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THE HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES

STATEMENT OF

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BEFORE THE

TACTICAL AIR AND LAND FORCES SUBCOMMITTEE

OF THE

HOUSE ARMED SERVICES COMMITTEE

ON

F-35 PROGRAM REVIEW

FEBRUARY 16, 2017

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I Introduction

Chairman Turner, Ranking Member Tsongas and distinguished Members of the Subcommittee, thank you for the opportunity to appear before you to discuss the F-35 Lightning II.

The F-35 Program is a much different and improved program than it was 5 years ago. The F-35 weapon system is now operational and forward deployed. The size of the fleet continues to grow and we are rapidly expanding its capability. The F-35 will form the backbone of United States (U.S.) air combat superiority for decades to come, replacing or complementing the legacy tactical fighter fleets of the Air Force, Navy, and Marine Corps with a dominant, multirole, fifth-generation aircraft, capable of projecting U.S. power and deterring potential adversaries. For our International Partners and Foreign Military Sales (FMS) customers who are participating in the program, the F-35 will become a linchpin for future coalition operations and will help to close a crucial capability gap that will enhance the strength of our security alliances.

The Program's costs are well understood, stable and with respect to production and operating costs, they are decreasing making the F-35 more affordable each and every day. The costs to complete the Development program still remain well within the budget established in 2011 after the Nunn-McCurdy Breach.

Our overall assessment is that the program is making solid progress, as it grows and accelerates; and shows improvement each day as we continue to manage emerging issues and mitigate program risks.

II Accomplishments

The F-35 fleet now exceeds 210 aircraft and it has surpassed 73,000 flight hours. The program continues to execute well across the entire spectrum of acquisition, to include

development and design, flight test, production, fielding and base stand-up, sustainment of fielded aircraft, and building a global sustainment enterprise. We are again pleased to report many accomplishments by the F-35 team during the past year but none are more satisfying than the declaration of Initial Operating Capability (IOC) for the F-35A by the U.S. Air Force (USAF) last summer and seeing the U.S. Marine Corps (USMC) forward deploy its F-35Bs.

The F-35 program had two overseas deployments and two additional sea trials this past year. The first deployment took two Dutch F-35A aircraft from the U.S. to the Netherlands for three weeks. The Dutch conducted a noise survey and introduced their people to the F-35s by flying it all around the Netherlands and flying it and displaying it at their annual airshow.

In June of last year, the USAF, USMC and the United Kingdom deployed 2 F-35As and 3 F-35Bs to England where the F-35 Lightning II made its debut at the Farnborough International Airshow and Royal International Air Tattoo in the United Kingdom allowing our European partners and allies a chance to see the F-35s and learn more about its capabilities. Additionally, the program completed its final round of sea trials with the USMC's F-35Bs aboard the USS AMERICA and with the U.S. Navy's (USN) F-35Cs aboard the USS GEORGE WASHINGTON. During these sea trials, the F-35Bs completed 60 sorties in 21 days and the F-35Cs completed 41 sorties in 19 days.

The F-35 Development Test (DT) team also completed all F-35A envelope testing and all F-35C aerial refueling testing in 2016. In addition, this year marked the successful in-flight firing of the F-35A internally-mounted GAU-22 25-millimeter cannon and the ground testing of the F-35B and F-35C centerline cannon pod. Air-to-Air accuracy testing of the GAU-22 is expected to complete spring 2017. Furthermore, there were several milestones with the United

Kingdom, including successfully testing its aerial refueling tanker's compatibility with the F-35 and first flight release of its unique weapons.

The program also successfully upgraded all Block 2A aircraft to the newer more capable Block 2B configuration. Today all F-35s in the field are either Block 2B aircraft or Block 3i aircraft, with both Block 2B and 3i having the same limited warfighting capability. The Block 3i software stability issues we reported on last year were corrected and the final iteration of software, Block 3F, is now in flight test and continues to mature.

The DT program achieved some significant milestones in 2016, flying 1,447 DT flights, performing 63 weapon separations and executing 16 Weapon Delivery Accuracy (WDAs) missions, all of which were the highest annual totals in the F-35 program's history. The program also executed a highly concentrated WDA test phase where 12 WDA tests and 13 weapon separations were accomplished in a 1 month span across multiple test ranges, outpacing a historical execution rate of roughly 1 WDA every 5 weeks.

The Autonomic Logistics Information System (ALIS) successfully supported Development and Operation test events demonstrating the deployability of the ALIS system ashore and afloat. Lessons learned were collected and incorporated into the ALIS Deployment Guide which was delivered to the users to help them more quickly and easily breakdown, move and set up the deployable ALIS. Further, the ALIS Operational Representative Environment (ORE) at Edwards Air Force Base in California is now testing the latest versions of ALIS before fielding to the operational fleet. This was an important improvement in delivering a better ALIS system to the warfighter. This testing has been highly successful in identifying software deficiencies that have proven difficult to identify in industry laboratories during earlier phases of

testing. The results of these findings from the ORE will result in fielding a more stable, better ALIS system with fewer discrepancies than in the past.

Understanding that the F-35 could be subject to hostile cyber environment, the program undertook more comprehensive cyber penetration testing for the ALIS and the F-35 air vehicle as a whole. This testing has facilitated improvements to ALIS cyber protection capabilities and procedures. In addition to this vulnerability, the F-35 Joint Program Office (JPO) with the Joint Operational Test Team (JOTT) has planned additional assessments in early to mid-2017 for the newer ALIS 2.0.2 release. We continue to work closely with the JOTT on planning and executing future ALIS and air vehicle cyber security testing throughout the life of the Program.

