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Department of Defense
OFFICE OF PREPUBLICATION AND SECURITY REVIEW

F-35 LIGHTNING II JOINT STRIKE FIGHTER (JSF) PROGRAM (F-35)

December 2022 Selected Acquisition Report (SAR)



DECEMBER 31, 2022
DEPARTMENT OF THE NAVY

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Program Manager

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Mission and Description

The F-35 Lightning II Program will develop and field an affordable, highly common family of next-generation strike aircraft for the U.S. Navy, Air Force, Marine Corps, and allies. The F-35 is produced in three variants: F-35A; F-35B; and F-35C. The F-35A is a stealthy multi-role aircraft, intended to serve primarily in air-to-ground roles for the U.S. Air Force (USAF); replacing the F-16 and A-10, and complementing the F-22. The F-35B variant is a multi-role strike fighter aircraft, replacing the AV-8B and F/A-18A/C/D for the U.S. Marine Corps (USMC). The F-35C is also flown by the USMC, and provides the U.S. Navy (USN) a multi-role, stealthy strike fighter aircraft to complement the F/A-18E/F. The planned DoD F-35 Fleet will replace the joint services' legacy fleets. The transition from multiple type/model/series to a common platform will result in a smaller total force over-time and generate operational and overall cost efficiencies.

Executive Summary

Program Highlights Since Last Report

Significant Accomplishments:

- **Capability: We are Developing, Delivering, and Sustaining 5th Generation capabilities to dominate the Joint Battlespace against near peer adversaries.**
 - Awarded the Production \$30B Lot 15-17 contract for 398 aircraft
 - Authorized further Block 4 work that includes nearly \$1B high priority weapons integration and capability development
 - Delivered - 141 aircraft to 3 U.S. services, 6 international partners, and 2 FMS customers; 894 total F-35s delivered; expanded F-35B shipborne capability envelope for Italian Navy Ship – Cavour
 - Improved contracts data requirements data list D03M oversight of standard work package performance; created standardized review process of Logistics Product Data resulting from Maintenance Plan Changes (MPC)
 - Successfully achieved initial nuclear design certification meeting our Nation’s commitment to deliver Nuclear Design Certification to our NATO allies 15 months ahead of original timeline.

- **Affordability: We are committed to cost reduction across the Acquisition lifecycle.**
 - Completed negotiation for \$750M Development Foundation Contract III in less than three months, achieving price agreement within the internal JPO Cost Estimate and significantly below the Contractor-proposed price
 - Continued to reduce Sustainment costs through growth and maturation of the F-35 Enterprise, JPO Product Support Manager (PSM) efforts to drive down contract costs, US Services better aligning requirements and budgets, and an active cost reduction initiative pipeline, resulting in 31% improvement in the DoD F-35 CPTPY between 2014-21 from \$9.4M to \$6.5M and a 58% improvement in the DoD F-35 CPFH between 2014-21, from \$86.7K to \$36.2K (all in Constant Year 2012\$)
 - Completed F-35B Improved Main Landing Gear (MLG) Tire wear evaluation demonstrating substantially improved wear life and introducing competition between vendors for the new F-35B MLG tires

- **Availability:**
 - Aircraft on Ground (AoG) due to awaiting power modules was reduced from 48 in January 2022 to 3 as of 21 December 2022. Actions taken to drive down engine removals and increase production, over the past two years successfully accomplished recovery and achieved outcomes more than 5 years ahead of original projection.
 - Completed 99% of inventory to establish the program’s property baseline in the Accountable Property Systems of Record (APSR), captured an estimated \$8B in accountable property for the Program.

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- Trained a USMC squadron, USAF squadron, and 3 LST engineers on use of the Optical Backscatter Reflectometer to diagnose, locate, and fix fiber optic issues, improving the fleet's ability to more accurately locate and troubleshoot Mission Systems issues on wing.

Significant Issues:

TR-3 provides computational horsepower to support future Block 4 modernization capabilities. The delivery schedule has been affected by delays associated with hardware and software development as well as testing of the Integrated Core Processor (ICP) – the brains of TR-3. The key remaining risks are centered around maturity and stability of the final integrated software, flight test execution with an aging fleet of test aircraft and infrastructure, and delivery of TR-3 hardware to the production line. The program has implemented mitigation plans to deal with these risk areas and meet our commitments to our U.S. Services, Partners, and other stakeholders by the end of this year. The continued delays in TR-3 absorbed lab capacity, staff, and other resources necessary to make more progress on the greater Block 4 development activities.

History of Significant Developments Since Program Initiation

History of Significant Developments Since Program Initiation	
Date	Significant Development Description
November 1996	Concept Demonstration Contracts Awarded - Contracts for development of the final two contenders for the Joint Strike Fighter (JSF) program
October 2001	Milestone B - Approval of Milestone B
October 2001	System Development and Demonstration (SDD) Contract Awarded - Award of the SDD contracts to the air vehicle and propulsion providers for the JSF
April 2007	Low Rate Initial Production (LRIP) 1 Contract Signed - Production of F-35 aircraft begins
June 2010	Nunn-McCurdy Recertification - Recertification of the program pursuant to 10 USC 2433a as required after a critical cost breach
December 2011	Creation of subprograms - Split of program to 'aircraft' and 'engine' subprograms
November 2018	Initial Operational Test & Evaluation (IOT&E) Starts
December 2019	Acquisition Decision Memorandum - Schedule breach relating to Milestone C/Full Rate Production Decision Review relating to Joint Simulation Environment (JSE) delays
February 2020	Acquisition Program Baseline change pursuant to December 2019 Acquisition Decision Memorandum (no additional changes)
May 2022	Acquisition Program Baseline (APB) Change 4 set new Objective/Threshold dates for Milestone C (MS-C) and Full Rate Production Decision (FRPD)

