

## F/A-18 E/F SUPER HORNET



### Navy ACAT IC Program

Total Number of Systems:	12 LRIP-1 20 LRIP-2 548 Production
Total Program Cost (TY\$):	\$47.0B
Average Unit Cost (TY\$):	\$49.9M
Full-rate production:	3QFY00

### Prime Contractor

Boeing

### SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2020

The FA-18E/F Super Hornet is a multi-mission, day/night strike fighter aircraft designed to add to the capability and tactical flexibility of the Carrier Air Wing via improvements in the FA-18 C/D's range, endurance, and carrier bring-back payload and weapons payload. The FA-18E/F features a larger airframe with more fuel capacity, two additional store stations and increased survivability with additional capacity for capability upgrades and growth. This aircraft will also serve as an airborne tanker, further improving Battle Group flexibility and mobility. The projected firepower from Super Hornets operating from aircraft carriers is a key contributor to the Joint Vision 2020 concepts of dominant maneuver and precision engagement.

## **BACKGROUND INFORMATION**

First flight of the FA-18E/F occurred in November 1996. A total of seven aircraft underwent testing during the EMD Phase which involved an integrated team of contractor and Navy pilots accumulating over 5000 flight hours. In April 1992, the DAB approved a Milestone IV/II for the FA-18E/F program. The Navy entered the EMD phase, which concluded in FY00.

A single DAB-level decision was reached in March 1997, with a decision to enter LRIP and delegation to the Navy of the Milestone III full-rate production decision.

OT-IIA was completed in November 1997, with an assessment of potentially operationally effective and potentially operationally suitable. Flight testing focused on validation of the performance data base to assess the accuracy of range and performance predictions. All evaluated key performance parameters were met.

OT-IIB, conducted in two phases, was completed in November 1998 with an assessment of potentially operational effective and potentially operationally suitable. An expanded envelope afforded the pilots the opportunity to evaluate the aircraft in a wide variety of tactical roles such as Weapons Delivery Accuracy, Dissimilar Air Combat Maneuvering, Night Vision Device Suitability, Fighter Escort, Interdiction, and Close Air Support.

OPEVAL was conducted from May to November 1999. Seven production aircraft were tested in a variety of rigorous and operationally realistic environments. Much of the testing took place at China Lake, CA with three deployments to other locations, including aircraft carrier operations.

Prior to full-rate production, three LRIP lots were planned and acquired. LRIP-1 (12 aircraft), LRIP-2 (20 aircraft) and LRIP-3 (30 aircraft) are currently under contract. LRIP-1 includes the seven aircraft that were utilized during OPEVAL.

The FA-18E/F Live Fire Test and Evaluation Program was granted a waiver to conduct less than full-up, system-level testing in May 1992. With the waiver approval, the program was required to execute an Alternative Plan, which included comprehensive ballistic testing of components and major assemblies. Building on the vulnerability reduction program for the early FA-18 aircraft and joint live fire testing of the FA-18C, as well as actual combat damage incidents, the Navy executed an aggressive LFT&E program for the FA-18E/F. Testing was completed on full-up drop test aircraft reconfigured for Live Fire testing. These tests include precedent setting ballistic shots with a running F-414 engine.

Although the FA-18E/F is approximately 20 percent larger than the FA-18C/D, its vulnerable area has not increased proportionally. One of the major survivability improvements was a redesign of the wall between the fuel tank and the engine inlet duct to mitigate a fire potential. Another major improvement is the addition of active fire suppression systems in the fuselage dry bays adjacent to fuel tanks that have proved effective during Live Fire testing. LFT&E and IOT&E results were reported to Congress on March 30, 2000 and supported the FA-18E/F approval of full rate production in April 2000.

Although OPEVAL found FA-18E/F to be operationally effective and operationally suitable in all mission areas, several OT issues relating to missing or deficient systems were identified as needing further attention by DOT&E. Among these were:

1. Large number of external stores carriage/release limitations that required additional testing to resolve.

2. Noise and Vibration levels in the under-wing environment and their effect on weapons/stores.
3. Integration/replacement of key systems.

## **TEST & EVALUATION ASSESSMENT AND RECOMMENDATIONS**

### **OPEVAL summary**

OPEVAL was conducted using three FA-18E (single-seat) aircraft and four FA-18F (two-seat) aircraft delivered under Low Rate Initial Production (LRIP). Although not all planned weapons for the FA-18E/F were cleared for use during OPEVAL, 29 distinct load-out configurations were employed for the test. The aircraft and the payloads tested in OPEVAL were representative of the operational configurations to be fielded.

The IOT&E Air-to-Ground Phase evaluated Air-to-Ground Weapons, Air-to-Ground Sensors, Air Combat Maneuvering, Defense Suppression, Tactics and Survivability. There were multiple ordnance flights dropping a variety of weapons such as Mk 82 (500 lb.), Mk 83 (1,000 lb.), and CBU's (cluster bombs). Also, for the first time since the A-6 aircraft, a new organic "by design" tanking capability was demonstrated by the FA-18E/F during day and night operations.

The Air Combat Phase took place at NAS Key West, FL, and assessed portions of Fighter Escort, Combat Air Patrol, Air Combat Maneuvering, Tactics, and Survivability issues. Scenarios included up to four Super Hornets versus an equal or larger number of F-16C opponents emulating the latest generation MiG-29 threat aircraft flying realistic threat tactics. Mixed formations of FA-18Cs and Super Hornets were also tested and compared.