III System Design and Development

System Design and Development (SDD) Schedule: Steady progress is being made toward the completion of the SDD program. There are two important milestones associated with the closeout of this phase of the program: completion of SDD flight test and the delivery of the full Block 3F capability. It is important for the committee to understand that the end of SDD will be event driven. The JPO/Industry team will continue SDD until the full Block 3F capability is delivered to warfighter. There is no intention of truncating the program on any specific calendar date or at some predetermined budget-level. With respect to completion of F-35 flight test, the original 2011 re-baseline Program of Record showed flight testing to end on 31 October 2017. The JPO has always believed there is 3 to 4 months of risk to this completion date, putting the end of SDD flight test in February 2018. This risk adjusted date is the result of a number of flight test delays experienced in the past 2 years including the F-35 engine fire which stopped flight testing for 2 months and software stability issues and fusion issues with the

Block 3i software which have delayed Block 3F flight testing.

The Department of Defense (DoD) has directed the JPO to maintain the resources necessary to continue flight testing to May 2018, if necessary, to ensure we will deliver the full Block 3F capability. The biggest risks to the timely completion of SDD flight testing include software stability, the discovery of new software deficiencies, the time it takes to correct deficiencies, and the health of our DT test fleet.

The second important milestone leading to the completion of SDD is the delivery and fielding of the full Block 3F capability including the full aircraft and weapons envelope. The following table shows the program's estimates of when these full capabilities will be delivered.

Full Block 3F Capability Delivery	
2011 Post Nunn-McCurdy APB Dates	**Current Estimate**
Objective: August 2017	**F-35A: October 2017 (w/o AIM-9X)** **November 2017 (w/ AIM-9X)**
	F-35B: November 2017 (1.3 Mach) **May 2018 (1.6 Mach)**
Threshold: February 2018	**F-35C: January 2018 (1.3 Mach)** **February 2018 (1.6 Mach)**

As you can see from the table, the delivery of the full capability for all 3 variants falls within the original 2011 Acquisition Program Baseline dates with the exception of the B-model envelope between 1.3 and 1.6 Mach which is slightly delayed, due to having only one B-model test aircraft (BF-3) properly instrumented for the testing needed to get to 1.6 Mach.

SDD Cost to Complete: The remaining SDD work is estimated to cost $2.3 billion which includes an additional $532 million above the current funded program. The additional funding is needed due to several factors. First, there were additional requirements added to the program during SDD (e.g., deployable ALIS, mandated program security changes, mandated aircraft cyber security changes) which were never paid for at the time they were executed. These new

requirements totaled $165 million. Secondly, DoD removed $100 million from SDD funding in prior years to pay other higher priority bills and this money was never restored to the Program's baseline SDD budget. Finally, a shortfall of approximately $267 million was caused by unforeseen events, such as the 2014 engine fire and the delay to Block 3F testing while the Program improved Block 3i software stability and fusion issues, both of these issues resulted in added schedule and cost to the competition of SDD. The $265 million of "payback" along with the $267 million due to unforeseen events resulted in a need for an additional $532 million. This money as mentioned above will be sourced from inside the F-35 Program using management reserve, unearned fee and the savings resulting from negotiating lower costs on various contracts. Use of this internal funding will result in no impact to any other DoD programs or the Services/DoD's budget requirements. Additionally, as mentioned previously the Department has directed the JPO to maintain the resources necessary to continue SDD flight testing to May 2018. Should flight testing beyond February 2018 to May 2018 be necessary the JPO will hold $100 million of Follow-on-Modernization (FoM) funding in fiscal year (FY) 2018 to pay for this added flight testing.

As a final note on the SDD budget, it is important to look back to the 2011 Rebaselined Program and compare today's cost estimate to complete SDD with the cost controls put in place after the Nunn-McCurdy Breach. The following table makes this comparison.

SDD Cost Baseline	
2011 Post Nunn-McCurdy 2011	Current Estimate
Objective: $13.9 B (50 % probability)	$13.9 B
Threshold: $15.1 B	delta = $267 M (discoveries)
	Total = $14.2 B

As the chart indicates, the Program has remained within $267 million (2.1%) of the 2011

Objective Budget Estimate and well below the Threshold Budget Estimate, indicating that the fiscal discipline and cost control measures executed by the Department have been effective.

SDD Risks: At this time last year and in response to software stability problems, the Program had launched an in-depth look at the architecture by a "Software Stability Red Team." After a wide-ranging technical analysis, the team confirmed that the F-35's basic software architecture is sound and can support the full Block 3F warfighting capability. However, the team also identified that the end-to-end testing of the software needs to be streamlined and improved, and the metrics used to track software performance need to be updated to reflect operational considerations.

One significant improvement that has been made over the past year, is the ability of the JPO/Industry team to find, fix, code, lab test, and deliver to flight test a new increment of mission systems software in 30 to 45 days. Previously during Block 2B and 3i software development and testing this process took approximately 3 to 4 months. Now with better software tools, faster feedback from the testers, and a streamlined airworthiness process we have cut this timeline significantly. This has greatly improved our ability to fix emerging software issues and field better software sooner. We intend on building on this success as we move to FoM. Additionally, the JPO implemented a new method of tracking software stability that takes into account at what point in a mission a stability event occurs and the operational impact of that event. These changes will provide better insight as to the causes and circumstances of these stability events and better position the program for more stable, effective software in the future.

Currently the stability of our Block 2B and 3i software is exceeding our initial estimates in terms of stability. Today the Block 2B software experiences a software stability event once

every 29 flight hours and Block 3i experiences a software stability event once every 25 flight hours. By way of comparison, our target for this stability was approximately one event every 10 flight hours. Although the Block 3F software is in its early stages of flight testing, we are seeing stability data indicating it will exceed the 20 flight hour mark before experiencing an event.