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Schedule

Schedule Events

Schedule Events					
Events	Development APB Objective	Current APB Development Objective/Threshold		Current Estimate/Actual	Deviation
Concept Demonstration Contract Award	Nov 1996	Nov 1996	Nov 1996	Nov 1996	
Milestone B	Oct 2001	Oct 2001	Apr 2002	Oct 2001	
EMD Contract Award	Oct 2001	Oct 2001	Oct 2001	Oct 2001	
Preliminary Design Review	Apr 2003	Mar 2003	Mar 2003	Mar 2003	
CDR					
CDR (CTOL & Common)	Feb 2006	Feb 2006	Feb 2006	Feb 2006	
CDR (STOVL & Common)	Feb 2006	Feb 2006	Feb 2006	Feb 2006	
CDR (CV & Common)	Jun 2007	Jun 2007	Jun 2007	Jun 2007	
DAE (IPR 1)	Mar 2006	Mar 2006	Mar 2006	Mar 2006	
DAE (IPR 2)	Apr 2007	Apr 2007	Apr 2007	Apr 2007	
First Flight					
1st Flt CTOL	Dec 2006	Dec 2006	Dec 2006	Dec 2006	
1st Flt STOVL	Jun 2008	Jun 2008	Jun 2008	Jun 2008	
1st Flt CV	Jun 2010	May 2010	May 2010	May 2010	
1st Production Aircraft Delivered	May 2011	May 2011	May 2011	May 2011	
Milestone B Re-approval	Mar 2012	Nov 2011	May 2012	Mar 2012	
Software Releases					
Block 2B Fleet Release	Mar 2015	Mar 2015	Sep 2015	Jun 2015	
Block 3F Fleet Release	Aug 2017	Aug 2017	Feb 2018	Aug 2017	
Initial Operational Capability					
USMC IOC	TBD	Jul 2015	Dec 2015	Jul 2015	
USAF IOC	TBD	Aug 2016	Dec 2016	Aug 2016	
USN IOC	TBD	Aug 2018	Feb 2019	Feb 2019	
DCA Certification	N/A	Jan 2023	Jan 2023	Sep 2022	
DAB Milestone C	Sep 2020	Sep 2023	Mar 2024	Dec 2023	

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Full Rate Production Decision	Sep 2020	Sep 2023	Mar 2024	Dec 2023	
Technical Refresh					
TR-3 CDR	N/A	Jun 2019	Jun 2019	Jun 2019	
First TR-3 Aircraft Delivery	N/A	Jan 2023	Jan 2023	Apr 2024	
Completed IOT&E	Feb 2019	Deleted	Deleted	Sep 2023	

Schedule Notes:

Deviation Explanations:

Significant Schedule Risks

Significant Schedule Risks	
Current Estimate (December 2022)	
1.	Completion of JSE verification, validation, accreditation and ultimately execution of the 64 Run for Score (RfS) mission trials is the primary schedule driver for the Full Rate Production Decision (FRPD). Over the last six months, the JPO has experienced unprecedented collaboration across the JSE stakeholder community to ensure RfS completion by August 2023 and support the FRPD by the end of 2023. Strong cooperation from our developers, the Director, Operational Test and Evaluation (DOT&E), the JSF Operational Test Team (JOTT), the Air Force Operational Test and Evaluation Center (AFOTEC), Naval Air Warfare Center Aircraft Division (NAWCAD), and Lockheed Martin has resulted in remarkable progress towards streamlined data collection, analysis, accreditation processes, and test preparation events while ensuring test sufficiency for simulator JSE accreditation.
2.	TR-3 late hardware delivery and longer than expected 40P01 software development put first TR-3 aircraft (AF-392) delivery at risk of further schedule delay. Developmental flight test will begin in January 2023 and is planned to be completed in November 2023. An F-35 JPO Schedule Risk Assessment forecasts acceptance of first TR-3 aircraft in April 2024 at the 80% confidence level.
3.	Recent development capacity modeling identified instrumented flight test aircraft non-availability, hardware and software development and test and lab capacity as the top 3 constraints. Flight science aircraft contracts were recently awarded, but are late to need and could slip planned Block 4 weapon and sensor delivery dates. Acceleration activities include accelerating supplier deliveries, adding production fixtures and increasing manpower.

Performance

Performance Characteristics					
Development APB Objective	Current APB Development Objective/Threshold	Demonstrated Performance (include Date of Demonstration)	Current Estimate/Actual	Deviation	
STOVL Mission Performance - STO Distance Flat Deck					
With four 1000# JDAMs and two internal AIM-120s, full expendables, execute a 600-foot (450 UK STOVL) STO from LHA, LHD, and aircraft carriers (sea level, tropical day, 10 kts operational WOD) and with a combat radius of 550 nm (STOVL profile). Also, must perform STOVL vertical landing with two 1000# JDAMs and two internal AIM-120s, full expendables, and fuel to fly the STOVL Recovery profile.	With four 1000# JDAMs and two internal AIM-120s, full expendables, execute a 600-foot (450 UK STOVL) STO from LHA, LHD, and aircraft carriers (sea level, tropical day, 10 kts operational WOD) and with a combat radius of 550 nm (STOVL profile). Also, must perform STOVL vertical landing with two 1000# JDAMs and two internal AIM-120s, full expendables, and fuel to fly the STOVL Recovery profile.	With two 1000# JDAMs and two internal AIM-120s, full expendables, execute a 600-foot (450 UK STOVL) STO from LHA, LHD, and aircraft carriers (sea level, tropical day, 10 kts operational WOD) and with a combat radius of 450 nm (STOVL profile). Also, must perform STOVL vertical landing with two 1000# JDAMs and two internal AIM-120s, full expendables, and fuel to fly the STOVL Recovery profile.	Execute 471 ft. STO with 2 JDAM (internal), 2 AIM-120 (internal), fuel to fly 450nm	Execute 471 ft. STO with 2 JDAM (internal), 2 AIM-120 (internal), fuel to fly 450nm	
Combat Radius NM -CTOL Variant					
690	690	590	669	669	
Combat Radius NM -STOVL Variant					
550	550	450	505	505	
Combat Radius NM -CV Variant					
730	730	600	670	670	
Mission Reliability - CTOL Variant					

