



Testimony
Before the Subcommittee on Tactical Air
and Land Forces, Committee on Armed
Services, House of Representatives

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F-35 JOINT STRIKE FIGHTER

Preliminary Observations on Program Progress

Statement of Michael J. Sullivan, Director
Acquisition and Sourcing Management

Accessible Version

GAO Highlights

Highlights of [GAO-16-489T](#), a testimony before the Subcommittee on Tactical Air and Land Forces, Committee on Armed Services, House of Representatives

Why GAO Did This Study

With estimated acquisition costs of nearly \$400 billion, the F-35 Joint Strike Fighter—also known as the Lightning II—is DOD's most costly acquisition program. Since 2001, GAO has reported extensively on the F-35 program's cost, schedule, and performance problems. The program plans to begin increasing production rates over the next few years.

The National Defense Authorization Act for Fiscal Year 2015 contains a provision for GAO to annually review the F-35 acquisition program. Today's testimony is based on ongoing work for the first report under this mandate, which GAO expects to issue in April 2016. This testimony focuses on GAO's preliminary observations regarding the F-35 program's (1) future modernization (2) affordability, remaining development, and ongoing manufacturing plans.

GAO analyzed program documentation including management reports, test data and results, and internal DOD program analyses. GAO collected data on F-35 development and test progress, and analyzed total program funding requirements. GAO also collected and analyzed production and supply chain performance data, and interviewed DOD, program, and contractor officials.

In light of its ongoing work, GAO is not making any recommendations at this time.

View [GAO-16-489T](#). For more information, contact Michael J. Sullivan at (202) 512-4841 or sullivanm@gao.gov.

March 23, 2016

F-35 JOINT STRIKE FIGHTER

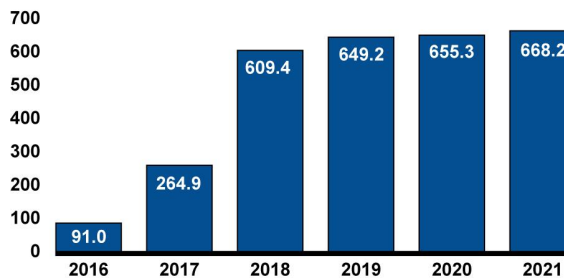
Preliminary Observations on Program Progress

What GAO Found

GAO's ongoing work on the F-35 Joint Strike Fighter (F-35) program shows that the Department of Defense (DOD) has begun planning and funding significant new development work to add to the F-35's capabilities, an effort known as Block 4. The funding needed for this effort is projected to be nearly \$3 billion over the next 6 years (see figure below), which would qualify it as a major defense acquisition program in its own right.

F-35 Block 4 Development Costs Increase Near-Term Funding Needs

Dollars (then-year millions)



Source: GAO analysis of Department of Defense data. | GAO-16-489T

DOD does not currently plan to manage Block 4 as a separate program with its own acquisition program baseline but rather as part of the existing baseline. As a result, Block 4 will not be subject to key statutory and regulatory oversight requirements, such as providing Congress with regular, formal reports on program cost and schedule performance. A similar approach was initially followed on the F-22 Raptor modernization program, in which the funding and content were comingled making it difficult to separate the performance and cost of the modernization from the baseline program. Best practices recommend an incremental approach in which new development efforts are structured and managed as separate acquisition programs with their own requirements and acquisition program baselines. The F-22 eventually adopted such an approach. If the Block 4 effort is not established as a separate acquisition program, cost, schedules, and the scope of the baseline and modernization efforts will be comingled. Therefore, it will be difficult for Congress to hold DOD accountable for achieving its cost, schedule, and performance requirements.

GAO's ongoing work indicates that although the F-35 total program acquisition costs have decreased since 2014, the program continues to face significant affordability challenges. DOD plans to begin increasing production and expects to spend more than \$14 billion annually for nearly a decade on procurement of F-35 aircraft. Currently, the program has around 20 percent of development testing remaining, including complex mission systems software testing, which will be challenging. Program officials continued to address many of the key technical risks, but the Autonomic Logistics Information System continues to be a challenge. At the same time, the contractors that build the F-35 airframes and engines continue to report improved manufacturing efficiency and supply chain performance.

Chairman Turner, Ranking Member Sanchez, and Members of the Subcommittee:

Thank you for the opportunity to discuss our ongoing work on the F-35 Joint Strike Fighter (F-35), also known as the Lightning II. With estimated acquisition costs approaching \$400 billion, the F-35 is the Department of Defense's (DOD) most costly acquisition program. Through this program, DOD is developing and fielding a family of strike fighter aircraft, integrating low observable (stealth) technologies with advanced sensors and computer networking capabilities for the United States Air Force, Navy, and Marine Corps, as well as eight international partners.¹ The F-35 family is comprised of the F-35A conventional takeoff and landing variant, the F-35B short takeoff and vertical landing variant, and the F-35C carrier-suitable variant. Over time, the program has made a number of changes affecting the planned quantities and associated costs.² According to current projections, the U.S. portion of the program will require acquisition funding of \$12.7 billion a year, on average, from now through 2038 to complete development and procurement of 2,457 aircraft. DOD also estimates that the F-35 fleet will cost around \$1 trillion to operate and support over its lifetime, which poses significant long-term affordability challenges for the department.