Block 3F Software Risk: An additional risk to completing SDD on time with Full capability within the JPO's budget is the level of complexity of the new capabilities in Block 3F software. For example, Block 3F software must take information from other sources, such as other non-F-35 aircraft, satellites, and ground stations and fuse this information with F-35 information, giving the pilot a complete and accurate picture of the battlespace. We are also fielding the capability for more than 4 F-35s, in some instances up to 8 and 12 F-35s to be linked together passing information to each other throughout the battlespace. This unprecedented networking capability and this taking in "off-board" information make the Block 3F software very capable but also very complex.

ALIS Risk: The next version of ALIS, version 2.0.2, also remains a technical and schedule risk. This version of ALIS combines the management of F135 engine maintenance within ALIS and tracks all the life-limited parts on each and every F-35 aircraft. The development of these capabilities is proving to be more difficult to integrate than previously estimated. To address these difficulties, industry has added additional software expertise to its team, and we have set up and operate the ALIS ORE at Edwards Air Force Base in California to test ALIS in a more operationally relevant environment. Despite these efforts, ALIS 2.0.2 is approximately 4 months late to fielding, with the first fielding to occur in March 2017 at Nellis Air Force Base in Nevada.

SDD Discoveries / Deficiencies: Although solid progress is being made -- we are now past the 90 percent complete with all of SDD -- F-35 development is not without technical discoveries and deficiencies, which are common for a system that is still in development.

Over the course of testing during SDD, we have discovered and reported deficiencies; however, no development program can ever expect to correct every open deficiency. The F-35 program is committed to correcting all deficiencies that the Services and Partners deem necessary to fix. The Program has a disciplined, long-successful process of using Services' and Partners' inputs to rank and prioritize all deficiencies that alone or in combination need to be corrected. The Program then fixes those high priority deficiencies. The Program has planned for additional flight testing for any deficiencies that require further fix verification or for any new deficiencies that may be discovered during continued development. We are committed to providing a Block 3F capability that operationally is effective and suitable for the operational test force and the warfighter.

Currently there are 100 Category 1 (Must Fix) deficiencies, and of those, 25 have already been corrected and verified as fixed, 33 have been corrected but are awaiting a test to verify that they are fixed, 39 are in the process of being fixed, and 3 are still being investigated. The Program has a plan in place to fix, test and verify all Category 1 (Must Fix) and Category 2 (Significant Impact) deficiencies with upgraded software releases and physical modifications to the aircraft.

During F-35C flight test in December 2015, it was discovered the outer, folding portion of the wing has inadequate structural strength to support the loads induced by pylons with AIM-9X missiles during maneuvers that cause buffet. The Program is currently flight testing re-designed outer wings. Once the new design is verified to provide the require strength, the fix

will be implemented in production and retrofitted to existing aircraft by swapping existing outer wings with the re-designed ones. Overall 32 aircraft will require the modification and the effort is scheduled to begin in summer 2017.

Another deficiency the Program is solving involves excessive F-35C vertical oscillations during carrier launch. During a catapult launch the nose landing gear strut is compressed as the catapult initial pre-tension load pulls on the nose landing gear, with the hold back bar restraining the aircraft from further forward movement due to engine thrust. Upon release of the hold back bar, the nose landing gear strut unloads and vertically oscillates as the aircraft accelerates towards take-off. The oscillations are more severe during lighter aircraft weight launches. The Program will test a reduced release load hold back bar in February/March 2017 with anticipated evaluation by the Navy in spring 2017. Results of this testing and the Navy's evaluation will determine if further corrective action is required.

IV Initial Operational Test and Evaluation

Initial Operational Test and Evaluation (IOT&E) Entrance: There are a number of criteria required by the DOT&E that must be met before IOT&E can begin. These include the release of the final Block 3F aircraft capability, the release of ALIS 3.0, the release of a verified and validated Mission Data File (MDF), the readiness of 23 instrumented aircraft in a Block 3F production representative configuration (6 USAF A-models, 6 USMC B-models, 6 USN C-models, 3 UK B-models, and 2 Netherlands A-models), and functioning Air-to-Air Range Infrastructure 2 (AARI 2) capability on the test aircraft and ranges. Additionally, a verified, validated, and accredited F-35 simulator must be delivered approximately 4 months prior to

completion of the 13 month long IOT&E program. This simulator requirement will be met by the Joint Simulation Environment located at Naval Air Station Patuxent River in Maryland.

It is likely that by February 2018, the release of ALIS 3.0, the release of a verified and validated MDF, the modifications necessary to place all 23 aircraft into a production representative configuration will not be completed. However, a large subset of those entrance criteria to start IOT&E will be met by February 2018. It is possible, with DOT&E approval, to incrementally start IOT&E by March 2018. Starting IOT&E incrementally, earlier than waiting for all entrance criteria to be fully met is desirable for many reasons: First, obtaining earlier feedback from the OT community will enable the JPO and Industry to make corrections and fixes sooner, providing better capabilities to the warfighter. Second, delaying IOT&E will result in higher costs because IOT&E support will have to continue longer than planned. The JPO estimates that a 6 month delay in the start of IOT&E will cost an additional $30 million. Finally, since F-35s will be produced at over 100+ airplanes per year during IOT&E, the sooner deficiencies are discovered the quicker they can be cut into production, saving the time and resources that would otherwise be needed to retrofit these jets if they were to be produced without the corrections.

