a total flyaway cost of \$1.537 billion in 2016 dollars, which equates to \$7.47 million/system in 2020. U.S. Department of Defense, *F-15 Eagle Passive Active Warning Survivability System (F-15 EPAWSS) as of FY 2020 President's Budget*, Selected Acquisition Report RCS: DD-A&T(Q&A)823-485, December 2018, p. 21, [https://www.esd.whs.mil/Portals/54/Documents/FOID/Reading%20Room/Selected\\_Acquisition\\_Reports/19-F-1098\\_DOC\\_31\\_F-15\\_EPAWSS\\_SAR\\_Dec\\_2018.pdf](https://www.esd.whs.mil/Portals/54/Documents/FOID/Reading%20Room/Selected_Acquisition_Reports/19-F-1098_DOC_31_F-15_EPAWSS_SAR_Dec_2018.pdf) (accessed February 26, 2020), and CPI Inflation Calculator.
7. The U.S. Air Force selected Lockheed Martin as the 60 percent share winner of an Advanced Targeting Pod-Sensor Enhancement (ATP-SE) competition (Sniper Pod) contract valued at \$1.667 billion for 670 targeting pods. Lockheed Martin, "Lockheed Martin's Sniper Pod Is Majority Winner for Advanced Targeting Pod-Sensor Enhancement Contract; Total Potential Value Exceeds \$1 Billion," *Defense Aerospace.com*, October 20, 2010, <http://www.defense-aerospace.com/articles-view/release/3/119275/lockheed%2C-northrop-share-%242.3bn-order-for-targeting-pods.html> (accessed February 26, 2020).
8. Valerie Insinna, "Raytheon Snags F-35 System Business Previously Held by Northrup," *Defense News*, June 13, 2018, <https://www.defensenews.com/air/2018/06/13/raytheon-beats-out-northrop-to-provide-key-f-35-system/> (accessed February 26, 2020).
9. U.S. Department of Defense, *F-35 Lightning II Joint Strike Fighter (JSF) Program (F-35) as of FY 2020 President's Budget*, Selected Acquisition Report RCS: DD-A&T(Q&A)823-198, December 2018, p. 66, [https://www.esd.whs.mil/Portals/54/Documents/FOID/Reading%20Room/Selected\\_Acquisition\\_Reports/19-F-1098\\_DOC\\_33\\_F-35\\_SAR\\_Dec\\_2018.pdf](https://www.esd.whs.mil/Portals/54/Documents/FOID/Reading%20Room/Selected_Acquisition_Reports/19-F-1098_DOC_33_F-35_SAR_Dec_2018.pdf) (accessed February 26, 2020).
10. Based on Author's discussions with senior representatives within the U.S. Air Force and Lockheed Martin on February 4, 2020, and February 7, 2020.
11. Jim Wolf, "U.S. Kills GE/Rolls Royce Engine for F-35 Fighter," *Reuters*, April 25, 2011, <https://www.reuters.com/article/us-ge-engine/u-s-kills-ge-rolls-royce-engine-for-f-35-fighter-idUSTRE73056G20110425> (accessed February 26, 2020).
12. John Venable, "If Trump Wants Lower F-35 Costs, He Should Compete F135 Engine," *Breaking Defense*, January 17, 2017, <https://breakingdefense.com/2017/01/if-trump-wants-lower-f-35-costs-he-should-compete-f135-engine/> (accessed February 26, 2020).
13. U.S. Department of Defense, *F-35 Lightning II Joint Strike Fighter (JSF) Program (F-35)*, p. 91.
14. *Ibid.*, p. 66.
15. Douglas Birkey, "The Pentagon's Cost Assessment Office Needs to Reassess Its F-15EX Findings," *Defense News*, March 29, 2019, <https://www.defensenews.com/opinion/commentary/2019/03/29/the-pentagons-cost-assessment-office-needs-to-reassess-its-f-15ex-findings/> (accessed February 26, 2020).
16. Eric T. Fick, "F-35 PEO End of Year Message to Ms. Lord and Senior Department Leadership," December 19, 2019 (not available online), and Lieutenant General Eric Fick, Program Executive Officer, F-35 Lightning II Program, Statement on "F-35 Program Update: Sustainment, Production, and Affordability Challenges" before the Readiness and Tactical Air Land Forces Subcommittees of the Committee on Armed Services, U.S. House of Representatives, November 13, 2019, <https://www.congress.gov/116/meeting/house/110184/witnesses/HHRG-116-AS03-Wstate-FickE-20191113.pdf> (accessed February 26, 2020).
17. U.S. Government Accountability Office, *F-35 Aircraft Sustainment: DOD Needs to Address Substantial Supply Chain Challenges*, GAO-19-321, April 2019, p. 15, note 24, <https://www.gao.gov/assets/700/698693.pdf> (accessed February 26, 2020).
18. Interview with senior Lockheed Martin Officials, January 17, 2020.
19. *Ibid.*
20. Venable, "The F-35A Fighter Is the Most Dominant and Lethal Multi-Role Weapons System in the World," p. 10.
21. Major General Scott Pleus, Director of Plans, Programs, and Requirements, Headquarters Air Combat Command, response to query, March 21, 2019.
22. The actual term used was "negative training," which means training that would undermine their chances of being effective, or of surviving in combat.
23. Pat Host, "Pentagon Announces Replacement for F-35's ALIS," *Jane's*, January 22, 2020, <https://www.janes.com/article/93861/pentagon-announces-replacement-for-f-35-s-alis> (accessed February 26, 2020).