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Performance Characteristics					
Development APB Objective	Current APB Development Objective/Threshold		Demonstrated Performance (include Date of Demonstration)	Current Estimate/Actual	Deviation
98%	98%	93%	93%	93% (estimate update in progress)	
Mission Reliability - CV Variant					
98%	98%	95%	95%	95% (estimate update in progress)	
Mission Reliability - STOVL Variant					
98%	98%	95%	97%	97% (estimate update in progress)	
Logistics Footprint - CTOL Variant					
Less than or equal to 6 C-17 equivalents	Less than or equal to 6 C-17 equivalents	Less than or equal to 8 C-17 equivalents	Less than or equal to 8 C-17 equivalents (as of 11 APR 2018)	Less than or equal to 8 C-17 equivalents (as of 11 APR 2018)	
Logistics Footprint - CV Variant					
Less than or equal to 34,000 cu ft., 183 ST	Less than or equal to 34,000 cu ft., 183 ST	Less than or equal to 46,000 cu ft., 243 ST	Less than or equal to 44,900 cu ft., 222 ST (as of 11 APR 2018)	Less than or equal to 44,900 cu ft., 222 ST (as of 11 APR 2018)	
Logistics Footprint - STOVL Variant					
Less than or equal to 4 C-17 equivalents	Less than or equal to 4 C-17 equivalents	Less than or equal to 8 C-17 equivalents	Less than or equal to 8 C-17 equivalents (as of 11 APR 2018)	Less than or equal to 8 C-17 equivalents (as of 11 APR 2018)	
Logistics Footprint - STOVL Variant L-Class					
Less than or equal to 15,000 cu ft, 104 ST	Less than or equal to 15,000 cu ft, 104 ST	Less than or equal to 21,000 cu ft, 136 ST	Less than or equal to 18,400 cu ft, 105 ST (as of 11 APR 2018)	Less than or equal to 18,400 cu ft, 105 ST (as of 11 APR 2018)	
Sortie Generation Rates - CTOL Variant					
4.0/3.0/2.0 2.5 ASD	4.0/3.0/2.0 2.5 ASD	3.0/2.0/1.0 2.5 ASD	3.4/3.0/2.0 2.5 ASD (as of 11 APR 2018)	3.4/3.0/2.0 2.5 ASD (as of 11 APR 2018)	

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Performance Characteristics					
Development APB Objective	Current APB Development Objective/Threshold	Demonstrated Performance (include Date of Demonstration)	Current Estimate/Actual	Deviation	
Sortie Generation Rates - CV Variant					
4.0/3.0/1.0 1.8 ASD	4.0/3.0/1.0 1.8 ASD	3.0/2.0/1.0 1.8 ASD	3.9/3.0/1.0 1.8 ASD (as of 11 APR 2018)	3.9/3.0/1.0 1.8 ASD (as of 11 APR 2018)	
Sortie Generation Rates - STOVL Variant (USMC)					
6.0/4.0/2.0 1.1 ASD	6.0/4.0/2.0 1.1 ASD	4.0/3.0/1.0 1.1 ASD	5.5/4.0/2.0 1.1 ASD (as of 11 APR 2018)	3.9/3.0/1.0 1.8 ASD (as of 11 APR 2018)	
CV Recovery Performance (Vpa)					
Maximum approach speed (Vpa) at required carrier landing weight (RCLW) of less than 140 knots.	Vpa at required carrier landing weight (RCLW) of less than 140 knots.	Vpa at required carrier landing weight (RCLW) of less than 145 knots.	Vpa at required carrier landing weight (RCLW) of less than 143 knots. (as of 11 APR 2018)	Vpa at required carrier landing weight (RCLW) of less than 143 knots. (as of 11 APR 2018)	

Performance Notes:

1. Classified Performance information is excluded in this submission.

Requirements Source:

Operational Requirements Document (ORD) Change 3 dated August 19, 2008, as modified by Joint Requirements Oversight Council Memorandum (JROCM) 040-12 dated March 16, 2012

Deviation Explanations:

Not Applicable.

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Acquisition Budget Estimate

Total Acquisition Cost

		Development APB	APB Change 4 - Current (5/12/2022)		Budget Estimate PB 2024	
Category	Constant Year	Objective (CY\$M)	Objective (CY\$M)	Threshold (CY\$M)	CYM\$	TYM\$
RDT&E	2012	\$59,677.3	\$76,594.3	\$84,253.7	\$78,095.1	\$79,818.9
Procurement	2012	\$266,665.8	\$271,899.2	\$300,541.2	\$248,065.8	\$358,532.9
MILCON	2012	\$4,168.0	\$4,168.0	\$4,584.8	\$3,601.7	\$4,022.7
Acq. O&M	2012	\$-	\$-	\$-	\$-	\$-
TOTAL						
PAUC	2012	\$134.52	\$142.78	\$157.64	\$133.51	\$179.10
APUC	2012	\$109.16	\$110.71	\$122.37	\$101.00	\$145.98

Total End Item Quantity

Quantity Category	Current APB Quantity	Current Estimate Quantity
Development	14	14
Procurement	2456	2456

Budget Notes:

This SAR reflects President's Budget (PB) 2024 and budget authority required to execute the requirements of JSF Executive Steering Board Decision Memorandum #151.

Quantity Notes:

This SAR reflects phasing changes in aircraft quantities reflected in PB2024 and accounts for U.S. aircraft only.

Cost Deviations Explanations:

The F-35 Joint Program Office (JPO) identified a breach of the Acquisition Program Baseline (APB) Operating and Support (O&S) cost threshold based on the JPO's 2022 Annual Cost Estimate (ACE), and declared this in a Program Deviation Report (PDR) on 31 Oct 2022. The APB O&S cost objective/threshold reflects the OSD CAPE Independent Cost Estimate (ICE) as of Dec 2018. Since that time, the program O&S requirement definition continued evolving due to updates to the Services' beddowns and the program's Weapons System Planning Document (WSPD), shifting the USAF end of operations from 2077, as of 2018, to 2088 in 2022. USAF beddown updates drive most of the change in O&S cost.