Annual Director of Operational Test and Evaluation (DOT&E) Evaluation: On 10 January, the Office of the Secretary of Defense (OSD) DOT&E released the 2016 DOT&E report on the F-35 to Congress. The independent program review from the DOT&E is an annual occurrence, and the process was executed with unfettered access to information and with the full cooperation of the F-35 JPO. There were no surprises in the draft report reviewed by the JPO; all of the issues mentioned are well-known to the JPO, the U.S. Services, International Partners

and our Industry team. While not highlighted by the DOT&E report, among the 17 issues cited in the report, the F-35 Program fully concurs with 10 of them, partially concurs with 4, and defers to the USN and USMC regarding the other 3. The F-35 Program has a dedicated effort underway to resolve or otherwise mitigate them, as shown in the table below.

DOT&E Recommendation	**F-35 JPO Corrective Action**
1. The program should complete all necessary Block 3F baseline test points. If the program uses test data from previous testing or added complex test points to sign off some of these test points, the program must ensure the data are applicable and provide sufficient statistical confidence prior to deleting any underlying build-up test points.	**Concur:** The program should complete all necessary test points. The F-35 program will continue to exercise the disciplined process of determining if test points are no longer required based on previous results. This process includes the OT, DT and operational user community. Any test point considered no longer required will documented through the process.
2. In light of the fact that the program is unable to correct all open deficiencies prior to IOT&E, the program should assess and mitigate the cumulative effects of the many remaining SDD deficiencies on F-35 effectiveness and suitability, especially those deficiencies that, in combination or alone, may cause operational mission failures during IOT&E or in combat, prior to finalizing and fielding Block 3F. The program will need to add test points to troubleshoot and address deficiencies that are currently not resolved.	**Partially Concur:** No acquisition program can ever expect to correct every open deficiency. The F-35 program is committed to correcting all deficiencies that the Services and Partners deem necessary to fix. The Program has a disciplined, long-successful process of using Services' and Partners' inputs to rank and prioritize all deficiencies that alone or in combination need to be corrected. The Program then fixes those high priority deficiencies. The Program has planned for additional flight testing for any deficiencies that require further fix verification or for any new deficiencies that may be discovered during continued development.
3. The program should consider developing another full version of Block 3F software to deliver to flight test in order to address more known deficiencies.	**Partially Concur:** The JPO partially concurs with the recommendation consistent with last year's response. The JPO software development strategy continuously evaluates known deficiencies for inclusion in future software releases. Whether additional software releases are necessary before the start of IOT&E will depend on the severity of the deficiencies, when they are discovered, and warfighter inputs on when and if they require fixes. Currently, the final version of software (3FR6) will have at least two additional updates (increments) to address deficiencies in the Feb to April 2017 timeframe.

DOT&E Recommendation	F-35 JPO Corrective Action
4. The program should ensure adequate resources remain available (personnel, labs, flight test aircraft) through the completion of IOT&E to develop, test, and verify corrections to deficiencies identified during flight testing.	**Partially Concur:** The JPO software development strategy continuously evaluates deficiencies for inclusion in future software releases. As part of the evaluation, the resources needed to support this work are continuously evaluated to ensure adequate resources are available as needed.
5. The program should address the deficiency of excessive F-35C vertical oscillations during catapult launches within SDD to ensure catapult operations can be conducted safely during IOT&E and during operational carrier deployments.	**Concur:** The JPO is already taking action, under the advice a NAVAIR-led Red Team. The program is planning field-based catapult testing of a SDD aircraft in February 2016 to assess: (a) standardized pilot guidance for use of cockpit restraints, (b) a corrected helmet magnetic map file that should reduce unintended movement of helmet display symbology during launch and (c) a reduced release load for the repeatable-release hold-back bar (RRHB) that will reduce the stored energy in the nose strut at the start of the launch. If successful, VFA-101 would return to carrier qualification trials in mid-2017 to assess these same changes. If further improvement is still required after making these changes, concepts have been developed for JPO to pursue longer-term solutions.
6. The Program Office must immediately fund and expedite the contracting actions for the necessary hardware and software modifications to provide the necessary and adequate Block 3F mission data development capabilities for the USRL, including an adequate number of additional radio frequency signal generator channels and the other required hardware and software tools.	**Concur:** The hardware and software necessary to develop, test, and release Block 3F mission data files will be in place at the USRL by February 2017. Additionally, Industry has gone out on risk to begin this effort prior to contract award. The additional radio frequency signal generator channels are being aligned with the Follow-on Modernization upgrade.
7. The program should address the JOTT-identified shortfalls in the USRL that prevent the lab from reacting to new threats and reprogramming mission data files consistent with the standards routinely achieved on legacy aircraft.	**Concur:** The mission data file generation tool being delivered in February 2017 addresses many of the shortfalls identified. The remaining shortfalls will be addressed in subsequent USRL capability upgrades to fully satisfy JOTT and DOT&E intent.
8. The program should correct deficiencies that are preventing completion of all of the TEMP-required Block 3F Weapons Delivery Accuracy (WDA) events and	**Concur:** Work is on-going to address all deficiencies that are preventing the completion of the final Block 3F WDA events. The current schedule has all WDA events completed by March 2017.