As we have previously reported, the F-35 program's significant cost, schedule, and performance problems can largely be traced to (1) decisions made at key junctures without adequate product knowledge; and (2) a highly concurrent acquisition strategy with significant overlap among development activities, flight testing, and production.³ This testimony is based on preliminary observations from our latest annual review of the overall F-35 program. Our work for the ongoing review is being conducted in response to a provision of the National Defense

¹The international partners are the United Kingdom, Italy, the Netherlands, Turkey, Canada, Australia, Denmark, and Norway. These nations contributed funds for system development and signed agreements to procure aircraft. In addition, Israel and Japan have signed on as foreign military sales customers.

²An overview of changes in program cost and quantity from 2001 through 2015 can be found in appendix I.

³GAO, *Joint Strike Fighter: DOD Actions Needed to Further Enhance Restructuring and Address Affordability Risks*, [GAO-12-437](#) (Washington, D.C.: June 14, 2012); *Joint Strike Fighter: Current Outlook Is Improved, but Long-Term Affordability is a Major Concern*, [GAO-13-309](#) (Washington, DC.: Mar. 11, 2013)

Authorization Act for Fiscal Year 2015, for GAO to review the F-35 acquisition program annually until the program reaches full-rate production. This statement, similar to our ongoing work, assesses: (1) future modernization; (2) program cost and affordability; (3) remaining development and testing; and (4) ongoing manufacturing including supply chain performance. We plan to issue our final report in April 2016.

For our ongoing work, we reviewed budget documents to identify costs associated with the future modernization effort and collected and analyzed information regarding capability and oversight plans. We reviewed and analyzed best practices identified by GAO and reviewed relevant DOD policies and statutes. To assess cost and affordability, we reviewed and analyzed program funding requirements through 2038 and compared cost information as of March 2016 to prior years. To assess ongoing development and testing we reviewed and analyzed test data and results, program briefings, and internal program analyses. To assess ongoing manufacturing and supply chain performance, we collected and analyzed manufacturing and supply chain performance data from Lockheed Martin, Pratt & Whitney, and DOD. We assessed the reliability of the cost, schedule, and performance data by reviewing supporting documentation and interviewing knowledgeable officials. Based on these steps, we determined that all of the data we used were sufficiently reliable for the purposes of this report. We discussed the information in this statement with DOD officials and incorporated their comments as appropriate. The ongoing work on which this statement is based is being conducted 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.

In brief, our preliminary results indicate that DOD plans to manage F-35 modernization as part of the existing program baseline, which has oversight implications. DOD has begun planning and funding significant new development work to add to the F-35's capabilities, known as Block 4. The funding needed for this effort is projected to be nearly \$3 billion over the next 6 years, which would qualify it as a major defense acquisition program in its own right. DOD does not currently plan to manage Block 4 as a separate program with its own acquisition program baseline but rather as part of the existing baseline. As a result, Block 4 will not be subject to key statutory and regulatory oversight requirements, such as providing Congress with regular, formal reports on program cost

and schedule performance. A similar approach was initially followed on the F-22 Raptor modernization program, making it difficult to separate the performance and cost of the modernization from the baseline program. Best practices recommend an incremental approach in which new development efforts are structured and managed as separate acquisition programs with their own requirements and acquisition program baselines. The F-22 eventually adopted this approach. If the Block 4 effort is not established as a separate acquisition program, transparency will be limited. Therefore, it will be difficult for Congress to hold DOD accountable for achieving its cost, schedule, and performance requirements.

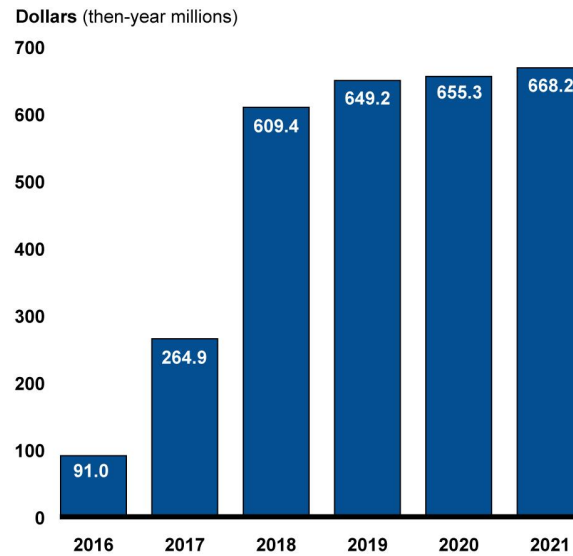
In addition, our ongoing work indicates that although the estimated F-35 program acquisition costs have decreased since 2014 the program continues to face significant affordability challenges. DOD plans to increase annual spending on F-35 aircraft procurements over the next 5 years and expects to need more than \$14 billion annually for most of the following decade. Moreover, the program's total operating and sustainment costs are estimated to be around \$1 trillion which some within the Office of the Secretary of Defense have stated is unaffordable. Currently, the program has around 20 percent of development testing remaining, including complex mission systems software testing, which will be challenging. The program continues to address technical risks but challenges with the Autonomic Logistics Information System (ALIS) remain. At the same time, the contractors that build the F-35 airframes and engines continue to report improved manufacturing efficiency and supply chain performance.