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Because the program and stakeholders understand the drivers for the breach and have adequate documentation of the same, the F-35 JPO intends to address the breach with an updated APB, including revised O&S estimates, in conjunction with the Milestone C and Full Rate Production (FRP) Defense Acquisition Board (DAB) planned for December 2023.

APB Unit Cost Deviations Explanations:

[Add data if applicable]

Risk and Sensitivity Analysis

Risks and Sensitivity Analysis	
Current Procurement Cost (December 2022)	
1.	
2.	
Original Baseline Estimate (September 2018)	
1.	
Revised Original Estimate (N/A)	
None	
Admin Baseline Estimate (Month YYYY)	
1.	
2.	

Unit Cost

Current Baseline (5/12/2022) Compared with Current Estimate

Category	Current APB (CY12\$M)	Current Estimate (CY12\$M)	% Delta	NMC Breach
PAUC				
Cost	\$352,661.5	\$329,762.6		-
Quantity	2470	2470		-
Unit Cost	\$142.78	\$133.51	-6.49%	-
APUC				
Cost	\$271,899.2	\$248,065.8		-
Quantity	2456	2456		-
Unit Cost	\$110.71	\$101.00	-8.77%	-

Original Baseline (3/26/2012) Compared with Current Estimate

Category	Original APB (CY12\$M)	Current Estimate (CY12\$M)	% Delta	NMC Breach
PAUC				
Cost	\$330,511.1	\$329,762.6		-
Quantity	2457	2470		-
Unit Cost	\$134.52	\$133.51	-0.75%	
APUC				
Cost	\$266,665.8	\$248,065.8		-
Quantity	2443	2456		-
Unit Cost	\$109.16	\$101.00	-7.47%	

Unit Cost Notes:

The DoD average F-35 Unit Recurring Flyaway cost consists of the Hardware (Airframe, Vehicle Systems, Mission Systems, Engine, Engineering Change Order) costs over the life of the program.

The URF assumes the benefit of 371 FMS aircraft and 547 International Partner Aircraft

U.S. F-35A (conventional takeoff and landing) URF: \$71.5M (CY12\$)

U.S. F-35B (short takeoff and vertical landing) URF: \$100.4M (CY12\$)

U.S. F-35C (carrier variant) URF: \$87.6M (CY12\$)

Current Baseline PAUC NMC Breach Explanation:

[Add data if applicable]

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Original Baseline PAUC NMC Breach Explanation:

[Add data if applicable]

Current Baseline APUC NMC Breach Explanation:

[Add data if applicable]

Current Baseline APUC NMC Breach Explanation:

[Add data if applicable]

Impacts of Schedule Changes on Unit Cost:

[Add data if applicable]

Actions Taken or Proposed to Control Future Cost Growth:

[Add data if applicable]

Contracts

Contract Data (\$TYM)		
Contract Number	N00019-17-C-0001	
Effort Number	N/A	
Modification Number	P00089	
Award Date:	28-Apr-17	
Definitization Date:	28-Oct-19	
Order Number	N/A	
CAGE Code/CAGE Legal Name	81755 / Lockheed Martin Aeronautics Co.	
Contract Title	Lot 12-14 Air Vehicle Production	
Contractor Address	P.O. Box 748, TX 76101	
Contract /Effort Price, Quantity and Performance (\$M)		
Initial Target Price	Current Target Price	
2,731.3	32,918.7	
Initial Ceiling Price	Current Ceiling Price	
N/A	N/A	
Contract's EAC	PM's EAC	
30,677.5	30,321.8	
Initial Quantity	Current Quantity	Delivered Quantity
466	466	250
BAC	BCWP	ACWP
30,046.5	21,568.3	22,094.0
BCWS	Cost Variance	Schedule Variance
22,778.2	-525.7	-1,209.9

Contract Notes: The difference between the Initial Contract Price and the Current Contract Price is driven by definitization of the effort. Initial Price consisted primarily of Long Lead material.

Cost Variance: The unfavorable net changes in the cost variance is primarily driven by steady cost performance degradation in assembly through Delivery due to ongoing staffing disruptions and inefficiencies related to COVID-19, unplanned tasks and material shortages driving assembly inefficiencies. Unfavorable performance was partially offset by steady cost performance improvement within Wing due to incorporation of definitized unit pricing for wings, negotiation gains, removal of Alternate Work Schedule hours, and incorporation of updated pricing.

Schedule Variance: The favorable net schedule variance is primarily driven by Lot 12 – 14 contract schedule rebaselining as authorized in contract modification P00060. Aircraft DD250 dates have been adjusted and the rebaselining of the Integrated Master Schedule is complete.

Contract Data (\$TYM)

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Contract Number	N00019-18-C-1021	
Effort Number		
Modification Number	P00042	
Award Date:	28-Mar-18	
Definitization Date:	30-Sep-19	
Order Number		
CAGE Code/CAGE Legal Name	52661/PRATT & WHITNEY, A RAYTHEON TECHNOLOGIES COMPANY	
Contract Title	F135 Lot 12-14	
Contractor Address	400 Main St, East Hartford, CT 06118	
Contract /Effort Price, Quantity and Performance (\$M)		
Initial Target Price	Current Target Price	
239.7	7,750.8	
Initial Ceiling Price	Current Ceiling Price	
239.7	7,752.1	
Contract's EAC	PM's EAC	
7,033.9	6,975.5	
Initial Quantity	Current Quantity	Delivered Quantity
213	473	352
BAC	BCWP	ACWP
6743.1	5995.3	6246.9
BCWS	Cost Variance	Schedule Variance
5888.1	-251.6	107.2

Contract Notes: The difference between the Initial Contract Price and the Current Contract Price is driven by definitization of the Production work scope. Initial Contract Price consisted of long lead production hardware.