DOT&E Recommendation	F-35 JPO Corrective Action
ensure the events are completed prior to finishing SDD.	
9. The program should ensure Block 3F is delivered with capability to engage moving targets, such as that provided by the GBU-49, that do not require lead-laser guidance.	**Concur:** JPO is working with the Service and Industry to integrate the GBU-49 on the F-35 by the end of CY2017.
10. The program should complete additional testing and analysis needed to determine the risk of pilots being harmed by the Transparency Removal System (which shatters the canopy first, allowing the seat and pilot to leave the aircraft) during ejections in other than ideal, stable conditions (such as after battle damage or during out-of-control situations). The program should complete these tests as soon as possible, with the new equipment, including the Gen III Lite helmet in a variety of off-nominal conditions, so that the Services can better assess risk associated with ejections under these "off-nominal" conditions.	**Partially Concur:** Off-nominal testing has been completed. The results were used to update the safety assessments which remained at a low risk and this has been shared with the Services. Upgrades to the ejection seat, currently in-work, or helmet would not impact performance of the Transparency Removal System.
11. The program needs to conduct an assessment to determine the extent to which the results of further durability testing with BH-1, the F-35B durability test article, are representative of production aircraft and, if necessary, procure another test article for the third life testing.	**Concur:** JPO has conducted an engineering assessment, resulting in a recommendation for an additional article and test. The UK MOD has provided a formal request for an additional test, and a similar requirement is expected from NAVAIR in the near future. Preliminary planning and budgeting activities have been initiated.
12. The Navy and the Program Office should investigate alternatives for determining the operational impact of an engine removal and install while conducting carrier air wing operations at sea.	**Concur:** Engine R&R has already been demonstrated for during sea trials for both the B and C models. If the Services require further testing or demonstrations, the JPO will support such events.
13. The Navy and Marine Corps should conduct an analysis, such as an operational logistics footprint study, which simulates flight deck and hangar bay spotting (aircraft placement) with a full ACE onboard, using data from the DT-III ship trials to determine what the impact of an	**Defer:** The JPO will defer to the U.S. Navy and USMC on this recommendation.

DOT&E Recommendation	F-35 JPO Corrective Action
engine removal and installation would be on integrated ship and ACE operations with a full ACE onboard.	
14. The program and the Navy should investigate if the heavy power module container should be redesigned for better usability at sea.	**Concur:** The power module container has been re-designed for better usability at sea and will be available for future deployments.
15. The program and the Navy should investigate potential options to improve ship-based communications bandwidth dedicated to ALIS connectivity off-ship, such as increasing the priority of ALIS transmissions, or reserving low-use times of the day for handling large volumes of ALIS message traffic.	**Defer:** The JPO will defer to the U.S. Navy on this recommendation.
16. The Navy should investigate any efficient, multi-use opportunities for F-35 support equipment (SE) such as using legacy SE on the F-35 or F-35 SE on legacy aircraft.	**Concur:** The Program already has in place a successful "multi-use" support equipment process where opportunities have already been harvested such as the use of a legacy lift for the engine power module container.
17. The Navy should investigate options for increasing the number of wall power outlets in CVN hangar bays to help facilitate simultaneous maintenance on multiple F-35Cs, or the ability to interconnect multiple pieces of support equipment from a single outlet to permit simultaneous operations.	**Defer:** The JPO will defer to the U.S. Navy on this recommendation.

V Follow-on-Modernization

Looking beyond the SDD program, the follow-on effort, known as FoM, is moving forward. The F-35 JPO will execute FoM as a continuation of the F-35 program with full transparency and reporting on cost, schedule and performance as if it were a new program. FY 2016 efforts included contracts for a Requirements Decomposition and System Functional Review effort for early Block 4 requirements. Additionally the Technical Refresh 3 (TR-3)

hardware strategy (new F-35 main computers and displays) has been identified, a suitable specification was developed and the TR-3 system design phase will be awarded to Lockheed Martin in the first half of 2017.

Efforts this year (2017) will include a Requirements Decomposition and Functional Allocation of Block 4.1 and completion of the System Functional Review this summer. A Planning and Systems Engineering Phase II contract award is planned for spring 2017, which will support a Preliminary Design Review for Block 4.1 prior to the major Engineering, Manufacturing and Development contract award in late 2018.

After a thorough analysis of the original F-22 and F/A-18 modernization strategies, the F-35 program will continue to heed lessons learned and will be fully transparent to the Congress by providing a separate modernization statement of work and contract, a separate modernization budget to be reported to the Congress, a separate cost reporting and earned value performance reporting system, an independent program cost estimate updated prior to contract award, and finally, rigorous, formal requirements oversight.

F-35 Dual Capable Aircraft continues to be aligned with and included in the initial increment of the Block 4 FoM effort. Detailed Risk Reduction activities have been completed to ensure that the F-35A is fully compatible with the B61-12 weapon. The JPO has begun initial planning for the Block 4 Nuclear Certification efforts in anticipation of beginning B61-12 integration on the Block 4.1 configured F-35A in 2018. The F-35 JPO is fully engaged with the USAF, Department of Energy, and strategic partners and is confident that this capability will be fielded and certified in time to meet specified need dates.

Block 4 planning for developmental and operational testing, to include the number of test

assets required, is in the early stages and seeks to successfully transition from a large scale air vehicle system testing to a more focused capability update(s) testing planned in modernization. The current focus is on planning for a sufficient and efficient level of test assets and infrastructure to fully support a planned 2 year update cycle. Further, the Program is identifying the modifications required by the development test fleet to accomplish FoM Block 4 testing.

VI Production

Production Delivery Performance: In 2016, the program delivered 46 aircraft, 7 short of the planned 53 aircraft. This includes 40 aircraft from the Fort Worth, Texas, Final Assembly and Check Out (FACO) facility and 6 aircraft from the Italian FACO in Cameri, Italy. In August of 2016, Lockheed Martin declared an issue with non-conforming insulation on the polyalphaolefin (PAO) cooling tubes in some F-35A wing fuel tanks. The subsequent investigation and repairs affected 42 production aircraft, and resulted in delays, limiting the production delivery to 46 aircraft from the planned 53 aircraft in 2016.

