

## F/A-18E/F Super Hornet Naval Strike Fighter (All Upgrades)

### Executive Summary

- The Navy reported on the first FOT&E (FOT&E 1) of the APG-79 radar with System Configuration Set (SCS) H4E in FY09. Significant deficiencies remain in radar performance, especially in short range dogfight engagements. Also, several suitability deficiencies remain, including continued poor reliability, poor built-in test performance, and a system anomaly that could mask an overheat condition, causing a potential fire hazard. The Program Office has proposed an engineering change to address this anomaly; it will be implemented and flight tested in FY10.
- Because development of the combat capability of the APG-79 was concurrent with IOT&E, it was problematic for the Navy to correct deficiencies observed during IOT&E prior to deployment or FOT&E 1. Additionally, those fixes that were implemented came at the expense of new functionality expected in the first combat software build. The Navy deployed APG-79 equipped F/A-18E/F aircraft prior to the end of FOT&E 1 and prior to correction of all identified deficiencies. Commander, Operational Test and Evaluation Force (COTF) identified specific deficiencies for correction prior to FOT&E 2.
- The Navy conducted Software Qualification Test (SQT) of the SCS H5E from October 2008 through May 2009 and of SCS 21X from June through September 2009. The H5E software was an improvement over previous versions and over 120 previous anomalies were corrected. Problems remain in the air warfare capability for both APG-79 and APG-73 radar systems including Electronic Warfare threshold shortfalls that increase the susceptibility of the aircraft.

### System

- The F/A-18E/F Super Hornet is the Navy's premier strike fighter aircraft and replaces earlier F/A-18 variants in the Navy's carrier air wings.
- The F/A-18E is a single-seat aircraft and the F model has two seats.
- Major combat capabilities are embodied in the operational software builds known as SCS. Two software programs are involved: the "X-series" for the legacy computer systems in the early aircraft and the "H-series" for the later aircraft with updated processors. The current fleet SCS for Block 2 Super Hornets is H5E. Super Hornets prior to Lot 26 (as well as legacy Hornets F/A-18 (A+/C/D)) currently operate with SCS 20X. The 21X upgrade is intended to enable all aircraft to operate with the same functionality as the Block 2 Super Hornets. Super Hornet capability improvements remain under DOT&E oversight.



- The F/A-18E/F Lot 26 aircraft and beyond provide functionality essential to the integration and operation of all Super Hornet Block 2 hardware upgrades. These upgrades provide capabilities including:
  - Single pass multiple targeting for GPS-guided weapons
  - Use of AIM-9 series infrared-guided missiles and AIM-120 and AIM-7 radar-guided missiles
  - Off-board target designation
  - Improved data link target coordinate precision
  - Implementation of air-to-ground target points
  - Increased fuel and weapons capacity
- The APG-79 Active Electronically Scanned Array (AESA) radar is one of several sub-systems that comprise the F/A-18E/F planned common avionics suite upgrade (Block 2), which will be integrated into Lot 26 aircraft and beyond. It replaces the APG-73 mechanically scanned array and is intended to correct current APG-73 radar deficiencies.
- The aircraft carries the Advanced Targeting and Designation Forward-Looking Infrared System (ATFLIR) that the crew uses to locate surface and airborne targets. The ATFLIR will have an infrared marker and target designator/ranger capability in addition to being able to provide infrared and/or electro-optical streaming video via data link.
- The Super Hornet is also fitted with the Shared Reconnaissance Pod, Multi-functional Information Distribution System (MIDS) for Link 16 tactical data link connectivity, the Joint Helmet Mounted Cueing System (JHMCS), and Integrated Defensive Electronic Countermeasures. The Joint Mission Planning System

# NAVY PROGRAMS

– Maritime (JMPS-M) is the fleet mission planning system. An infrared search and track system is under development.