Cost Variance: The unfavorable net change in cost variance is primarily driven by higher costs for engine hardware in Controls, Externals, High and Low Pressure Turbines, Nozzle; and increased costs in engine assembly and test.

Schedule Variance: The unfavorable net change in schedule variance is primarily driven by burn-down of favorable schedule variance from early hardware deliveries in Controls, High Pressure Compressor, Fan, High and Low Pressure Turbine and Turbine Exhaust Case.

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Contract Data (\$TYM)		
Contract Number	N00019-19-C-0010	
Effort Number	N/A	
Modification Number	P00081	
Award Date:	30-Sep-18	
Definitization Date:	7-Jun-19	
Order Number	N/A	
CAGE Code/CAGE Legal Name	81755 / Lockheed Martin Aeronautics Co.	
Contract Title	Follow-On Modernization Phase 2.3	
Contractor Address	P.O. Box 748, TX 76101	
Contract /Effort Price, Quantity and Performance (\$M)		
Initial Target Price	Current Target Price	
1,891.6	3,639.8	
Initial Ceiling Price	Current Ceiling Price	
N/A	N/A	
Contract's EAC	PM's EAC	
3,219.2	3,300.0	
Initial Quantity	Current Quantity	Delivered Quantity
N/A	N/A	N/A
BAC	BCWP	ACWP
3,132.2	912.3	958.0
BCWS	Cost Variance	Schedule Variance
980.5	-45.7	-68.2

Contract Notes: The difference between the Initial Contract Price and the Current Contract Price is driven by contract modifications adding workscope for reprogramming labs, incentive fee for dual capability aircraft software development delivery, fuselage bulkhead development, super multi-function aircraft data link workscope, additional dual capable aircraft development, and training workscope.

Cost Variance: The unfavorable net cost variance is primarily driven by complexity of work for electronic warfare, dual capable aircraft, radar, and video data link capability development and additional resources required to support resolution of action items found during testing.

Schedule Variance: The unfavorable net schedule variance is primarily driven by material delays for multifunction advanced datalink ground shelters and build-up and integration of virtual wingman stations, receiver firmware delays, hardware module design delays, systems engineering complexity, and software development delays.

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Contract Data (\$TYM)		
Contract Number	N00019-14-C-0020	
Effort Number	N/A	
Modification Number	P00029	
Award Date:	24-Dec-18	
Definitization Date:	24-Dec-18	
Order Number	N00019-F-2474	
CAGE Code/CAGE Legal Name	81755 / Lockheed Martin Aeronautics Co.	
Contract Title	FOM Tech Refresh 3 Phase 3	
Contractor Address	P.O. Box 748, TX 76101	
Contract /Effort Price, Quantity and Performance (\$M)		
Initial Target Price	Current Target Price	
712.5	830.3	
Initial Ceiling Price	Current Ceiling Price	
N/A	N/A	
Contract's EAC	PM's EAC	
1,342.4	1,262.9	
Initial Quantity	Current Quantity	Delivered Quantity
N/A	N/A	N/A
BAC	BCWP	ACWP
741.9	522.3	1,014.4
BCWS	Cost Variance	Schedule Variance
600.0	-492.1	-77.7

Contract Notes: The difference between the Initial Contract Price and the Current Contract Price is driven by contract modifications adding workscope for data acquisition recording and telemetry development and tooling.

Cost Variance: The unfavorable net cost variance is primarily driven by technical complexity, design changes, and maturation driving additional engineering effort for the Integrated Core Processor (ICP), Panoramic Cockpit Display (PCD), and Aircraft Memory System (AMS) efforts.

Schedule Variance: The unfavorable net schedule variance is primarily driven by a supplier experiencing delays on their Integrated Core Processor (ICP), Panoramic Cockpit Display (PCD), and Aircraft Memory System (AMS) development engineering efforts for design, integration, and test activities due to technical complexity.

Contract Data (\$TYM)		
Contract Number	N00019-18-C-1004	
Effort Number	N/A	
Modification Number	P00044	
Award Date:	9-Nov-17	
Definitization Date:	9-Nov-17	
Order Number	N/A	
CAGE Code/CAGE Legal Name	81755 / Lockheed Martin Aeronautics Co.	
Contract Title	Follow-On Modernization Phase 2.2	
Contractor Address	P.O. Box 748, TX 76101	
Contract /Effort Price, Quantity and Performance (\$M)		
Initial Target Price	Current Target Price	
245.9	481.6	
Initial Ceiling Price	Current Ceiling Price	
N/A	N/A	
Contract's EAC	PM's EAC	
402.8	405.8	
Initial Quantity	Current Quantity	Delivered Quantity
N/A	N/A	N/A
BAC	BCWP	ACWP
411.8	391.5	380.9
BCWS	Cost Variance	Schedule Variance
400.6	10.5	-9.1

Contract Notes: The difference between the Initial Contract Price and the Current Contract Price is driven by contract modifications adding workscope for mission systems software, cross system shared efforts, and weapons.

Cost Variance: The favorable net cost variance is primarily driven by radar supplier completing tasking without using management reserve, less systems engineering support required than planned for requirements work package development, technical interchange meetings, and design reviews, fewer change requests than anticipated, and utilizing lower salary grades than planned.

Schedule Variance: The unfavorable net schedule variance is primarily driven by complexities with electronic warfare, hardware and software delays, and delayed supplier work.