In 2017, the goal is to deliver a total of 66 aircraft, which includes carryover of the seven aircraft originally planned for delivery in 2016. Of those 66 aircraft, 61 aircraft will be delivered from the Fort Worth FACO, 3 aircraft from the Italian FACO, which includes their first "B" model produced, and the first 2 aircraft deliveries from the Japanese FACO in Nagoya, Japan.

F-35 LRIP Pricing: The price of F-35s continues to decline steadily Lot after Lot. For example, the price (including airframe, engine, and contractor fee) of a LRIP 9 F-35A aircraft is approximately 5.5 percent less than an LRIP 8 aircraft, a LRIP 9 F-35B aircraft is approximately 2.0 percent less than an LRIP 8 aircraft, and a LRIP 9 F-35C aircraft is approximately 2.6

percent more than an LRIP 8 aircraft. The F-35C increase is driven by the quantity negotiated dropping from four in LRIP 8 to two in LRIP 9.

We recently reached an agreement with the F-35 prime contractor for LRIP 10 marking the first time the price for an F-35A will be below $100 million. The price for a LRIP 10 F-35A will be $94.6 million, a 7.3 percent reduction from LRIP 9. The LRIP 10 prices for an F-35B ($122.8 million) and F-35C ($121.8 million) will also be lower than LRIP 9 prices by 6.7 percent and 7.9 percent, respectively.

Over the course of the LRIP contracts we have had a challenge on the timeliness of aircraft deliveries. However, over the past few years, even though production quantities have increased, we are seeing a dramatic reduction in the number of average days aircraft are being delivered late as shown in the table below.

LRIP	Average Days Late to Contract Deliveries
1	23
2	96
3	131
4	139
5	87
6	68
7	20
8	30

Late deliveries have jumped from an average of 20 to 30 days for the 34 aircraft in LRIP 8, mainly due to the PAO tube issue referenced earlier. The trend of fewer and fewer late deliveries is a positive development that the JPO and Industry will continue to improve upon in the coming years.

Production Block Buy / EOQ Contracting: The program has initiated a Block Buy/Economic Order Quantity (EOQ) contracting strategy for LRIPs 12, 13 and 14. This strategy gives the F-35 Partners and FMS customers the flexibility to procure all aircraft in a single procurement for LRIP 12 (FY 2018) or to procure aircraft and engines in a multiple lot format for LRIP 12 (FY 2018), LRIP 13 (FY 2019), and LRIP 14 (FY 2020). The U.S. Services will procure LRIP 12, 13 and 14 as single year procurements and will only request Congressional approval to award a single contract to procure material and equipment in EOQ for FY 2019 and FY 2020. There is no multi-year commitment for U.S. Services aircraft and engines; which will continue to be bought on an annual basis for LRIPs 12 - 14 (FY 2018 -2020) and preserves Congressional annual discretion. The estimated savings have been validated by an F-35 JPO cost estimate, an industry analysis study and an independent assessment conducted by RAND Corporation. Procuring approximately 445 aircraft with this Block Buy/EOQ strategy is estimated to save approximately $2 billion compared to the LRIP 11 annual procurement price.

Block Buy savings are achieved by allowing contractors to utilize EOQ purchases, enabling suppliers down to the component level to maximize production economies of scale. Savings are also achieved due to learning curve improvements on production lines and other Government and Industry cost reduction initiatives which may not have been otherwise executed, if not for a stable multiple year requirement to procure parts.

The risk of the Block Buy/EOQ strategy for Partner and FMS customers for Lots 12, 13 and 14 is considered low because the design of the weapon system will be stable during this period of time. All F-35 models (A, B and C) have already completed second life (8,000 hours full life) durability testing. Additionally, 98 percent of all hardware and subsystems

qualifications are completed, and the full Block 3F capability will begin delivery near the end of Lot 9, well before Lots 12, 13 and 14 are delivered. For the U.S. Services and Congress, the risk is even lower because the only commitment is to purchase 2 years-worth of parts in a single EOQ procurement, (FY 2019 and FY 2020).

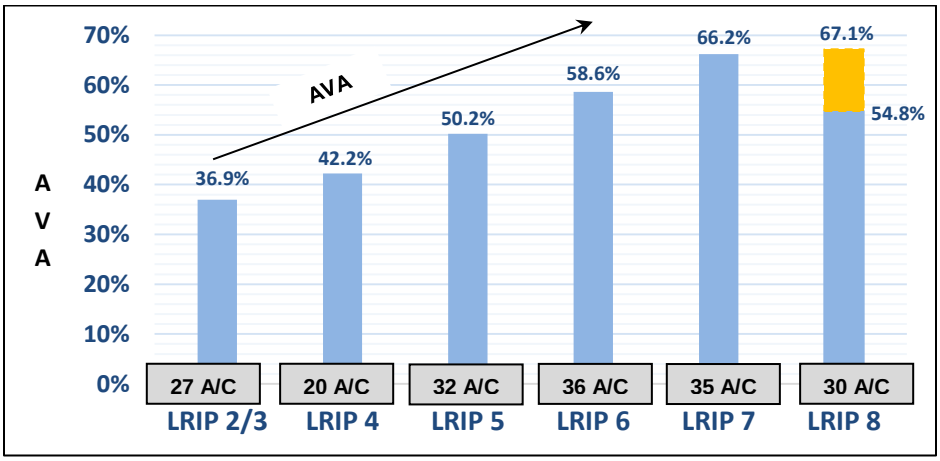
Engine Production: In 2016, the Program completed contractual actions with Pratt & Whitney on LRIP 9 & 10 for the F135 propulsion system. The F-35A/F-35C propulsion system reduced 3.4 percent from the previously negotiated LRIP 8 price to the negotiated LRIP 10 price. The F-35B propulsion system (including lift systems) reduced 6.4 percent from the previously negotiated LRIP 8 price to the LRIP 10 price. Pratt & Whitney has delivered approximately 50 percent of the 67 production propulsion systems in LRIP 9 and is currently slightly ahead of contract delivery requirements. Pratt & Whitney continues efforts to improve quality surveillance within its manufacturing processes resulting in a 35 percent reduction in quality escapes during 2016; however, improvements at the vendor level are needed to identify and eliminate quality non-conformances which have interrupted engine deliveries. For 2017, Pratt & Whitney remains focused on increasing capacity at existing suppliers and qualifying second and third sources as needed to meet production ramp.

