

## F/A-22 Advanced Tactical Fighter

### SUMMARY

- The F/A-22 program completed the operational test and evaluation (OT&E) Phase 1 operational assessment in February 2004 and began the Initial OT&E (IOT&E) in April 2004.
- The Air Force executed the open air trials and Air Combat Simulator trials outlined in the test plan between April and September 2004.
- To complete IOT&E, the Air Force must complete four end-to-end operational test missile firings and several modeling and simulation evaluations for operational effectiveness and suitability.
- DOT&E continues to analyze available open-air trials, supplemental flight evaluations, and modeling results.
- The Air Force completed the live fire test program in 2004.
- DOT&E will complete a beyond low-rate initial production report, including the live fire report, before the full-rate production decision planned in early 2005.

### SYSTEM DESCRIPTION AND MISSION

The Air Force intends the F/A-22 to provide air dominance with improved capability over current U.S. Air Force combat aircraft. The F/A-22 must have improved lethality to ensure first-look/first-kill in all environments, and maneuverability and acceleration to ensure superiority over any known or predicted threat in the close-in fight. It must have the survivability to conduct its air superiority mission over enemy territory. The system is to accomplish this through a balanced combination of supersonic cruise (without afterburner), low observability, tailored countermeasures, and maneuverability. It must fight in all weather, day or night, over the land or sea. The F/A-22 systems must provide the pilot significantly improved beyond-visual-range situational awareness using highly integrated offensive and defensive functions. Another major requirement for the F/A-22 is a reduction in manpower and equipment supportability through improved reliability, maintainability, and onboard support systems.

Other features critical to the F/A-22 concept of operations are:

- An integrated avionics suite incorporating offensive and defensive sensors; an electronically scanned, active element radar array; and an advanced electronic warfare system with a variety of identification and countermeasures capabilities.
- A cockpit designed to exploit the capabilities of these advanced systems without overwhelming the pilot.
- Enhanced logistics features include an Integrated Maintenance Information System and advanced Diagnostics and Health Management to achieve reduced maintenance manpower and improved deployability.

Basic armament consists of six AIM-120C radar-guided air-to-air missiles, two AIM-9M infrared guided missiles, and a



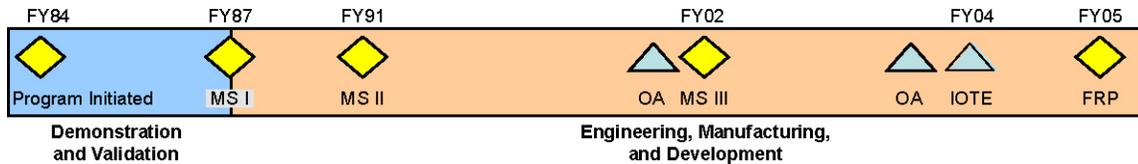
*The IOT&E began in late April 2004 with four OT&E aircraft.*

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20 mm cannon. Alternatively, the Air Force intends the F/A-22 to internally carry two 1,000-pound Joint Direct Attack Munition precision-guided bombs with two AIM-120s and two AIM-9Ms.

Lockheed Martin is the prime contractor for the F/A-22 with significant involvement from Boeing Military Aircraft for mission software development, avionics integration laboratory, flying test bed, and manufacturing. Pratt and Whitney is the prime contractor for the F119 engines.

## TEST AND EVALUATION ACTIVITY



In August 2003, The Air Force Operational Test and Evaluation Center (AFOTEC) revised the IOT&E test plan and included an operational assessment called OT&E Phase 1. OT&E Phase 1 established a baseline for performance of the F/A-22 prior to IOT&E. OT&E Phase 1 documented what worked, what did not work, and enabled recommendations for fixes or improvements needed for combat prior to the start of IOT&E. AFOTEC conducted OT&E Phase 1 between October 2003 and February 2004 on the Nellis Test and Training Range. It consisted of single- and two-ship open-air trials. AFOTEC used three OT&E aircraft configured with avionics software Block 3.1.2 Flight Test-3.2 and 3.3. AFOTEC operated aircraft within an interim flight envelope, detailed in the November 2003 Modified Flight Manual.

In March 2004, the test team conducted F-15C comparison test trials as part of the IOT&E. These trials used two Offensive Counter-Air scenarios – High Value Airborne Asset-Attack and Force Protection (with one B-2 as the strike aircraft). Both scenarios included two blue fighters and four red airborne interceptors (i.e., 2v4). The test team completed 22 valid open-air trials in addition to 26 first-look-first-kill (1v1) trials.