DOD's Approach to Managing Follow-on Modernization May Hinder Transparency and Oversight

The F-35 program has begun planning and funding the development of new capabilities, known as follow-on modernization, but our ongoing work indicates that DOD's current plan for managing the development of these new capabilities may limit transparency and oversight. The current F-35 development program is projected to end in 2017, when Block 3F developmental flight testing is complete, with a total development cost of \$55 billion. The first increment of follow-on modernization, known as Block 4, is expected to add new capabilities and correct deficiencies of 9 capabilities carried over from the current development program such as the prognostics health management system down-link and communication capabilities. Although the requirements are not yet final and no official cost estimate has been developed for Block 4, DOD's fiscal year 2017 budget request indicates that the department expects to spend

nearly \$3 billion on these development efforts over the next 6 years (see figure 1).

Figure 1: F-35 Joint Strike Fighter Block 4 Development Costs Increase Near-term Funding Needs



Source: GAO analysis of Department of Defense data. | GAO-16-489T

Our preliminary analysis indicates that F-35 Block 4 development costs of this magnitude would exceed the statutory and regulatory thresholds for what constitutes a major defense acquisition program (MDAP), and it would be larger than many of the MDAPs in DOD's current portfolio. However, in August 2015, the Under Secretary of Defense for Acquisition, Technology, and Logistics issued an Acquisition Decision Memorandum directing the F-35 program office to manage Block 4 development under the existing F-35 acquisition program baseline and not as a separate incremental acquisition program. As a result, DOD will not hold a Milestone B review—the decision point in which program officials would present a business case in order to initiate system development. A Milestone B review would also set in motion oversight mechanisms including an acquisition program baseline; Nunn-McCurdy unit cost

growth thresholds⁴; and periodic reporting of the program's cost, schedule, and performance progress. These mechanisms form the basic business case and oversight framework to ensure that a program is executable and that Congress and DOD decision makers are informed about the program's progress. Best practices recommend an incremental approach in which new development efforts are structured and managed as separate acquisition programs and that a business case should match requirements with resources—proven technologies, sufficient engineering capabilities, time, and funding—before undertaking a new product development.⁵ Because DOD does not yet have approved requirements and is not planning to hold a Milestone B review, its approach for Block 4 modernization will not require the program to have such important cost, schedule, and performance reporting and oversight mechanisms in place.

Based on our ongoing work, we have concerns about DOD's approach to Block 4 that are partly rooted in our assessment of a similar case with the F-22 modernization program. In March 2005 we found that the Air Force was managing its multi-billion dollar F-22 modernization efforts as part of the program's existing acquisition baseline and had not established a separate knowledge-based business case.⁶ As a result, the F-22 baseline and schedule were adjusted to reflect the new timeframes and additional costs, comingling the funding and some content for the baseline development and modernization efforts—some content that had not been achieved under the baseline program were deferred into the modernization program. When the content, scope, and phasing of modernization

⁴Section 2433 of title 10 of the United States Code, commonly referred to as Nunn-McCurdy, requires DOD to notify Congress whenever a major defense acquisition program's unit cost experiences cost growth that exceeds certain thresholds. This is commonly referred to as a Nunn-McCurdy breach. Significant breaches occur when the program acquisition unit cost or procurement unit cost increases by at least 15 percent over the current baseline estimate or at least 30 percent over the original estimate. For critical breaches, when these unit costs increase at least 25 percent over the current baseline estimate or at least 50 percent over the original, DOD is required to take additional steps, including conducting an in-depth reassessment of the program. Programs with critical breaches must be terminated unless the Secretary of Defense certifies to certain facts related to the program and takes other actions, including restructuring the program. 10 U.S.C. § 2433a.

⁵GAO, *Tactical Aircraft: Air Force Still Needs Business Case to Support F/A-22 Quantities and Increased Capabilities*, [GAO-05-304](#) (Washington, D.C.: March 15, 2005) and GAO, *Best Practices: Better Matching of Needs and Resources Will Lead to Better Weapon System Outcomes*, [GAO-01-288](#) (Washington, D.C.: March 8, 2001).