VII Sustainment

As of the beginning of February 2017, there are 216 F-35s operating at 11 sites. Luke Air Force Base in Arizona is the main training base for the USAF, many Partners and our FMS customers. Marine Corps Air Station (MCAS) Beaufort in South Carolina is the main F-35B training base for the USMC and United Kingdom. Additionally, Italy will utilize MCAS Beaufort when it receives its F-35Bs from the Italian FACO. Eglin Air Force Base in Florida is

the main training base for the USN's F-35C until Naval Air Station (NAS) Lemoore in California is stood up. All F-35 maintainers also get their initial maintenance training at Eglin Air Force Base. In the next 4 years, we will add another 17 operating bases to the F-35 enterprise across all 3 regions of North America, the Pacific and Europe.

Aircraft availability rates remained steady in 2016 at 50 percent for the A-model, 47 percent for the B-model and 59 percent for the C-model. This continues to be a focus area for the Program and various program initiatives are being executed to improve overall weapon system availability. A disciplined Reliability & Maintainability (R&M) program, improved maintenance procedures and manuals, continued improvement in the ALIS, better forecasting of spares requirements, improved repair turnaround times from suppliers and incorporation of aircraft design improvements are having a positive effect, but at a slower rate than desired. However, newer aircraft are showing significantly better R&M Availability Rates when compared to older lot aircraft. The chart below shows the combined (F-35 A, B and C-model) Aircraft Availability (Air Vehicle Availability – AVA) rates for each production lot. The F-35A LRIP 8 rate (54.8 percent) was impacted by the F-35A Fuel Systems modifications and the PAO insulation corrections. The LRIP 8 AVA rate would have been 67.1 percent if we did not experience the PAO insulation issue.



In 2016, the Program continued its efforts toward the establishment of the Global Sustainment posture across Europe, Asia-Pacific, and North America. Last fall, the Program made regional Maintenance, Repair, Overhaul, and Upgrade (MRO&U) selections for repairing 65 out of 774 repairable components on the F-35. These initial component repair capabilities when combined with F-35 airframe and engine heavy-level maintenance will provide all customers including the U.S. Services the ability to maintain and repair their aircraft globally.

The F-35 JPO will assign the remaining 709 components over the next 2 to 3 years and in October 2016 released a request for information for F-35 warehousing and support equipment repairs. DoD will assign to the F-35 Partners and FMS customers repair capabilities such as wheels and brakes, electrical and hydraulic systems, maintenance of support equipment, and warehousing for the global supply chain. These same capabilities either currently exist or are being developed at the U.S. Services' depots in the U.S. in accordance with current U.S. law.

VIII Delivering Combat Capability

In support of meeting the USAF's IOC, the 388th Fighter Wing at Hill Air Force Base in Utah deployed its F-35As to Mountain Home Air Force Base in Idaho for a two-week exercise last summer. The unit successfully flew all 88 of its planned sorties and achieved 94 percent direct hits with the weapons it expended. F-35 pilots executed multiple air-to-air and air-to-ground engagements with threats and the F-35 proved to be extremely survivable in both environments.

The USMC took its F-35Bs to Red Flag last summer. The F-35 flew 67 of its 70 scheduled sorties and proved itself as a dominant weapon system. During the first few weeks of that exercise, F-35s were not only NOT shot down but were not targeted. They also hit all their targets. And by the end of the exercise, F-35s were being used as Intelligence Surveillance

Reconnaissance platforms above the battlespace to connect with fourth-generation airplanes to improve their survivability.

The USMC also conducted a live fire weapons exercise at Eglin Air Force Base in Florida last summer. The main highlight of that was one of the pilots simultaneously laser-guided a GBU-12 bomb at the same time he was engaging an air-to-air target with an AIM-120 radar missile. Both were direct hits. This is something that no fourth-generation fighter can accomplish.

Additionally, the USMC conducted a live fire test in conjunction with the Naval Integrated Fire Control-Counter Air family of systems last September. An F-35B from Marine Operational Test and Evaluation Squadron 1 (VMX-1) at Edwards Air Force Base in California participated in Live Fire Test at White Sands Missile Range in New Mexico. During this demonstration an F-35B detected, tracked and targeted a low flying MQM-170E drone aircraft and passed this information via the aircraft's Multi-functional Advanced Data Link (MADL) to the Aegis combat system aboard the USS Desert Ship (LLS-1). The USS Desert Ship then fired a Standard Missile-6 missile from "over-the-horizon" and shot down the drone. This demonstrated the interoperability of the F-35 with the Navy's Integrated Fire Control system and how the F-35 can make other linked platforms in the battlespace smarter and more survivable.

