

FA-18 E/F Super Hornet

The FA-18E/F Super Hornet is a multi-mission, day/night strike fighter aircraft that provides precision strike capabilities to Joint Task Force and Carrier Battle Group Commanders. The aircraft features improvements in range, endurance, carrier bring-back, weapon payload, and survivability. It also provides in-flight tanking for other tactical aircraft, and additional room for growth and upgrades. The FA-18E is a single seat aircraft while the FA-18F is a two seater.

Three major upgrades to the aircraft are planned: an Active Electronically Scanned Array (AESA) radar with an Advanced Crew Station (ACS) in the rear seat of the FA-18F aircraft; an Advanced Targeting and Designating Forward Looking Infrared (ATFLIR) system, and a Positive Identification System (PIDS).

AESA, the APG-79 radar, is intended to significantly increase E/F capabilities. It is designed to improve aircraft lethality, survivability, and enhance signature characteristics. It corrects current APG-73 radar deficiencies, including a lack of capability for growth, while allowing near-simultaneous operation of different radar modes. Because of the potential significance of AESA, DOT&E placed it on oversight for both Operational Test and Evaluation (OT&E) and Live Fire Test and Evaluation (LFT&E). AESA Milestone B was conducted in February 2001. Milestone C is planned for summer 2003 with an Initial Operating Capability (IOC) in FY07. AESA requires several significant structural changes to the aircraft's forward fuselage and cooling system. An umbrella LFT&E program that evaluates the modified aircraft structure with all changes incorporated is under consideration.

In conjunction with the ACS, AESA permits new workload strategies within the two-seat "F" cockpit by allowing each crewman to perform different mission functions independently. For example, the pilot might concentrate on air-to-air while the Weapon Systems Officer (WSO) concentrates on air-to-ground. The two-seat FA-18F was initially designed and produced as a trainer for single-seat FA-18E pilots. Aft cockpit displays and controls replicated those of the front cockpit so that an instructor pilot had the same information as the front-seat student pilot. ACS introduced design and structural changes to the FA-18F aft cockpit when the Navy decided to retire the two-seat F-14 and replace it with the FA-18F. The most significant ACS change decouples rear seat displays and functions from the front seat so that the WSO can perform functions independently of the front seat pilot.

A redesign of the main instrument panel increases multi-function display area. A Digital Video Map Computer provides a high-resolution map on the 8 x 10 display to increase WSO situation awareness. Secondary Hardware-Software Integration, the situational awareness format, and secondary sequence lines allow independent control in each cockpit. The pilot and WSO can independently view maps giving each crewmember the display needed to perform separate but complementary functions, particularly in a combat environment. The first flight of an ACS aircraft is scheduled for FY03, with installation beginning in Lot 26 aircraft to be delivered in CY04 and fleet deployment in Lot 27 aircraft in late CY05.

ATFLIR represents the latest generation of technology in infrared targeting capabilities, including navigation Forward Looking Infrared (FLIR), laser spot tracker, air-to-air laser ranging, electronic zoom, geographic-point targeting, and



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Electro-optics. The existing F/A-18 FLIR pod has documented deficiencies in high altitude magnification and resolution that degrade and, in some instances, preclude target location and precise aimpoint selection. ATFLIR incorporates sensor technologies designed to correct these deficiencies. This next-generation technology is designed to provide three fields of view, incorporate a larger detector array, and allow flight operations up to 50,000 feet altitude.

PIDS is intended to provide the E/F with the ability to positively identify friendly aircraft. The system is essentially an airborne radar transponder/interrogator consisting of a single electronic “black box” in the avionics bay linked to two dedicated external antennas.

TEST & EVALUATION ACTIVITY

Operational Evaluation (OPEVAL) on the E/F was conducted from May to November 1999. In April 2000, DOT&E’s Beyond Low-Rate Initial Production (BLRIP) report to Congress found that the E/F was operationally effective and operationally suitable.