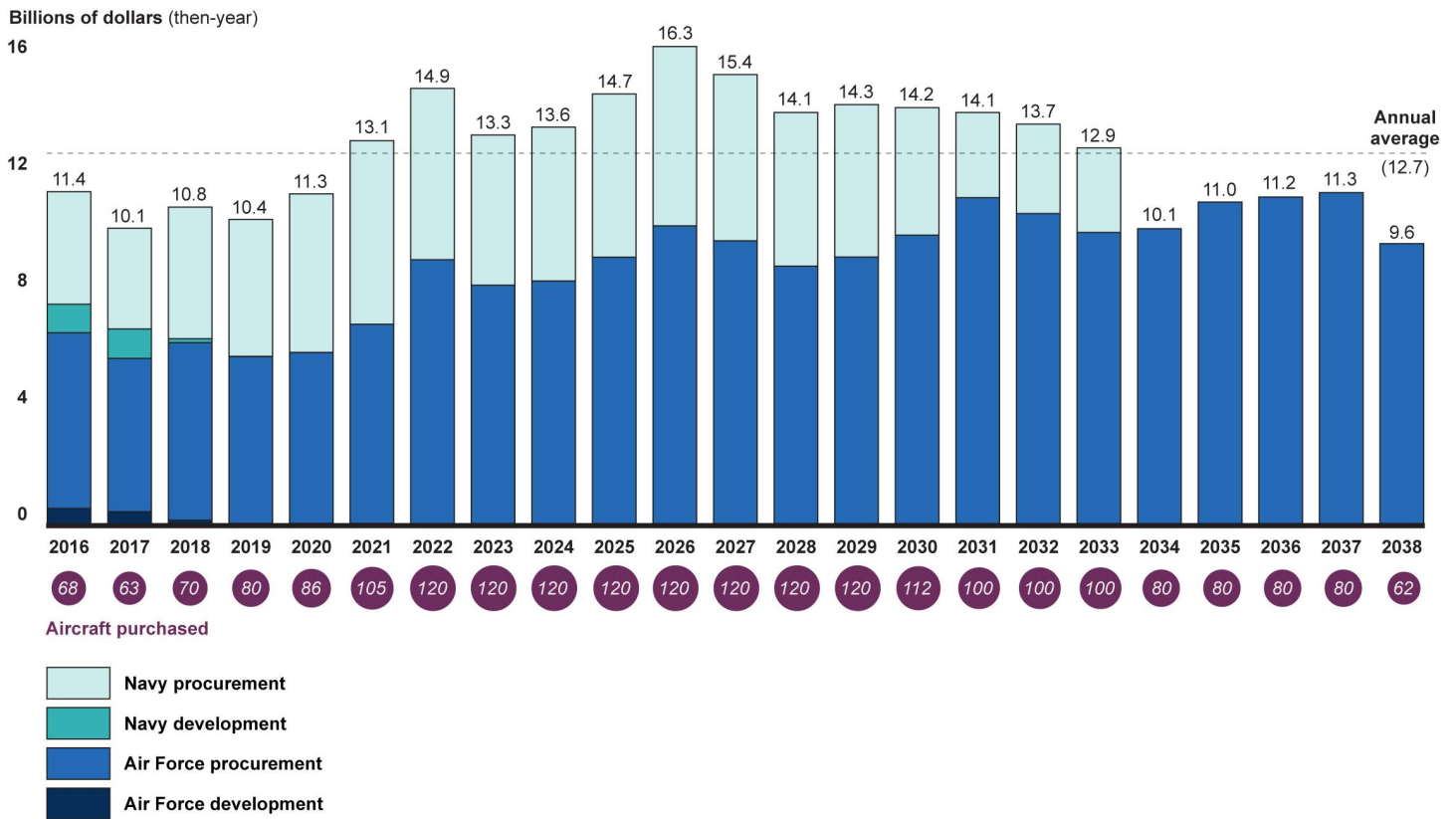
⁶[GAO-05-304](#).

capabilities changed over time, it appeared that the F-22 program was fraught with new schedule delays and further cost overruns. The comingling of modernization efforts with the existing baseline reduced transparency and Congress could not distinguish the new costs associated with modernization funding from cost growth in the original baseline. We recommended that the Air Force structure and manage F-22 modernization as a separate acquisition program with its own business case—matching requirements with resources—and acquisition program baseline. Eventually, the department separated the F-22 modernization program from the baseline program with a Milestone B review, in line with our recommendation, which increased transparency and better facilitated oversight. The department has the opportunity to apply similar lessons learned to the F-35 Block 4 program.

Program Continues to Face Affordability Challenges

Although the estimated F-35 program's total acquisition costs have decreased since 2014, the program continues to face affordability challenges. As of March 2016, DOD's estimated total acquisition cost for the F-35 program is \$379 billion, or \$12.1 billion less than it reported in 2014. The program will require an average of \$12.7 billion per year to complete the procurement of aircraft through 2038 (see figure 2).

Figure 2: F-35 Joint Strike Fighter Budgeted Development and Procurement Costs Reported By Service as of December 2015



Source: GAO analysis of Department of Defense data. | GAO-16-489T

Note: Program office data from December 2015 was used to determine yearly funding requirements reflected in this figure, because updated funding data was not available at the time of this testimony.

The program expects to reach peak production rates for U.S. aircraft in 2022, at which point DOD expects to spend more than \$14 billion a year on average for a decade. At the same time, DOD will be operating and sustaining an increasing number of fielded F-35 aircraft. DOD officials we spoke with for our September 2014 report, stated that the current F-35 sustainment strategy with cost estimates around \$1 trillion is not

affordable.⁷ When acquisition and sustainment funds are combined, annual funding requirements could easily approach \$30 billion in some years.

Our preliminary results indicate that affordability challenges will compound as the program competes with other large acquisition programs including the long range strike bomber, KC-46A Tanker, Ohio Class Submarine Replacement and the DDG-51 Class Destroyer. In recent years, affordability challenges, in part, have forced the Air Force to defer F-35 aircraft procurements to later years. Since 2014, the Air Force has deferred 45 aircraft between 2017 and 2021 to later years. This will likely require the military service to make unplanned investments in extending the service life of their current fighter aircraft. The cost of extending the lives of current fighter aircraft and acquiring other major weapon systems, while continuing to produce and field new F-35 aircraft, poses significant affordability risks in a period of austere defense budgets.