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Contract Data (\$TYM)		
Contract Number	N00019-20-C-0037	
Effort Number	N/A	
Modification Number	P000031	
Award Date:	4-Mar-20	
Definitization Date:	24-Sep-20	
Order Number	N/A	
CAGE Code/CAGE Legal Name	81755 / Lockheed Martin Aeronautics Co.	
Contract Title	Development Foundation Contract 002	
Contractor Address	P.O. Box 748, TX 76101	
Contract /Effort Price, Quantity and Performance (\$M)		
Initial Target Price	Current Target Price	
449.2	593.8	
Initial Ceiling Price	Current Ceiling Price	
N/A	N/A	
Contract's EAC	PM's EAC	
515.3	542.1	
Initial Quantity	Current Quantity	Delivered Quantity
N/A	N/A	N/A
BAC	BCWP	ACWP
523.3	408.2	396.6
BCWS	Cost Variance	Schedule Variance
428.8	11.6	-20.6

Contract Notes: The difference between the Initial Contract Price and the Current Contract Price is driven by contract modifications adding workscope for Labs Development, Training Lab and Training Labs Infrastructure.

Cost Variance: The favorable cumulative cost variance is primarily driven by labor underruns at Edwards Air Force Base and Pax River. In addition, Air Vehicle Supplier Labs experienced underruns due to less than estimated lab material and staff requirements and reduced Software Development and Lab improvement efforts.

Schedule Variance: The unfavorable cumulative schedule variance is primarily driven by Mission Systems Integration Lab Special Tooling and Prime Mission Equipment scope being scheduled to complete within the Period of Performance (PoP) while repair material delivery is not expected until 18 months later. Also due to less support required by suppliers as well as supplier material procurement delays, infrastructure staffing delays and technical blockers issues.

Technologies and Systems Engineering

The program is updating the F-35 Lightning II Joint Strike Fighter Program Systems Engineering Plan (SEP) to Version 5.0 to reflect changes in program office structures and responsibilities. Additionally, the SEP version 5.0 will document engineering process changes which implement recommendations from the F-35 Software Independent Review Team (2021) and Systems Engineering Tiger Team (2022). The SEP Version 5.0 is expected to be submitted to OSD for staffing and approval beginning in March 2023. Additionally, the SEP update will capture the new Model Based Systems Engineering approach being utilized for Follow on Modernization capability development. This approach includes the Early Life Cycle Systems Engineering process to mature capability requirements sufficiently to reduce technical and programmatic risks prior to inclusion into a formal Capability Increment.

Significant Technical Risks

Significant Technical Risks	
Current Estimate (December 2022)	
1.	Development and delivery of the Technical Refresh (TR)-3 capability is the highest priority risk for the program. The program is managing risk to deliver on-time into Lot 15. TR-3 delivery for Lot 15 is off track and it is expected that the program will realize both a cost and schedule impact, but the program continues to actively work mitigation actions to limit the size and scope of the impacts.
2.	TR3 Prime Mission Equipment hardware and software tool delays are generating substantial risk to the integration schedule at the Reprogramming Labs (USRL, ACURL, and NIRL). JPO and LM are working together to mitigate and deliver the capability to verify and validate Mission Data Files to support Lot 15 aircraft.
3.	The program will begin work to implement recommendations from two separate Safety Investigation Boards as a result of two mishaps which occurred late in calendar year 2022. The implementation of these recommendations will help mitigate the two Serious Risk to F-35 operations across all variants.
4.	The program tracks and mitigates other technical issues from across the Air System discovered as a result of normal fleet operations while the size and usage of the fleets from US Services, Partner Nations, and FMS customers continues to grow. These issues are a normal part of operations and sustainment phases of the program's life cycle but must continually be monitored and tracked to limit the impacts to operational forces.
5.	Lot 17 production risk is the concurrent efforts between development, procurement and production efforts to meet the first aircraft delivery.
6.	Lot 17 software development and integration and production break-in delays could impact production aircraft build plans and potentially delay deliveries. TR3 delays continue to consume resources and put pressure on all post Lot 15 software releases.
7.	The program currently uses four aging Flight Sciences Aircraft to support development flight test. These aircraft are becoming more difficult to sustain and drive significant risk to flight test operations in support of critical F-35 development programs. Service life extensions are planned, but gaps could develop until placements are delivered. If gaps are realized, the F-35 enterprise's

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	developmental flight test capacity will be insufficient, resulting in quality escapes to the field, schedule delays in capability delivery, increased cost & decreased performance
8.	As the F-35 Air System continues to add additional mission capabilities it is increasing the power and cooling demands that are provided by the PTMS and F135 engine. The engine is currently providing bleed air that is double what it was specified to provide and as a result is running hotter which will lead to earlier than anticipated removals with an increased life cycle cost of \$32B. If the PTMS and engine are not upgraded to meet the future power and capacity demands the F-35 will not be able to fully exploit the capabilities being developed and will continue to drive increased sustainment cost associated with the engine running hotter than projected.

Deliveries and Expenditures

Deliveries				
Delivered to Date	Planned to Date	Actual to Date	Total Quantity	Percent Delivered
Development	14	14	14	100.00%
Production	592	597	2456	48.41%
Total Program Quantity Delivered	606	611	2470	49.27%

Expended and Appropriated (TY \$M)

Total Acquisition Cost: 416197.4

Expended to Date: 158085.9

Percent Expended: 37.9%

Total Funding Years: 51

Years Appropriated: 29

Percent Years Appropriated: 56.86%

Appropriated to Date: 180422.5

Percent Appropriated: 43.4%

The above data is current as of March 31, 2022.

Deliveries and Expenditures Notes:

[Add data if applicable]

Low Rate Initial Production

Item	Initial LRIP Decision	Current Total LRIP
Approval Date	10/26/2001	4/29/2021
Approved Quantity	465	968
Reference	Milestone B ADM	Lot 15-17 Authorization and LRIP Quantity Increase ADM
Start Year	2006	2006
End Year	2015	2025

Rationale if Current Total LRIP Quantity exceeds 10% of the total Procurement quantities:

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The Current Total LRIP Quantity is more than 10% of the total production quantity due to the necessity to prevent a break in production and to ramp up to FRP planned for December 2023.