Follow-on Test and Evaluation (FOT&E)(1)—First Period of Aircraft FOT&E:

The Commander, Operational Test and Evaluation Force (COMOPTEVFOR) conducted the first of several FOT&E(1) of the E/F with new tactical software (SCS-18E) from September 2001 to May 2002 in accordance with a Test and Evaluation Master Plan (TEMP) and Test Plan approved by DOT&E.

Aircraft FOT&E(1) began September 24, 2001, and finished May 23, 2002, accumulating over 800 sorties, 1,280 flight hours, and 52 carrier arrested landings.

The objectives of FOT&E(1) were to:

- Determine the operational effectiveness and operational suitability of the E/F aircraft with SCS-18E installed.
- Evaluate items that were waived from OPEVAL that are now ready for test.
- Evaluate corrections to deficiencies identified in OPEVAL.
- Complete evaluation of Critical Operational Issues that were only partially resolved during OPEVAL.
- Investigate potential new tactics for use with the E/F.

For OPEVAL, the Navy had approved 50 waivers to the testing of required capabilities. For FOT&E(1), 30 of those waivers were declared ready to test with no additional waivers. FOT&E(1) also initiated operational test of two new systems in addition to SCS-18E: a PIDS and the Joint Helmet-Mounted Cueing System (JHMCS).

In November 2002, COMOPTEVFOR’s Report on FOT&E(1) concluded that the E/F with SCS-18E installed is operationally effective in the non-electronic attack environment and operationally suitable.

- AESA - Developmental Test and Evaluation: During 2002, AESA conducted developmental testing focusing on a number of prototype modules or components to reduce specific design risks that had been identified by the several Integrated Product Teams that are responsible for specific AESA components. This testing supported the conduct of a series of design reviews for each of the major subsystems, culminating in the successful conduct of a Critical Design Review in October 2001 for the integrated AESA design.
- ATFLIR - Operational Assessment Period: First flight of the ATFLIR occurred in November 1999. COMOPTEVFOR conducted an operational assessment (OA) of ATFLIR from January to April 2002, based on 37 sorties and reported in August 2002 that ATFLIR is potentially operationally effective, and potentially operationally suitable. Due to 100 percent contractor support of the ATFLIR, COMOPTEVFOR did not assess ATFLIR’s reliability, maintainability, availability, or logistic supportability. This OA supported a Navy decision for an early operational capability deployment of ATFLIR with the first FA-18E deployment (VFA-115) in July 2002. OPEVAL of ATFLIR is planned during CY03.

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- PIDS - Operational Test and Evaluation: During FY02, PIDS completed its OPEVAL (October 1, 2001 to March 21, 2002). The OPEVAL consisted of 91 dedicated sorties, comprising approximately 170 flight hours, and an additional 2,400 flight hours of “piggy-back” testing concurrent with the F/A-18E/F’s first period of FOT&E(1). A final test report from COMOPTEVFOR has not yet been received by DOT&E.

TEST & EVALUATION ASSESSMENT

DOT&E’s assessment is informed both by operational testing activities conducted during the past year as well as by a visit conducted by DOT&E personnel to Fifth Fleet and VFA-115 aboard the nuclear aircraft carrier *USS Abraham Lincoln* (CVN-72) in the Persian Gulf in late October 2002, to evaluate the aircraft’s performance under deployed conditions.

FOT&E(1) — First Period of Aircraft FOT&E:

FOT&E(1) of the aircraft confirmed that the operational effectiveness and operational suitability of the aircraft has improved due to the correction of deficiencies observed in OPEVAL, the addition of upgraded tactical software (SCS-18E), and the addition of several new systems.