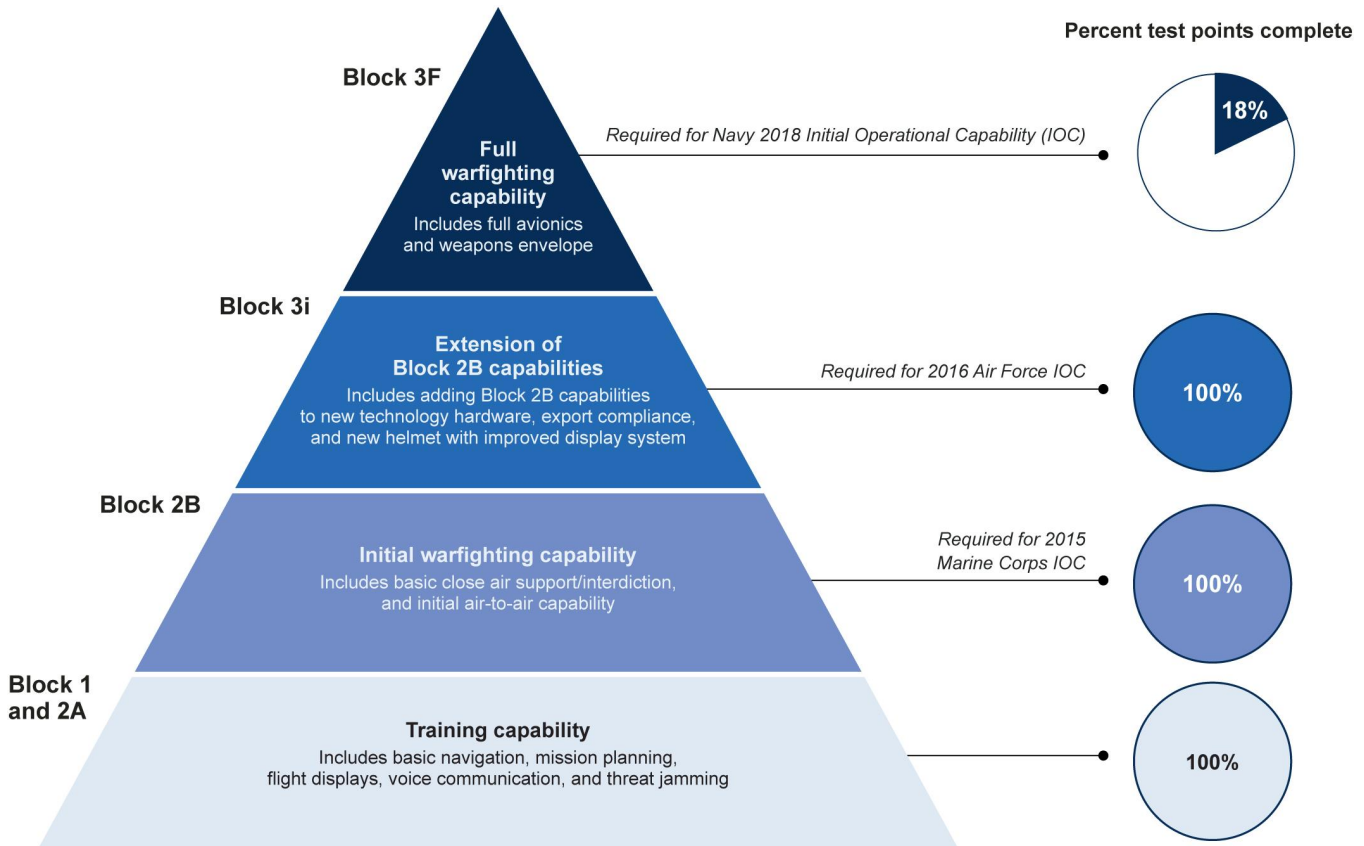
Developmental Flight Testing Is Nearing Completion with Challenging Mission Systems Software Testing Remaining

The F-35 program is nearing the completion of the initial developmental test program with about 20 percent of its flight sciences and mission systems testing remaining; however our ongoing work indicates that the remaining testing is likely to be challenging as it will require complex missions and stressing environments. Developmental flight testing is separated into two key areas referred to as flight sciences and mission systems. Developmental flight science testing is done to verify the aircraft's basic flying capabilities, while mission systems testing is done to verify that the software and systems that provide warfighting capabilities function properly and meet requirements. The F-35 program is nearing the completion of developmental flight testing with only 20 percent of its total planned test points remaining. Before completing the remaining high speed and high altitude flight science testing, Lockheed Martin officials noted that they will incorporate a pressure relief valve into the aircraft's fuel system to allow the aircraft to fly at altitudes and speeds that are currently restricted due to fuel pressure concerns.

As we have reported in the past, DOD is developing, testing, and fielding mission systems capabilities in software blocks (see figure 3).

⁷GAO- F-35 Sustainment: Need for Affordable Strategy, Greater Attention to Risks, and Improved Cost Estimates, GAO-14-778 (Washington, D.C.: September 23, 2014).