To round out the year, VMX-1 also deployed aboard the USS AMERICA in conjunction with the DT ship event in October. The Marines not only assisted in DT execution with manpower and resources, but also executed a "Lightning Carrier" concept demo during the final 4 days of the at-sea period during which 12 F-35B were embarked on the ship and conducted Suppression of Enemy Air Defenses Strike missions followed by an assault support escort mission with 2 MV-22s, 1 UH-1 and 1 AH-1. The operation successfully represented the largest

number of F-35s aboard a ship to date.

In January of this year, the USMC also deployed 10 F-35Bs from its Marine Fighter Attack Squadron (VFMA) 121 from Marine Corps Air Station (MCAS) in Yuma Arizona to MCAS Iwakuni, Japan. The F-35 Lightning II JPO applauds the Marines for this accomplishment and will continue to support them as they deploy more aircraft to MCAS Iwakuni later this year and ready for an operational shipboard deployment next year.

IX International Partner and FMS Participants

International participation on the program with eight Partners and three FMS customers remains strong. Over the past ten months, aircraft deliveries to our United Kingdom, Italy, and Norway Partners have continued, while FMS customers Israel and Japan received their first aircraft deliveries. Two significant milestones for Italy included the delivery of its first jet completed at the Italian Final Assembly and Check-Out (FACO) facility in Cameri, Italy and also the first aircraft arrival into its operational base located in Amendola, Italy. Notably, Israel also achieved first aircraft arrival into its operational base in Nevatim, Israel and it has identified a requirement for an additional 17 aircraft from an existing fleet of 33. Also, the Japanese aircraft FACO in Nagoya and engine FACO in Mizuho are both on track to deliver their first respective Japanese aircraft and engine later this year.

The international pilot and maintainer training taking place at Luke Air Force Base in Arizona continues to expand with the arrival of the first Japanese aircraft in late November, while the training taking place between the USMC and the British Royal Air Force at MCAS Beaufort in South Carolina, continues to pay dividends for both services.

This past May, the two Dutch aircraft that are part of the DT fleet at Edwards Air Force Base in California completed their first deployment to the Netherlands, where they conducted aerial and ground environmental noise surveys, performed flights over the North Sea range, and also appeared at the Netherlands' Open Days, the largest air show held annually in the Netherlands. Following their three-week deployment, the jets returned to the U.S., and the resulting noise surveys showed there were no noticeable differences between the F-35 and F-16 to the Dutch communities surrounding their airbases.

In early June, the Danish Parliament approved its government's recommendation to acquire 27 F-35As, and Denmark became the 7th partner nation and 11th nation overall to buy the F-35. Also that same month, F-35Bs landed for the first time in the United Kingdom. The United Kingdom F-35B was the first to touch down and was followed shortly afterwards by two other F-35Bs from the USMC and two USAF F-35As. The F-35s were in the United Kingdom to support the Royal International Air Tattoo and the Farnborough Air Show taking place in early July. More importantly, this was a deployment for the United Kingdom, USMC and USAF where they sustained and maintained the aircraft, generated sorties, and ultimately provided lessons learned on future F-35 operations.

In September, Turkey held the 65 percent Design Review for its first Main Operating Base which will be located in Malatya, Turkey. This review is a major milestone on the way to ensuring Turkey's infrastructure is ready for aircraft arrival in 2019. In late October, the Turkey Defense Industrial Executive Committee met and approved the Block Buy for 24 aircraft over 3 contract years.

Following flight testing and the USAF's recommendation, Australia authorized aerial refueling operations between its KC-30A tanker aircraft and F-35As in January. Preparations at Australia's first operating base, Royal Australian Air Force Base in Williamtown continue as construction of hangers, training centers, and information support centers remain on schedule. And, finally, the debut of Australia's F-35As at the 2017 Avalon International Airshow is on track and scheduled for March 2017 near Melbourne.

November was a significant month for South Korea as it was one of the countries assigned initial F-35 component repair capability. In addition, the first six Korean aircraft were awarded as part of the recent Lot 10 aircraft contract, with expected delivery in 2018.

Over the past year, the JPO has worked closely with the U.S. Defense Security Cooperation Agency to promptly and thoroughly answer all questions provided by the Canadian government in support of its fighter replacement analysis. Further, the JPO has continued to work with potential FMS customers, including Belgium, Finland, and Spain, responding to all requests for information and other official inquiries.

X Conclusion

In summary, the F-35 fleet is rapidly expanding and F-35s are now flying in the U.S., Japan, Italy and Israel. The F-35 Program is nearing the completion of development within the cost and schedule boundaries laid in during the 2011 Rebaseline. The Program is also continuing to ramp up production and building the global sustainment enterprise. The Program's main focus areas include:

- Completing development within the time and resources we have;
- Delivering the full Block 3F capabilities;
- Smoothly transitioning from development to Follow-on-Modernization;

- Completing the production ramp-up while continuing to improve quality and the delivery schedule;
- Continuing to grow the global sustainment enterprise, and;
- Improving the fielded fleet's performance

As always, our number one overarching priority is to continue to drive cost out of all aspects of the F-35 Program, making it more affordable for all our customers.

As development continues we expect new technical discoveries will occur; however, as we have demonstrated in the past, we believe the combined Government/Industry team has the ability to resolve any future issues. My JPO team's commitment to overcoming these and any future challenges is unwavering and we will deliver the F-35's full capability to our customers. We will continue executing with integrity, discipline, transparency and accountability, holding ourselves accountable for the outcomes on this Program. Our team recognizes the great responsibility we have been given to provide the foundation of future U.S. and Allied fighter capability for decades to come. We also recognize that someday your sons and daughters, or grandsons and granddaughters may take this aircraft into harm's way to defend our freedom and way of life. It is a responsibility we never forget.

Thank you again for this opportunity to discuss the F-35 Program. We look forward to answering any questions you have.