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Joint Strike Fighter
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Good morning Mr. Chairman, Senator McCain, and Members of the Committee. Thank you for the opportunity to appear before you today to discuss the Joint Strike Fighter program.

In my view, the primary issues in the Joint Strike Fighter program have been late delivery of test aircraft and the failure to adjust to that reality by building and resourcing realistic system development and test plans, as well as plans for producing and delivering aircraft. These problems have increased concurrency between testing and production beyond what was originally expected and beyond historical precedent. The resultant delays relative to unrealistic plans and the associated increase in costs to complete development created the need to restructure the program, which is in progress. In my FY 2009 Annual Report, I assessed that completion of Initial Operational Test and Evaluation (IOT&E) of the most capable combat capability now formally planned (the so-called Block 3 aircraft) could occur in early to mid-2016, provided certain changes are made to specific aspects of the program. Key changes needed include providing sufficient flight test aircraft, providing the resources and time needed to develop, deliver, and test effective software, accounting realistically for the inevitable discovery of problems during flight testing, and providing the engineering and other resources needed

to maintain an adequate pace of testing. I would like to review the status of these issues as I understand them today:

- Sufficient flight test aircraft. In the past fiscal year the program failed to meet the planned goals for testing, primarily due to the late delivery of test aircraft. As of today, three of the twelve previously planned flight test aircraft operate at one of the government test centers. Expectations at this time last year were that ten flight test aircraft would have begun productive flight test activity by now, with the final two following in the next 90 days. The program office now projects that all twelve of the previously planned developmental flight test aircraft will ferry to test centers by February, 2011. More test aircraft, generated from production lots, are needed to complete Block 3 development. I agree with the assessment of the Joint Estimating Team that two C-model aircraft, one A-model aircraft, and at least one B-model aircraft are needed in addition to the twelve previously planned developmental test aircraft to complete developmental testing in March 2015. Using production aircraft as developmental flight test assets, however, needs to be carefully managed to assure the original purposes for those aircraft, including operational test and evaluation, can still be met, either by returning the borrowed aircraft, or replacing them with other production aircraft.

- Software development and test. The delivery schedules for the remaining mission systems software Blocks 1, 2, and 3 have recently been extended by more than one year each compared to the plans existing at this time last year. The late delivery of test aircraft has, so far, masked the effect of delays in software development. Extending the Cooperative Avionics Test Bed availability through the end of developmental testing was a good decision, as the test bed will continue to provide risk reduction. I understand the contractor has also proposed creating a new, additional software integration and test line. Although a lack of software integration and test resources was not identified previously as a problem by program management, the new test line will be very useful provided the contractor has the manpower to operate it and simultaneously accomplish multiple integration activities. However, the reality is that flight test of the essential warfighting capabilities has yet to start. Mission systems flight test in F-35 aircraft begins when aircraft BF-4, the first of four previously planned mission systems test aircraft, ferries to a test center. This is currently planned to occur in May of this year. Only one of the remaining three previously planned aircraft is expected to ferry before the end of 2010, with the final two delivering early in 2011. By mid-2011, flight test is planned to transition from Block 1 to Block 2 capabilities—this will be an important point where the program will deal with the realities of software

performance in the first significant combat capability available. Throughout this testing, the program needs to assure software is released to flight test only when it is ready and prepare to cope with the many problems that will be discovered during flight testing; this has been the case with all complex programs of this kind.

- Realistic Schedules and Sufficient Resources. The program's ability to maintain an adequate pace of testing is dependent on how the government and contractors manage several aspects of the planned verification strategy.
    - Integration of multiple test venues. The fundamental test strategy is to integrate multiple test venues, including the corporate labs and the Cooperative Avionics Test Bed, while using F-35 flight test as a "capstone" event. Effective orchestration of these venues and this build-up process is critical to assure efficient use of flight test sorties. We have yet to see how the process being put in place will cope with multiple events for three different variants operating at two flight test centers. Ultimately, those responsible for issuing, or rescinding, flight clearances will need time and resources to examine the data and, if necessary, request and receive additional information. This has already been the case with the Short Takeoff/Vertical Landing (STOVL) aircraft testing being conducted at Patuxent River. The contractor predicted early last December that

full STOVL flight clearance would be achieved by the end of 2009. That clearance had not yet been achieved as of March 9, 2010, although we hope it is imminent. The decision cycle for understanding flight test results and achieving flight clearance will be under considerable pressure in the coming months, and will require continual supervision in order to meet test goals.

- Accreditation of models. The testing strategy puts a high premium on accreditation of the labs and models that the program plans to use in the build-up to flight test. As of November 2009, about 40 percent of the currently-planned model accreditation activities are planned to complete in 2013 or thereafter. While this gives the program time to incorporate performance data from flight tests in the accreditation process, it also highlights the limited margin available if the models and labs cannot play the intended role of limiting flight test sorties to a minimum amount.
- Resources at the flight test centers. Flight test center resources are also a specific area for continued examination. Adequate spare parts, trained personnel, and training/mission rehearsal tools are essential to reaching the eventual pace of flight test events totaling over 140 per month. While early results in the area of spare parts usage and availability for the three aircraft now flying at Patuxent

River are encouraging, managing adequate resources at two flight test centers after the upcoming test aircraft deliveries requires considerable focus and early response as issues arise; again, this has been the case with other programs of this complexity. A high fidelity mission simulator located at the primary flight testing center, which I understand is being considered by the program office, will also be key to sustaining an adequate pace of testing.

- Margin for discoveries. While it is difficult to determine what level of additional schedule is needed for issues yet to be identified, it is important to acknowledge that this is the reality of testing—we will discover problems and need to make adjustments. Engine performance in ground tests, deficiencies in the flight control surface actuators, and slow progress towards the first vertical landing are examples that have already occurred. A more recent example is the need to modify C-model test aircraft and change the design of the keel beam area for production aircraft. I understand the program is now incorporating short periods of down-time in its revised test plans for modifying test aircraft based on discovery of problems. Combined with planning for a realistic number of refly and regression test sorties, these components of planning are the margin for discovery. I note that, while the planned flight testing refly and

regression rates were recently increased by a modest amount, they remain below historical experience.

I want to briefly mention a system vulnerability issue. The program office is executing a comprehensive, robust, and fully funded Live Fire test plan. However, the program's recent removal of shutoff fuses for engine fueldraulics lines, coupled with the prior removal of dry bay fire extinguishers, has increased the likelihood of aircraft combat losses from ballistic threat induced fires. F-35 live fire testing to date has shown that threat impact into fuel tanks results in sustained fires. In addition, the F-35 will be more vulnerable to typical non-combat fires caused by fuel leaks and other system failures without the fire-suppression systems. At present, only the Integrated Power Plant (IPP) bay has a fire suppression system. Though the configuration control process has approved the program office's request to remove these safety systems as an acceptable system trade to balance weight, cost, and risk, I remain concerned regarding the aircraft's vulnerability to threat-induced and safety-related fires.

In conclusion, establishing realistic plans and adjusting to new realities revealed through flight test is essential as we move forward in the JSF program. Restructuring the test program and funding development consistent with the Joint Estimating Team's analysis are essential steps being taken now. In my view, the program needs to adjust continually to balance the pressure to complete testing on schedule and the need to demonstrate that the combat performance needed by the Navy, Marines, and Air Force has been achieved. The demonstrated performance of the aircraft should have the

greatest influence on the decisions and adjustments that need to be made as the program progresses.