Figure 3: Subsequent Development and Flight Test Status of F-35 Joint Strike Fighter Mission Systems Software Blocks as of December 2015



Source: GAO analysis of Department of Defense data. | GAO-16-489T

The full warfighting capability for the F-35 is to be attained with the completion of Block 3F, the final software block in the current development program. As indicated by the percent of test points completed, all of the blocks leading up to 3F have been completed, although they experienced delays in getting to this point. Block 3F has completed 18 percent of its test points. Our preliminary findings show that the program completed all of the mission systems software testing planned in 2015, but completion of Block 3F testing could be challenging given the complexity of the missions and the stressing environments that remain to be tested. Program officials believe that the completion of 3F developmental testing could be delayed by about 2-3 months. As of December 2015, our preliminary analysis of program data indicated that Block 3F testing could be delayed by as much as 6 months if the program

performs at the same rate it has in the past and is executed according to the current plan with no additional test point growth.⁸ Delays could be exacerbated by the current mission system software stability issues and large number of remaining weapon delivery accuracy events that must take place.

Our preliminary work indicates that in 2015 program officials continued to address many of the key technical risks that we have highlighted in the past—including an engine seal and the helmet mounted display—and they identified some new risks. Problems with the engine seal were addressed through a design change that was incorporated into production, and as of September 2015, 69 of 180 engines had undergone retrofits. A new helmet—known as the Gen III helmet—that is intended to address shortfalls in night vision capability, among others, was developed and delivered to the program in 2015. Developmental testing of the new helmet is mostly complete, with final verification testing planned in 2016. The program also identified new risks with the ejection seat and cracking in the F-35C wing structure. Program officials discovered that pilots less than 136 pounds could possibly suffer neck injuries during ejection. Officials noted that although the problem was discovered during testing of the new helmet, the helmet’s weight was not the root cause. The program is exploring a number of possible solutions to ensure pilot safety. In addition, program officials discovered cracking in the wing structure of the F-35C structural test aircraft during durability testing. Structural testing was halted for about 3 months, and Lockheed Martin officials we spoke with stated that a long-term fix had not been identified.

Although improvements have been made, ALIS continues to pose technical risks. Recognizing that a fully functional ALIS is critical to the program’s overall success, in October 2015, the F-35 executive program officer testified before Congress that ALIS is one of the most significant technical and schedule risks to the program. ALIS is a complex system of systems that supports operations, mission planning, supply-chain management, maintenance, and other processes. In the past, we have reported that ALIS software has not been delivered on time and has not

⁸Test point growth is defined as test points that are unplanned and are required to be conducted, often as a result of issues found during testing. The program plans for test point growth, but has historically experienced higher growth than anticipated.

functioned as expected when it is delivered.⁹ In addition to continuing software problems, our ongoing work indicates that the F-35 program faces other key challenges related to ALIS. For example, some equipment management data is inaccurate or incomplete and engine health information is not included in the current version of ALIS. In addition, the system may not be deployable and does not have a backup in case the hardware system was to fail.¹⁰

Ongoing Manufacturing and Reliability Progress Continue

Our ongoing work has shown that the F-35 airframe and engine contractors continue to report improved efficiency and supply chain performance, and program data indicates that reliability and maintainability are also improving. Since 2011, a total of 154 aircraft have been delivered to DOD and international partners, 45 of which were delivered in 2015.¹¹ As Lockheed Martin continues to deliver more aircraft, the number of hours needed to manufacture each aircraft continues to decline. Although prior to 2015 Lockheed Martin had only delivered one aircraft on or ahead of its contracted delivery date, the contractor has been making progress and in 2015 the contractor was able to deliver 15 of the 45 aircraft on time or early. Other manufacturing data are also trending in a positive direction. For example, scrap, rework, and repair hours, and time spent on work conducted out of sequence continue to decrease. Although it has improved, Lockheed Martin's supply chain continues to deliver parts late to production, resulting in inefficiencies and requiring workarounds.

Engine manufacturing deliveries remain steady and 218 engines have been delivered to date. The labor hours required for assembling engines has remained steady and very little additional efficiency is expected. As a result, Pratt & Whitney is looking for additional ways to save cost. Scrap,

⁹GAO, *Joint Strike Fighter: DOD Actions Needed to Further Enhance Restructuring and Address Affordability Risks*, [GAO-12-437](#) (Washington, D.C.: June 14, 2012); [GAO- F-35 Joint Strike Fighter: Program Completing Software Testing May Hinder Delivery of Expected Warfighting Capabilities](#), [GAO-14-322](#) (Washington, D.C.: March 24, 2014). [GAO- F-35 Sustainment: Need for Affordable Strategy, Great Attention to Risks, and Improved Cost Estimates](#), [GAO-14-778](#) (Washington, D.C.: September 23, 2014).

¹⁰GAO is currently conducting an in-depth review of ALIS. The final report is expected to be issued in April 2016.

¹¹Lockheed Martin has delivered 10 international: 2 to Australia, 1 to Italy, 3 to Great Britain, 2 to the Netherlands, and 2 to Norway.

rework, and repair costs have remained steady over the last year and engineering design changes is relatively low and continues to decrease. Pratt & Whitney is conducting production reviews of its supply chain and is managing supplier quality initiatives to address shortfalls, according to officials.