In April 2004, the Joint Requirements Oversight Council validated interim thresholds for suitability parameters to be met in IOT&E. The Air Force stated that, if these interim values are met, then the aircraft might be on track to meet mature thresholds. The measures are sortie generation rate, mean time between maintenance, and airlift support.

The program office, test team, and the Office of the Secretary of Defense closely tracked a measure of avionics stability (mean time between avionics anomalies) throughout the year in order to assess the growth in avionics maturity and to use as an indicator of system readiness to enter IOT&E. The data for the mean time between avionics anomalies metric came from Aircraft 4006 (the contractor-maintained aircraft used as an avionics stability test bed), as well as the four OT&E aircraft.

The integrated contractor and test team completed safe separation unguided missile launches with AIM-9M and AIM-120C missiles throughout the F/A-22 flight envelope. Testing of AIM-120C separation under rolling conditions, as well as air-to-ground weapon and wing tank separation testing, is under way. The Air Force completed 13 of 17 planned end-to-end guided missile launches. Three of the remaining launches are subsequent attempts after failures occurred in first attempts at the given scenario.

The IOT&E began in late April 2004 with the four OT&E aircraft and a spare aircraft (a joint developmental test/operational test aircraft that is fully contractor maintained). Based on OT&E Phase 1 performance, the contractor updated these aircraft with avionics software Block 3.1.2 Flight Test-3.6.1 prior to the start of the test. The test team added a fifth operational test aircraft late in July. During the first six weeks, the F/A-22 flew comparison test open-air trials similar to those flown by the F-15C and completed a total of 25 (2v4) trials and 24 first-look-first-kill (1v1) trials. During the next six weeks, the F/A-22 flew two additional scenarios; these were Defensive Counter-Air High Value Airborne Assesst-Protect and Offensive Counter-Air Force Protection (with four F-117s as the strike aircraft). Both of these scenarios included four blue fighters and eight red airborne interceptors (4v8). The test team completed 23 (4v8)

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trials. Additionally, the test team conducted supplemental missions to provide information on system effectiveness under conditions that could not be included in the open-air trials. The F/A-22 flew approximately 60 supplemental sorties including the mission areas of night-time, live gun firings, advanced infrared threats, advanced electronic countermeasure threats, low altitudes, and high signal density.

The test team conducted a sortie surge demonstration as part of the IOT&E. The approved test plan called for a five-day four-aircraft exercise to generate 24 F/A-22 sorties within five days. AFOTEC conducted the five-day event in two parts, the first two days took place at the end of June and the last three days took place in early August. In the first two days, AFOTEC intended to demonstrate short sortie durations with high sortie rate. The last three days demonstrated a long sortie duration with lower sortie rate.

The test team conducted the final phase of IOT&E in the F/A-22 Air Combat Simulator with approximately seven weeks of trials against current and advanced threats. The Air Combat Simulator simulates a dense surface-to-air and air-to-air threat and electronic signal environment that is not possible in open-air trials.

The program office and test team began planning for the F/A-22 follow-on operational test and evaluation (FOT&E). The FOT&E will evaluate air-to-ground mission capability, as well as fully expand the F/A-22 air-to-air capability to include evaluation of its capability in a cruise missile defense environment. The Air Force must submit a FOT&E Test and Evaluation Master Plan for Office of the Secretary of Defense approval in conjunction with the full-rate production.

The Air Force completed live fire testing of the Onboard Inert Gas Generator System in FY04. Fuel tank tests, conducted in the contractor flight simulator system facility, measured oxygen concentrations during several simulated high-altitude mission profiles.

## **TEST AND EVALUATION ASSESSMENT**

OT&E Phase 1 established a performance baseline, which the developer, tester, and user determined was adequate for combat operations in the limited operational environment made available in the open-air trials. Inadequate technical order data and an immature Integrated Maintenance Information System prevented the collection of meaningful maintainability data, and maintenance issues hampered the sortie generation rate. AFOTEC documented system deficiencies that affected performance and identified 25 problems that needed to be addressed prior to entry into IOT&E. The fixes primarily involved sortie generation rate, mean time between avionics anomalies, chaff and flare countermeasure reliability, and identification performance.

The end-to-end missile shots against realistic targets will provide a critical validation of the F/A-22 air-to-air capability.

The Onboard Inert Gas Generator System successfully maintained fuel tank ullage oxygen concentration levels well below those necessary to support fire or explosion. This testing completes the F/A-22 alternative live fire test program. The DOT&E will combine the live fire test and evaluation results with the operational test results in the beyond low-rate initial production report.

