Major Findings

1. The F-35’s final suitability for combat will not be known until 2022 at the earliest.

   • Operational testing—specifically the weapons delivery accuracy tests—for Block 3F aircraft will not be completed before November 2021 in even the best case scenario. The final DOT&E report would then not be completed until spring 2022.

   Page 55: “Unless the accomplishment rate increases over the rate during the Block 2B testing period, completing all Block 3F WDA events will not occur until November 2021.”

   • Current Block 2B aircraft are unsuited for combat.

   Page 48: “Because of the limited combat capability provided in Block 2B, if the Block 2B F-35 aircraft will be used in combat, it will need the support of a command and control system that will assist in target acquisition and to control weapons employment for the limited weapons carriage available. If in an opposed combat scenario, the F-35 Block 2B aircraft would need to avoid threat engagement and would require augmentation by other friendly forces.”

   • “G” Limits when fully fueled leave all current F-35s vulnerable to surprise attack.

   Page 44: “Fleet F-35A aircraft are limited to 3.0 g’s when fully fueled and the allowable g is increased as fuel is consumed, reaching the full Block 2B 7.0 g envelope when approximately 55 percent of full fuel capacity is reached.” “Until relieved of the g restrictions, operational units will have to adhere to a reduced maneuvering (i.e., less “g available”) envelope in operational planning and tactics; for example, managing threat engagements and escape maneuvers when in the restricted envelope where less g is available.”

   • Hardware/software to build combat-essential mission data loads will not be available for at least two years after the scheduled IOT&E start date.

   The F-35 relies on very detailed mission-specific input data files, ones custom created for each mission, to be effective. (For example, they contain enemy radar positions, critical for the “stealth” properties of the aircraft. The pilot needs to know those positions to plot a path that avoids presenting the less stealthy parts of the plane to the enemy’s arrays.) For OT&E tests, the mission loads are to be generated by a special-purpose lab, the U.S. Reprograming Lab (USRL), at Eglin AFB, Florida.

   Page 52: “Despite the $45 Million budget, the program has still not designed, contracted for, and ordered the required equipment—a process that will take at least two years, not counting installation and check-out.”

   Page 52: “The program recently briefed that once the equipment is finally ordered in 2016, it would take at least two years for delivery, installation, and check-out—after IOT&E begins (according to the current schedule of the program of record).”
2. The ultimate measure of the F-35’s reliability and maintainability is the sortie rate.

- The test aircraft at Edwards AFB were only able to fly once every 5 days (6 flights per month). This sustained availability rate is similar to data seen at other bases (Luke AFB achieves 1 flight every 5 days, Nellis AFB 1 flight every 4.75 days). Even taking advantage of a long lead time to specially prepare planes for a scheduled one-week sortie surge test, the F-35 delivered disappointingly few sorties. The Marine Corps surged 8 F-35s for 8 days of maximum sortie effort in support of the Operation Steel Knight air-ground exercise in December 2015. The Marine Corps had planned for each of the 8 aircraft to fly approximately 1 sortie per day. They only managed to get 1 sortie every 2.3 days. In general, F-35 sortie rates actually being achieved are way under those of any previous U.S. fighter except for the F-22.

Page 70: “While deployed, and in support of the exercise, the Marine Corps flew approximately 46 percent of the planned sorties (28 sorties flown versus 61 sorties planned), not including the deployment, redeployment, and local familiarization sorties.”

- Maintenance crews have struggled to keep half of the complex, failure-prone F-35 fleet in fully mission-capable status.

Page 62: “The FMC (full mission capable) rate calculates only the proportion of aircraft not in depot status that are capable of flying all assigned missions and can give a better view into the potential combat capability available to the field. It averaged 46 percent for the 12-month window considering all variants, but started to drop steadily from a peak of 62 percent achieved in December 2014, reaching a minimum value of 32 percent in October 2015.”

- Worst causes of maintenance downtime: avionics processors, stealth material maintenance, fuel system components. Please read the section on ALIS beginning on page 67.

Page 66: “From July 2014 to June 2015, program records show that maintenance on “attaching hardware,” such as nutplates and heat blankets, absorbed approximately 20 percent of all unscheduled maintenance time, while low observable repairs accounted for 15 percent; these were the two highest drivers.”

3. Verification Simulation (VSim) threatens to derail the entire F-35 testing program.

- The VSim facility was supposed to be an ultra-realistic, thoroughly verified “man-in-the-loop, mission systems software in-the-loop simulation developed to meet the operational test requirements for Block 3F IOT&E.” It was intended to permit an operational evaluation of large multi-ship flights of F-35s against dense air and ground threats, replacing the flight tests that are the hardest, most expensive, and most important of all operational tests to conduct with real airplanes and threat simulators. The VSim incorporates realistically detailed cockpits with a “Battlespace Environment (BSE), models of the F-35 and other supporting aircraft, and models of airborne and ground-based threats.” To thoroughly verify VSim, massive flight data has to collected—threat radar and other sensor signatures, onboard computer behavior, weapons firing parameters and trajectories, etc.—from actual F-35 flights. This actual flight data has to be compared to a pilot operating the simulator and presented with the same scenario and threat. For verification, the simulator system response has to be realistically close to the actual flight results.