Our ongoing work shows that although the program has made progress in improving some reliability and maintainability measures, the program continues to fall short in some measures as shown in figure 4.

Figure 4: F-35 Joint Strike Fighter System-level Reliability and Maintainability Status as of August 2015

| Metric | Program office assessment Trend of values | | Program office assessment Trend of values | | Program office assessment Trend of values | |
|---|--|-------|--|-------|--|-------|
| | F-35A | F-35B | F-35B | F-35B | F-35C | F-35C |
| 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 | ● | + | ● | + | ● | + |
| Mean flight hours between critical failure – measures time between failures that result in the loss of a capability to perform a mission-essential function | ⊙ | + | ⊙ | – | N/A | N/A |
| Mean time to repair – measures the amount of time it takes a maintainer to repair a failed component or device | ⊙ | + | ⊙ | + | ● | + |
| Mean corrective maintenance time for critical failures – measures the amount of time it takes to correct critical failure events | ⊙ | – | ⊙ | + | N/A | N/A |
| Maintenance man hours per flight hour – measures the average amount of time spent on maintenance per flight hour | ● | + | ● | + | ● | – |
| Mean flight hours between maintenance event – measures all failures that lead to maintenance, unscheduled inspections, and servicing actions | ⊙ | + | ● | + | ⊙ | + |
| Mean flight hours between removal – measures time between part removals from the aircraft for replacement from the supply chain | ● | + | ● | + | ⊙ | + |

- At or above the plan line
 - At or above the threshold line
 - ⊙ Below the threshold line
 - +
 -
- Positive trend
Negative trend

Source: GAO analysis of Department of Defense data. | GAO-16-489T

While the metrics in most areas were trending in the right direction, the F-35 program office's own assessment indicated that as of August 2015 the F-35 fleet was falling short of reliability and maintainability expectations in 9 of 19 areas. The program has time to improve. As of August 2015, the F-35 fleet had only flown a cumulative total of 35,940 hours of the 200,000 cumulative flight hours required for system maturity.

Similarly, although engine reliability improved significantly in 2015, the engine was still not performing at expected levels. In 2014, Pratt and Whitney data indicated that engine reliability—measured as mean flight hours between failure (design controllable)¹²—was very poor and we reported in April 2015 that the engine would likely require additional design changes and retrofits.¹³ While Pratt & Whitney has implemented a number of design changes that have resulted in significant reliability improvements, the F-35A and F-35B engines are still at about 55 percent and 63 percent, respectively, of where the program expected them to be at this point.¹⁴ Program and contractor officials continue to identify ways to further improve engine reliability.

In conclusion, our preliminary results indicate that, although the F-35 development program is nearing completion, the program is not without risks. The remaining significant and complex 3F mission systems software developmental testing, continuing issues with ALIS, and new issues with the ejection seat and F-35C wing structures pose ongoing risks. Going forward, the program will likely continue to experience affordability and oversight challenges. DOD expects that beginning in 2022 it will need more than \$14 billion a year on average for a decade to procure aircraft. It is unlikely that the program will be able to receive and sustain such a high level of funding over this extended period, especially given DOD's competing resources such as the long range strike bomber and KC-46A tanker. DOD's plan to manage Block 4 under the current acquisition program baseline presents oversight challenges because key reporting requirements and oversight mechanisms will not be initiated; therefore, the two efforts will be comingled. Without setting up the

¹²This specific metric tracks failures that are directly attributed to design and are considered fixable with design changes.

¹³[GAO- F-35 Joint Strike Fighter: Assessment Needed to Address Affordability Challenges](#), [GAO-15-364](#) (Washington, D.C.: April 14, 2015)

¹⁴The F-35C variant will use the same engine as the F-35A variant.

modernization as a separate program with its own baseline and regular reporting as best practices recommend, it will be difficult for Congress to hold DOD accountable for achieving F-35 Block 4 cost, schedule, and performance goals. It also makes it easier to re-categorize work planned for the baseline program as modernization. In light of our ongoing work, we are not making any recommendations to DOD at this time. We plan to issue our final report in April 2016.

Chairman Turner, Ranking Member Sanchez, and members of the Subcommittee, this completes my prepared statement. I would be pleased to respond to any questions you may have. We look forward to continuing to work with the Congress as we to continue to monitor and report on the progress of the F-35 program.

GAO Contact and Staff Acknowledgments

For further information on this statement, please contact Michael Sullivan at (202) 512-4841 or sullivanm@gao.gov. Contact points for our Office of Congressional Relations and Public Affairs may be found on the last page of this statement. Individuals making key contributions to this statement are Travis Masters, Peter Anderson, Jillena Roberts, and Megan Setser.