LRIP Note:

[Add data if applicable]

Operating and Support Costs

Total Program O&S Cost Compared with Baseline

Total O&S (\$Millions)	Current APB Objective (CY12\$)	Current APB Threshold (CY12\$)	Current Estimate (CY12\$)	Current Estimate (TY\$)	Deviation
F-35 OSD CAPE ICE	\$630,534.5	\$693,588.0	\$659,800.0	\$1,265,600.0	No
F-35 JPO ACE			\$705,773.8	\$1,556,654.1	Yes

Deviation Explanation:

The F-35 Joint Program Office (JPO) identified a breach of the APB O&S cost threshold based on the JPO's 2022 Annual Cost Estimate (ACE) and declared this in a Program Deviation Report (PDR) on October 31, 2022. The APB O&S cost objective/threshold reflects the OSD CAPE Independent Cost Estimate (ICE) as of December 2018. Since that time, the program O&S requirement definition continued evolving due to updates to the Services' beddowns and the program's Weapons System Planning Document (WSPD), shifting the USAF end of operations from 2077, as of 2018, to 2088 in 2022. USAF beddown updates drive most of the change in O&S cost.

Because the program and stakeholders understand the drivers for the breach and have adequate documentation of the same, the F-35 JPO intends to address the breach with an updated APB, including revised O&S estimates, in conjunction with the Milestone C and FRP DAB planned for December 2023.

O&S Cost Breakdown

Category (CY12\$ Million)	F-35 OSD CAPE ICE	F-35 JPO ACE
Unit-Level Manpower	\$142,800.0	\$175,629.4
Unit Operations	\$85,100.0	\$73,419.5
Maintenance	\$221,700.0	\$218,411.2
Sustaining Support	\$93,200.0	\$102,300.7
Continued System Improvements	\$42,700.0	\$50,071.5
Other	\$74,300.0	\$85,941.4
Total O&S	\$659,800.0	\$705,773.8

Cost Estimate Source

- Current APB Objective/Threshold based on OSD CAPE ICE, December 20, 2018

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- OSD CAPE ICE for Section 167 of the FY 2020 National Defense Authorization Act (NDAA), June 18, 2020
- Air Force Cost Analysis Agency (AFCAA) and Naval Air Systems Command (NAVAIR) Joint Services Cost Position (JSCP) for Interim Progress review (IPR), June 15, 2020, aligns with JPO ACE
- F-35 JPO, 2022 ACE, November 2, 2022

O&S Cost Notes

- a. Disposal/Demilitarization Cost Estimate and Source of Estimate:

The JSCP for IPR included Disposal estimates of \$262.0 (CY12\$M) / \$810.0 (TY\$M).

- b. Sustainment Strategy:

Design, develop, deliver, and sustain a single, integrated, and global system of sustainment products, processes, and business practices. These actions will enable the F-35 Air System to achieve a high degree of effectiveness at an affordable cost.

Tailor the global system to meet warfighter-defined readiness and cost objectives. This action will ensure that the global system is responsive and flexible as operational needs vary over time.

Maintain life-cycle focus, including the reduction of costs. This action will provide critical affordability benefits and further supports a high degree of effectiveness as Air System maturity grows.

Create a mutually-beneficial enterprise that – with relevant metrics and incentives – operates, manages, and supports the global system. This action further improves responsiveness and enhances affordability.

Leverage the global resource base – government and commercial – to take advantage of stakeholder capabilities, human capital, best practices, and similar critical contributions. This action increases robustness and scalability as the F-35 fleet grows and matures.

- c. For Each Acquired System or System Variant:

- i. Quantity to Sustain: 2,456
- ii. First Operational Fiscal Year: 2011
- iii. Final Operational Fiscal Year: 2088
- iv. Note: OSD CAPE ICE as of December 2018 and June 2020 include operations through 2077. JPO ACE as of November 2022 extends through 2088.
- v. Unit Expected Service Life: Various, with number of years defined by 8,000 flight hour airframe life and service/variant annual flight hour utilization rates

- d. Antecedent System(s) O&S Costs:

- i. The F-35A/B/C family of aircraft variants replace the following current aircraft: F-16C/D, A-10, F/A-18C/D, and AV-8B. Comparing the costs of the 5th generation F-35 to legacy aircraft proves challenging. Given the significant

- increase in military capabilities provided, DoD reasonably expects F-35A to cost more to operate and sustain than 4th generation legacy aircraft.
- ii. An update to the F-35A and F-16C/D comparison remains in work.

e. O&S Estimate Description - OSD CAPE ICE

The CAPE ICE reflects the sustainment portion of the CAPE ICE prepared in accordance with Section 167(d)(2) of the FY 2020 National Defense Authorization Act and delivered to Congress. This CAPE ICE is inclusive of the USAF F-35A, USMC F-35B, USMC F-35C, and USN F-35C. This estimate of \$659.8 (CY12\$B) / \$1265.6 (TY\$B) was based on the 2020 v1.0 beddown plans and uses the departments 2020 inflation indices. The CAPE F-35 life cycle O&S cost estimate incorporated then recent programmatic decisions and updated cost estimating techniques and data relative to the F-35 O&S cost estimate prepared in 2018. The 2018 CAPE ICE was included in the 2019 Selected Acquisition Report (SAR) to Congress and serves as the current APB objective. As in 2013, 2015 and 2018, the CAPE 2020 update of the F-35 O&S cost estimate incorporated the latest available data for actual component reliabilities obtained from ongoing F-35 flight operations, including flight testing and field operations. These data enabled CAPE to independently estimate the reliability and reliability growth for the CTOL and STOVL F-35 variants, as well as forecast the component-level reliabilities for more than 2,600 unique parts, using approximately 130,000 hours of F-35 flight operations. The CAPE 2020 O&S estimate also incorporated, for the first time, actual data on F-35 Air Vehicle (AV) component repair prices.

