

The Joint Strike Fighter, F-35 Lightning II



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The Vision:

- A “tri-variant” (Air Force, Navy & Marines), multirole fighter aircraft:
 - F-35A is conventional takeoff/landing variant;
 - F-35B is a short takeoff/vertical landing (STOVL) variant; and,
 - F-35C is a carrier-based variant.
- Capable of air superiority/domination through unprecedented capabilities and versatility;
- Conceived in the mid-1990s, First Flight: 2006;

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More of The Vision:

- Key advantages:
 - Stealth,
 - Sensor Fusion,
 - Situational Understanding, and,
 - Precision Attack
- The F-35 Combines radar evading stealth, supersonic speed and extreme agility with the most powerful and comprehensive integrated sensor package of any fighter aircraft in history;

F-35 Lightning: The Holy Grail?

- 4x more effective than legacy fighters in air-to-air combat;
 - 8x more effective in air-to-ground combat; and,
 - 3x more effective in reconnaissance and suppression of air defenses
- while having better range, requiring less logistics support, and having around the same procurement costs (if development costs are excluded) as legacy fighters.

F-35 Lightning: The Holy Grail!

- Aircraft share common parts (80%), support equipment and technical data, yielding greater reliability and long-term cost savings.
 - Designed to replace the United States military F-16, A-10, F/A-18 (excluding newer E/F “Super Hornet”) and AV-8B tactical fighter aircraft.
- Strong global partnership (UK, Canada, Australia, Denmark, Italy, the Netherlands, Norway, and Turkey).

DoD, Industry & Politicians Smiling

- Broad industrial base ensures affordability through economies of scale;
 - \$200B Program
- “Built-in” sustainment for a new level of operational readiness;
- U.S. Buy Projected to be 2,443 aircraft.
 - F-35 variants are intended to provide the bulk of manned tactical airpower for the USAF, USMC, and Navy for decades.
 - Deliveries for the U.S. military to be completed in 2037.
- Global partnership = thousands of technology sector jobs around the world.

F-35 Quality Assurance Assessment

- DoD IG Report No. 2013-140, 30 Sept. 2013
 - Assessed implementation of aviation critical safety items (CSIs) requirements;
 - A CSI is a part, assembly, or support equipment whose failure could cause loss of life, permanent disability or major injury, loss of a system, or significant equipment damage.

F-35 Quality Assurance and CSIs

- CSIs require special handling, engineering, manufacturing, and inspection documentation to control and ensure flight safety;
- U.S. statutory law requires the Dept. of Defense to prescribe a quality control policy for the procurement of aviation CSIs;
 - Dept. of Defense Instructions implement the CSI program and establishes policies, procedures, and responsibilities to manage CSIs;
 - Dept. of Defense Handbook describes the technical and quality assurance requirements for a Prime Contractor CSI program.

DoD Quality Assurance Oversight Errors

- The Dept. of Defense Joint Program Office (JPO) failed to flow down a contractual requirement to the Prime Contractor and its subtier suppliers to implement a CSI management program;
- The Dept. of Defense failed to develop a Diminishing manufacturing sources and material shortages (DMSMS) Program Management Plan;
 - The Dept. of Defense failed to fund the Prime Contractor's creation of a DMSMS Program.
- JPO did not establish definitive criteria for a certain Air System Test Readiness Review
- JPO was not reviewing and documenting program risks during risk level management reviews.

Holy Grail or Unholy Blunder?

The Critics See:

- “Managing an extensive, still-maturing global network of suppliers adds another layer of complexity to producing aircraft efficiently and on-time” and that “due to the extensive amount of testing still to be completed, the program could be required to make alterations to its production processes, changes to its supplier base, and costly retrofits to produced and fielded aircraft, if problems are discovered.”
- A cascade of problems made it heavier, slower, more complex, more expensive and more vulnerable to enemy attack.

Holy Grail or Unholy Blunder?

The Critics See Red:

- Cost overruns (\$396B) and developmental delays (5 yrs +);
- Buy before fly mistake: Untested risky design;
 - Excessive concurrency resulting in expensive refits for 100s of F-35 aircraft planned for production before design testing is completed;
- The F-35 is the “Jack of all trades, and Master of None”; It “can’t turn, can’t climb, can’t run.” (John Stillion, RAND simulation);

Holy Grail or Unholy Blunder?

Combating the Laws of Physics:

- The F-35 violates the important aerospace design principle of “area rule,” which encourages narrow, cylindrical fuselages for best aerodynamic results;
- Stealth and STOVL are not compatible;
- Supersonic speed, STOVL and stealth cannot co-exist.



**F-35 Joint Strike Fighter
Concurrency Quick Look Review
November 29, 2011**

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Oh, Oh!

Thirteen (13) Areas of Concern:

1. The helmet-mounted display system does not work properly.
2. The fuel dump subsystem poses a fire hazard.
3. The Integrated Power Package is unreliable and difficult to service.
4. The F-35C's arresting hook does not work.
5. Classified "survivability issues", (speculated to be about stealth.)
6. The wing buffet is worse than previously reported.
7. The airframe is unlikely to last through the required lifespan.
8. The flight test program has yet to explore the most challenging areas.
9. The software development is behind schedule.
10. The aircraft is in danger of going overweight or, for the F-35B, not properly balanced for STOVL operations.
11. There are multiple thermal management problems. The air conditioner fails to keep the pilot and controls cool enough, the roll posts on the F-35B overheat, and using the afterburner damages the aircraft.
12. The automated logistics information system is partially developed.
13. The lightning protection on the F-35 is uncertified.

The F-35 Is A Cyber Security Target

- The aircraft depends on sophisticated and complex software systems;
 - Millions of lines of code – over 3x more lines of code than any other aircraft.
- The software development is behind schedule, and many key software features do not yet operate or operate optimally;
- Software continues to remain the number one technical risk on the program.

Cyber Security and the F-35

- In 2009 it was revealed that during 2007-2008, spies breached Lockheed Martin and subcontractor networks and downloaded ***several terabytes*** of data related to the F-35's design and electronics systems;
 - The cyber attacks utilized encryption of the stolen data, making it difficult if not impossible to identify precisely what data was taken;
 - Potentially compromised the aircraft and aiding in the development of defense systems against it. ¹⁶

No Cyber Security Breach?

- Lockheed Martin rejected suggestions that the project was compromised, stating it "does not believe any classified information had been stolen".
- The Government of China vehemently denied any state sponsored cyber attack or intrusion, noting that *violating cyber security is illegal* under Chinese law.

No Breach. The F-35



No Breach? The 2012 PRC J31



Questions?