Appendix I: Changes in Reported F-35 Joint Strike Fighter Cost, Quantity, and Deliveries, 2001-2015

| | Component | October 2001 initial baseline | March 2012 latest baseline | December 2015 estimates | Change from 2001 to 2012 | Change from 2012 to 2015 |
|--|----------------------------------|-------------------------------|----------------------------|-------------------------|--------------------------|--------------------------|
| Expected quantities (number of aircraft) | Developmental quantities | 14 | 14 | 14 | 0% | 0% |
| | Procurement quantities | 2,852 | 2,443 | 2,443 | -14 | 0 |
| | Total quantities | 2,866 | 2,457 | 2,457 | -14 | 0 |
| Cost estimates (then-year dollars in billions) ^a | Development | \$34.4 | \$55.2 | \$55.1 | 60% | -.18% |
| | Procurement | 196.6 | 335.7 | 319.1 | 71 | -4.94 |
| | Military construction | 2.0 | 4.8 | 4.8 | 140 | 0 |
| | Total program acquisition | 233.0 | 395.7 | 379 | 70 | -4.22 |
| Unit cost estimates (then-year dollars in millions) ^a | Program acquisition | \$81 | \$161 | \$154 | 99 | -4.35 |
| | Average procurement | 69 | 137 | 130.6 | 99 | -4.67 |
| Estimated delivery and production dates | Initial operational capability | 2010-2012 | Undetermined | 2015-2018 | undetermined | 5-6 years |
| | Full-rate production | 2012 | 2019 | 2019 | 7 years | 0 years |

Source: GAO analysis of DOD data | GAO-16-489T

^aAnnual projected cost estimates expressed in then-year dollars reflect inflation assumptions made by a program.

Appendix II: Accessible Data

Data Tables

Data Table for Figure 1 and Highlights Figure: F-35 Joint Strike Fighter Block 4 Development Costs Increase Near-term Funding Needs

| Year | Dollars (then-year millions) |
|------|------------------------------|
| 2016 | 91.0 |
| 2017 | 264.9 |
| 2018 | 609.4 |
| 2019 | 649.2 |
| 2020 | 655.3 |
| 2021 | 668.2 |

Data Table for Figure 2: F-35 Joint Strike Fighter Budgeted Development and Procurement Costs Reported By Service as of December 2015

| | Air Force development | Air Force procurement | Navy development | Navy procurement | Average | Aircraft purchased |
|--------|-----------------------|-----------------------|------------------|------------------|---------|--------------------|
| "2016" | 0.5155 | 6.0198 | 0.9737 | 3.857 | 11.4 | 68 |
| "2017" | 0.4035 | 5.25 | 1.0114 | 3.4532 | 10.1 | 63 |
| "2018" | 0.1136 | 6.0814 | 0.1322 | 4.5119 | 10.8 | 70 |
| "2019" | 0.0053 | 5.7102 | 0.0096 | 4.6919 | 10.4 | 80 |
| "2020" | 0.0054 | 5.8495 | 0.0058 | 5.4289 | 11.3 | 86 |
| "2021" | 0.0055 | 6.8191 | 0.0039 | 6.2878 | 13.1 | 105 |
| "2022" | 0 | 9.0387 | 0 | 5.8661 | 14.9 | 120 |
| "2023" | 0 | 8.1643 | 0 | 5.1451 | 13.3 | 120 |
| "2024" | 0 | 8.3072 | 0 | 5.2718 | 13.6 | 120 |
| "2025" | 0 | 9.1248 | 0 | 5.5928 | 14. | 120 |
| "2026" | 0 | 10.1977 | 0 | 6.1419 | 16.3 | 120 |
| "2027" | 0 | 9.6861 | 0 | 5.6928 | 15.4 | 120 |
| "2028" | 0 | 8.818 | 0 | 5.2636 | 14.1 | 120 |
| "2029" | 0 | 9.1267 | 0 | 5.2209 | 14.3 | 120 |
| "2030" | 0 | 9.8767 | 0 | 4.3725 | 14.2 | 112 |
| "2031" | 0 | 11.1599 | 0 | 2.9177 | 14.1 | 100 |
| "2032" | 0 | 10.6152 | 0 | 3.064 | 13.7 | 100 |
| "2033" | 0 | 9.9707 | 0 | 2.8957 | 12.9 | 100 |
| "2034" | 0 | 10.1021 | 0 | 0 | 10.1 | 80 |
| "2035" | 0 | 11.0095 | 0 | 0 | 11.0 | 80 |
| "2036" | 0 | 11.1847 | 0 | 0 | 11.2 | 80 |
| "2037" | 0 | 11.3339 | 0 | 0 | 11.3 | 80 |
| "2038" | 0 | 9.5869 | 0 | 0 | 9.6 | 62 |

Accessible Text for Figure 3: Subsequent Development and Flight Test Status of F-35 Joint Strike Fighter Mission Systems Software Blocks as of December 2015

Block 3F:

Full warfighting capability

Includes full avionics and weapons envelope

Percent test points complete: 18%

Block 3i:

Extension of Block 2B capabilities

Includes adding Block 2B capabilities to new technology hardware, export compliance, and new helmet with improved display system

Percent test points complete: 100%

Block 2B:

Initial warfighting capability

Includes basic close air support/interdiction, and initial air-to-air capability

Percent test points complete: 100%

Block 1 and 2A:

Training capability

Includes basic navigation, mission planning, flight displays, voice communication, and threat jamming

Percent test points complete: 100%

Source: GAO analysis of Department of Defense data. | GAO-16-489T

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