Testing also highlighted several issues relating to missing or deficient systems that require further attention or funding:

- For OPEVAL (November 1999), not all stores combinations intended for use by the E/F were cleared for carriage and release. While the configurations available were extensive for this phase of testing, there were numerous restrictions involving weapon type, weapon quantity, release interval, multiple release, and mixed loads that were not available during OPEVAL. At the conclusion of FOT&E(1), COMOPTEVFOR reported that, “While the FA-18E/F demonstrated weapon carriage capability and recoverable carrier load flexibility, the mixed weapon load maturity of the aircraft has not progressed enough to support an FA-18E/F exclusive carrier air wing.”
- During OPEVAL, due to an increased noise and vibration environment discovered under the wing of the E/F during developmental testing, a variety of stores and air-to-air missiles, in particular, required additional and more frequent inspections to help ensure acceptable reliability. The FOT&E(1) final report found “Weapon carriage and release limitations continue to affect the capability to effectively employ the full spectrum of Naval air-to-ground ordnance. The FA-18C is required to fulfill employment roles in support of Standoff Land Attack Missile – Expanded Response, 500 lb (GBU-12), and penetrator (GBU-24B/B) variants of the laser guided bomb family.”
- Following OPEVAL, DOT&E’s BLRIP Report found that the full potential of the E/F will be realized only after the incorporation of several new subsystems on the Navy’s roadmap for the aircraft, especially the JHMCS, the AIM-9X missile, and ATFLIR. While OPEVAL has been conducted on the JHMCS and an OPEVAL is currently underway on the AIM-9X, a mismatch appears to exist in procurement and integration of these systems into the F/A-18E/F, such that the first E/F squadrons will deploy for several years with only part of their high-off-boresite combat envelope. The Navy will not realize the full air-to-air combat potential of the E/F until it corrects the funding mismatch and conducts adequate FOT&E of the E/F with JHMCS and the AIM-9X missile.

DOT&E’s BLRIP Report noted that one of the principal reasons underlying the upgrade to the E/F is the capacity for growth to accept further improvements and to correct deficiencies in key subsystems of the FA-18C/D. DOT&E also reported that the E/F must incorporate several key improvements to realize its full potential and operational capabilities. FOT&E(1)’s confirmation of a wide array of improvements indicates that the necessary growth process is underway, but the aircraft’s maturity in air-to-air and air-to-ground weapons and air-to-ground sensors (ATFLIR) has not progressed as rapidly as projected at the end of OPEVAL.

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Aircraft Upgrades:

- AESA is on track to increase performance of the E/F. Developmental Test activity to date includes laboratory bench testing of prototype array modules and an assessment of the anticipated array performance using modeling and simulation of a completed array using the bench testing results. Simulation results indicate that AESA will meet requirements. The accuracy of this simulation in a similar antenna program has been demonstrated. DOT&E will monitor this effort as hardware becomes available for operational test assessment. Early operational test involvement supports full integration and compatibility of five new systems or modifications: the Advanced Mission Computer & Displays, Fiber Channel Network Switch, Software Configuration Set High Order Languages, Advanced Crew Station and the structural modifications to the aircraft's avionics cooling system. The LFT&E evaluation of the Common Block 2 E/F AESA aircraft effort will be an incremental LFT&E update based on the E/F Engineering and Manufacturing Development aircraft program.
- ATFLIR. VFA-115 deployed with 3 pre-production ATFLIR pods and two contractor technical representatives as part of an "early operational capability" initiative. The FA-18E with ATFLIR was not allowed to participate in Operation Enduring Freedom due to concerns about ATFLIR reliability. ATFLIR was highly effective when it worked. Documentation showed that the ATFLIR pod had a Mission Capable rate between 33 percent (1 pod available for daily ops) and 66 percent (2 pods available for daily operations).
- PIDS. Results of the OPEVAL appear to indicate the system to be effective and suitable with some areas of concern remaining. In effectiveness, interrogator azimuth accuracy remains below Operational Requirements Document (ORD) threshold values in some restricted portions of the operational envelope. On average, under typical conditions, interrogator azimuth accuracy is within ORD threshold. A second effectiveness issue where the system fails to meet requirements is in "false ID". Here again this discrepancy is restricted to a segment of the operational envelope. In suitability issues, the system will probably be assessed unsatisfactory for logistical supportability and training. Analysis of OPEVAL data by DOT&E is ongoing as of this writing and will be updated upon receipt of the final OPEVAL report form COMOPTEVFOR.