In the future, CAPE will continue to work with the stakeholders to expand government access to and understanding of actual data sources available for cost estimating. Although the 2020 CAPE cost estimate comprehensively used all available data, there remains uncertainty in F-35 O&S estimates. This is because of: 1) the need for additional repair cost information; 2) the fact that many components on the F-35 have seen few failures to date (making reliability forecasts more uncertain); 3) the continued maturation of the overall sustainment concept and available data; and 4) the long time-horizon of the O&S cost estimate.

f. O&S Estimate Description - JPO 2021 ACE

The 2021 ACE is included as a reference point for going forward with the 2022 ACE.

The JPO estimate reflected the program's 2021 v1.0 ACE for the U.S. DoD, inclusive of the USAF F-35A, USMC F-35B, USMC F-35C, and USN F-35C, with operations through 2081. This estimate of \$663.5 (CY12\$B) / \$1,339.7 (TY\$B) incorporated recommendations from the JSCP team which appeared in the 2020 v1.0 estimate as of Interim Progress Review (IPR). It further refined the IPR estimate with updates to: propulsion methodologies, reflecting a transition from a largely legacy analogy basis to a F135 specific engineering basis, with maturing information on event forecasts, event costs, and staffing; the latest service/variant requirements from customer beddowns; air vehicle methodologies, to reflect the latest repair costs and reliability actuals or engineering predictions, and staffing; unit level manpower and indirect support, aligning with actuals, trends, and current pricing; escalation methodologies and inflation rates; JPO program

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costs based on recent actuals and trends; modifications forecasts; and contractor, government, and military labor rates.

The estimate represented Affordability efforts, where adequate definition for pricing differences in the baseline program and future state existed. These reduced the estimate by \$19.8 (CY12\$B) / \$41.7 (TY\$B), meaning the ACE would otherwise have appeared this much higher.

g. O&S Estimate Description - JPO 2022 ACE

The JPO estimate reflects the program's 2022 Sustainment ACE for the U.S. DoD, inclusive of the USAF F-35A, USMC F-35B, USMC F-35C, and USN F-35C, with operations through 2088. This estimate of \$705.8 (CY12\$B) / \$1,556.7 (TY\$B) incorporated the 2022 Weapons System Planning Document (WSPD) beddowns, including a seven-year extension for the USAF and a four-year extension for the USN. The beddowns' shifting of operations into later more expensive years drives most of the cost growth between the 2021 and 2022 ACE. This refines the 2021 estimate with a number of propulsion related improvements based on the latest available information, including event forecasts, component pricing, near term depot capacity, and manpower projections, as well as fan rotor redesign reductions. It incorporates updates to align with the air vehicle sustainment FY21-23 contract pricing results, by updating labor rates, repair prices, and manpower requirements for contractor logistics support (CLS), as well as identifying new estimate scope for cyber, security, maintenance systems training, and training support. This also includes new sustainment scope, for the joint simulation environment and effects-based simulator, DevSecOps, helmet, and propulsion development test scope, as well as a number of estimating updates resulting in offsetting decreases.

The estimate represents Affordability efforts, where adequate definition for pricing differences in the baseline program and future state exist. These reduce the estimate by \$21.0 (CY12\$B) / \$48.8 (TY\$B), meaning the ACE would otherwise have appeared this much higher. These values reflect current assessments of projected future savings based on engineering and SME inputs, and final impacts may prove different as the efforts realize over time. The JPO Affordability Efforts section provides greater detail.

The U.S. Services provide their operational requirements to the JPO via service/variant beddowns. These beddowns define timelines for squadron and site standups and standdowns, aircraft delivery and operational profiles (total aircraft inventory, attrition, primary authorized aircraft (PAA), and flight hours for the O&S phase.

As of Milestone B in Feb 2012, operations extended through 2065 and included 56,741 aircraft operating years (PAA basis). The current APB, based on OSD CAPE's ICE as of Dec 2018, assumed operations extended through 2077 and included 61,274 aircraft operating years. In the 2022 Sustainment ACE operations now extend through 2088 and include 72,862 aircraft operating years, +19% from the APB basis.

h. JPO Affordability Efforts

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In Sustainment, the affordability goal is to drive price AND demand reductions for parts and labor.

The program received Cost Per Tail Per Year (CPTPY) Affordability Constraints from the Services in an October 16, 2018 ADM which are the foundation for the F-35 Sustainment Affordability Targets. These constraints include a consistent cost definition of O&S less Indirects (CES elements 1.0 to 5.0), appear in CY12\$, and focus on Service defined Steady State periods ranging from 2033 to 2043. They were largely based on budget projections and legacy aircraft comparisons. From the JPO 2018 v1.0 ACE, these constraints reflected a challenge of 43% (USAF), 24% (USMC), and 10% (USN). Per the ADM, the Services have a requirement to review and if necessary, update the Steady State constraints in preparation for the Milestone C and Full Rate Production (FRP) Defense Acquisition Board (DAB).

Recent NDAA language requires the Services to provide Affordability Targets by October 2025 for the FY 2027 timeframe. The JPO is working closely with the Services to ensure full transparency and understanding of the current JPO cost projections in that year to better align Service and program expectations. The JPO is pushing to have updated FY 2027 CPTPY targets ahead of October 2025.

The 2022 Sustainment ACE incorporates 23 well defined Should Cost improvements. Without these the Sustainment ACE would otherwise appear higher by +\$21.0 (CY12\$B) / +\$48.8 (TY\$B). These reductions reflect a collection of initiatives fielded through the JPO's Affordability Directorate and consisted of various reliability and maintainability projects, capability updates, and other various cost reduction initiatives.

The program is focused on reducing sustaining support and maintenance costs, as well as enabling the Services to reduce their work force requirements, to achieve the affordability constraints. The program is exploring future logistic based sustainment contracts to incentivize outcome-based logistics and has identified levers associated with reducing the Autonomic Logistics Information System (ALIS) administrator headcount, ensuring sustaining support achieves economies of scale, and reducing the price of parts or hardware. In 2022, the Air Force approved an immediate reduction of twenty ALIS system administrators and reduced the requirement for all future training and test units, which led to a \$650M savings across the life of the program.