The Super Hornet conducted Carrier Operations from the deck of USS JOHN C. STENNIS (CVN 74) and was integrated into Carrier Air Wing NINE conducting simulated alert launches, long-range strikes and aerial refueling.

The FA-18E/F operated from Nellis AFB, NV, participating in a Combined/Joint Exercise Red Flag, an intense training exercise involving Air Force, Navy, Marine Corps and multi-national assets. A realistic air campaign was conducted to attack representative threat targets with inert and live munitions. Adversary aircraft and multiple surface-to-air threat systems opposed these assets.

Operational testing at China Lake focused upon survivability flights and the delivery of air-to-air missiles and smart weapons. Survivability flights involved the conduct of operationally representative strike missions, using targets defended by a variety of actual and surrogate threat surface-to-air missile systems along their en route flight paths. Air-to-air gunnery and air-to-ground sensor flights were also completed at the China Lake operational testing facilities.

The following operational test limitations were encountered and managed:

- The FA-18E/F Acquisition Logistic Support Plan calls for 12.5 maintenance personnel per aircraft for the FA-18E and 11.9 maintenance personnel per aircraft for the FA-18F. For the seven aircraft participating in OPEVAL, this would allocate 85 maintenance personnel. During OPEVAL, however, the Navy maintenance team was comprised of only 54 persons. As a result, the aircraft availability threshold was not met during OPEVAL. To resolve this

COI, a correction factor was devised and applied by DOT&E based on a reasonable expectation of maintenance man-hours that would have been available with the full complement of 85 personnel. With the application of this correction factor all suitability COI's were successfully resolved.

- Not all stores combinations intended for eventual utilization by the FA-18E/F were cleared for carriage and release during OPEVAL. 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.
- Due to an increased noise and vibration environment discovered under the wing of the FA-18E/F during developmental testing, a variety of hardware security problems were encountered with various stores. As a result, additional and more frequent inspections of air-to-air missiles were required during OPEVAL.
- Live Fire Testing was adequate with minor limitations:
- The live fire tests of the engine bay fire extinguishing system were not sufficiently realistic to verify the effectiveness of that system.
- Although the tests verified that the fuel tank ullage (fuel-air mixture) would be in the explosive range under certain known conditions, operational data is lacking to determine how often these conditions will occur during typical mission scenarios.
- Although testing on the FA-18E version (single-seat) was adequate to determine the potential for crew casualties from an adjacent fuel tank ullage explosion, the results do not necessarily extrapolate to the FA-18F configuration (two-seat) because the rear seat of the FA-18F is closer to the ullage area than the single-seat in the tested configuration.
- The vulnerability estimates produced by the state of the art vulnerability models used in this program were incomplete in their predictions of target damage. Many sources of aircraft damage (e.g., fires, toxic fumes, blast, bending, ricochet, projectile breakup, spall, secondary spall, and delamination) are not modeled well or not modeled at all.

### **Follow-On Test and Evaluation (FOT&E)**

The Navy Roadmap for the Super Hornet calls for the incorporation of many subsystems that are expected to increase that aircraft's effectiveness and survivability. Of primary importance are the Active Electronically Scanned Antenna (AESA), the Advanced Targeting Forward Looking Infrared Radar (ATFLIR), and the Joint Helmet Mounted Cueing System (JHMCS), discussed in this report under *Hornet Upgrades*.

Periods of FOT&E are planned to evaluate the enhancements to the Super Hornet that these new subsystems are postulated to provide. The first of these FOT&E periods, OT-III A, is scheduled for Sep01 to Feb02 and will support 1<sup>st</sup> deployment with Operational Tests on Joint Standoff Weapon (JSOW), Joint Direct Attack Munition (JDAM), Integrated Defensive Electronic Counter Measures (IDECM) Block 2/3 (OPEVAL), Tactical Aircraft Moving Map Capability (TAMMAC), Positive Identification/Conformal Antenna System (PIDS/CAS)(OPEVAL), Multifunction Information Distribution System (MIDS) (OA), Joint Helmet Mounted Cueing System (JHMCS) (OPEVAL) and Shared Aerial Reconnaissance Pod (SHARP) (OA). The second FOT&E period will be Nov02 to Feb03 with Lot 24 configuration aircraft and will test GBU-24B/B, MIDS and DCS to support the second deployment for the FA-18E/F. DOT&E will closely monitor the FOT&E periods and will include our assessment in future annual reports.

Since the completion of OPEVAL, the Developmental Test community has been exploring the Noise and Vibration issues through a flight test program intended to assess the efficacy of various airflow “trim” fixes devised to smooth out turbulence-induced vibrations. These fixes include various fairings, trim strips, vortex generators and fences. A series of 17 dedicated flights have been defined and scheduled for the October through December 2000 timeframe. DOT&E will closely monitor progress in this activity.

The Operational Test community has been actively pursuing the ordnance carry/release restrictions in order to clear as many as possible by the time of the first deployment. Little progress has been made in this regard, however, due to competing priorities and asset availability. DOT&E remains focused on continuing DT/OT efforts to correct deficiencies identified in the FA-18E/F OPEVAL.