Page 56: “Due to inadequate leadership and management on the part of both the Program Office and the contractor, the program has failed to develop and deliver an adequate Verification Simulation (VSim) for use by either the developmental
test team or the JSF Operational Test Team (JOTT), as has been planned for the past eight years and is required in the approved TEMP (Test and Evaluation Master Plan).”

- Despite spending $250 million as part of the Nunn-McCurdy restructuring of the troubled program in 2010 (page 37), the originally planned Lockheed Martin VSim fell far behind schedule and L-M requested a huge overrun to complete the system. The JSF Program Office decided in September 2015 to cancel the L-M contract and then replace it by building a new simulation, the Naval Air Systems Command (NAVAIR) Joint Simulation Environment (JSE). DOT&E says such a move comes much “too late” and has not even been put under contract yet.

Page 56: “Without a high-fidelity simulation, the F-35 IOT&E will not be able to test the F-35’s full capabilities against the full range of required threats and scenarios.”

- The Program Office attempted to use the VSim to test the Block 2B aircraft, the same plane the Marine Corps declared combat ready in July.

Page 57: “Verification, Validation, and Accreditation (VV&A) activity completely stalled in 2015 and did not come close to making the necessary progress towards even the reduced set of Block 2B requirements.”

- The decision to build a new simulation and new facility means the BSE will not be ready in time for F-35 IOT&E in 2018—and is likely to never reach usefully verified status. So rather than simulating the most complex and important operational test scenarios, these scenarios will have to be tested using open-air test flights—a hugely time-consuming process that may add six months to a year to the spring 2022 Final IOT&E Report.

Page 58: “Even with these additional flights, some testing previously planned against large-scale, real-world threat scenarios in VSim will no longer be possible.”

4. The Marine Corps IOC declaration was a sham. The Air Force’s declaration in August will be, too.

- The USMC declared a squadron of 10 Block 2B F-35Bs ready for combat in July 2015. Some of the crippling combat deficiencies of those 2B aircraft are listed above (p. 48). The Air Force expects to declare IOC in August 2016 with Block 3i aircraft. Though the name “Block 3i” suggests the aircraft is improved from the earlier model, in fact it simply replaces the old, now-obsolete computer of Block 2B with a newer computer while adding no new combat capabilities over and above Block 2B.

Page 50: “Since no capabilities were added to Block 3i, only limited corrections to deficiencies, the combat capability of the initial operational Block 3i units will not be noticeably different than the Block 2B units. If the Block 3i F-35 aircraft will be used in combat, they will need equivalent support as for the Block 2B F-35 aircraft, as identified previously in this report.”

- Rather than reducing the number of problems the previous version had, the new Block 3i F-35s actually have more problems. Officials wrote the Block 3i testing plan simply “to confirm Block 3i had equivalent capabilities to those demonstrated in Block 2A (for 3iR1) and Block 2B (page 49).” The testing office originally planned for 514 baseline testing points. During the baseline testing, another 364 additional “discovery” testing points were identified. This means during testing, 364 new tests had to be added to try to fix newly discovered problems in a system that was already supposed to work. An example of one of these problems was the unacceptable “instability” (that is, frequent crashing) of the Block 2B computer-based radar. In fact, Block 3i radar performance was found to be “less stable” than Block 2B. Numerically, the 3i radar now crashes 7.5 times more often.
Page 49: “Radar stability is measured in terms of the number of times per flight hour that either of these events occurred: a failure event requiring action by the pilot to reset the system; or, a stability event where the system developed a fault, which affected performance, but self-corrected without pilot intervention.”

5. JSF Program Office’s push for multi-year funding and contract is at least 6 years premature.

- In recent months, JSF program officials and Lockheed Martin have argued publically and strongly for a “block buy” over three fiscal year budgets of 465 F-35s beginning in FY 2018. According to section 2399 of Title 10 U.S.C., the final decision to proceed beyond low rate initial production can only take place after DOT&E submits its final report. There are a total of 7,230 test points that need to be completed before that can happen (page 36). Of these tests, the weapons delivery accuracy (WDA) tests are among the most critical. There are 50 identified weapons delivery accuracy tests for the Block 3F aircraft (page 37), the first weapons tests scheduled to assess real combat capabilities.

Page 55: “Completing the full set of Block 3F WDA events by May 2017, the planned end of Block 3F flight test according to the most recent program schedule, will require an accomplishment rate of over 3 events per month, more than 3 times the rate observed in completing the 12 Block 2B WDA events (approximately 0.8 events per month).”

- Based on the F-35 program’s performance over the years, the DOT&E estimate of a November 2021 testing completion date based on 0.8 WDA events per month is still highly optimistic because the 3F operational WDA tests are far more complex and time-consuming than the much simpler 2B engineering tests that only progressed at 0.8 WDA events per month (page 55). Ignoring this built-in optimism and only adding a minimal four months after November 2021 for the Service test teams and then the DOT&E office to analyze the mass of operational test data collected, it is clear that a final report cannot be expected until the spring of 2022 at the very earliest.

Page 55: “The program plans to accomplish the remaining 35 events as schedule margin allows. The overall result of the WDA events must be that the testing yields sufficient data to evaluate Block 3F capabilities. Deleting numerous WDA events places successful IOT&E and combat capability at significant risk.”