## Mission

- The F/A-18E/F provides the Aircraft Carrier Battle Group Commander with a multi-mission capable aircraft. Carrier Strike Group Commanders and Joint Force Air Component Commanders use the F/A-18E/F to:
  - Conduct offensive and defensive air combat missions
  - Attack ground targets with most of the U.S. inventory of GPS-guided, laser-guided, and free-fall weapons, as well as the 20 mm cannon

- Employ both the High-Speed Anti-Radiation Missile and the Advanced Anti-Radiation Guided Missile against enemy radars
- Provide in-flight refueling for other tactical aircraft
- Provide the fleet with an organic tactical reconnaissance capability available for tasking by the Carrier Strike Group Commander and supported Joint Task Force

## Prime Contractor

- The Boeing Company, Integrated Defense Systems, St. Louis, Missouri

## Activity

- COTF submitted their final report on the first FOT&E of the APG-79 (AESA) radar in January 2009. During that test, APG-79-equipped F/A-18E/F aircraft with SCS H4E completed 867 flight hours in 587 sorties. APG-79 (AESA) radar testing was intended to support the first fleet deployment of this system by verifying correction of deficiencies identified in IOT&E (2006), and evaluating the newly implemented Anti-Tamper capability and the inherent electronic protection capability of the radar.
- The Navy conducted testing of the 21X build between June and September 2009 in accordance with the DOT&E-approved Test and Evaluation Master Plan (TEMP) and test plan. The 21X build is the SCS for the legacy Super Hornets and other F-18 aircraft that do not have advanced mission computers and was intended to add capabilities common to those aircraft with the advanced mission computer/higher-order language software (e.g., H3E and H4E).
- The Navy conducted SQT of the SCS H5E from October 2008 through May 2009. F/A-18E/F aircraft with H5E software installed flew 1,100 flight hours in 793 sorties. In addition to providing initial capability for the EA-18G (reported separately), testing of the block H5E update testing assessed integration of JMPS, MIDS-Joint Tactical Radio System, Joint Stand-off Weapon C-1, Stand-off Land Attack Missile Expanded Response (SLAM-ER), and the Joint Helmet Mounted Cueing System – Night Vision Cueing Device (JHMCS-NVCD).

## Assessment

- DOT&E agrees with COTF that the F/A-18E/F equipped with APG-79 (AESA) radar presents a considerable upgrade in technology; however, significant deficiencies remain in radar performance, especially in short range dogfight engagements. Several suitability issues remain, including failure to meet reliability requirements, poor built-in test performance, and a masking of an overheat condition, which is a potential fire hazard. The Program Office has an engineering change proposal to address this anomaly; it will be implemented

and flight tested in FY10. Development of the full electronic warfare capability of the radar continues to be deferred to later software builds; SCS H6E and H8E are currently planned to implement these capabilities.

- F/A-18E/F equipped with APG-79 (AESA) radar demonstrate an improved warfighting capability over the legacy APG-73 radar.
- Because APG-79 (AESA) equipped F/A-18E/F aircraft are already deployed, COTF did not make additional Fleet release recommendations. COTF identified specific deficiencies for correction prior to FOT&E 2 in April 2010.
- H5E JHMCS display upgrades provided notable improvements and over 120 previous anomalies were corrected from the H4E software set. Electronic protection capability deficiencies and performance are not resolved for both APG-79 (AESA) and APG-73 radar systems.
- IOT&E of the APG-79 identified major deficiencies. COTF's assessment found the system not effective and not suitable but recommended the release for training pending correction of deficiencies. The Navy elected to deploy the F/A-18E/F aircraft with the new radar and found that it is a significant capability improvement over the APG-73 even with the reported deficiencies.

## Recommendations

- Status of Previous Recommendations. The Navy has made progress in addressing the recommendation from FY08. The two FY07 recommendations remain valid.
- FY09 Recommendations. The Navy should:
  1. Correct APG-79 (AESA) deficiencies identified in the COTF assessment prior to FOT&E 2.
  2. Continue to improve the APG-79 (AESA) mean time between operational mission failure rate.
  3. Conduct operationally representative end-to-end missile shot testing to demonstrate multi-AIM-120 support with the APG-79 and current SCS, as well as develop and characterize the full electronic warfare capability of the AESA radar.