F/A-18E/F Super Hornet and EA-18G Growler

Executive Summary

- During FY16, the Navy released System Configuration Set (SCS) H10E for use in the F/A-18E/F Super Hornet and the EA-18G Growler fleets. Software upgrades for the Super Hornet included improved multi-sensor integration, aircrew displays, short-range tracking, and combat identification. For the Growler, SCS H10 added the Joint Tactical Terminal Receiver, enhanced combat identification capability, and expanded jamming assignments. SCS H10 included an initial capability allowing aircrew for both platforms to operate more easily in Air Traffic Control (ATC)-controlled airspace.
- The reliability of the APG-79 Active Electronically Scanned Array (AESA) radar improved during SCS H10 testing for the F/A-18E/F and EA-18G, demonstrating the highest reliability to date since introduction of the AESA in 2006. However, it failed to meet the program reliability requirement.
- SCS H10 built-in test (BIT) detection and isolation functions demonstrated strong performance, but a high BIT false alarm rate resulted in an unnecessary maintenance burden.
- The Super Hornet weapons system has demonstrated operational effectiveness and suitability in most, but not all, threat environments. Previous DOT&E classified reports have discussed the threat environments in which the Super Hornet is not effective.
- The EA-18G Growler weapons system equipped with SCS H10 demonstrated operational effectiveness and suitability with the same radar limitations as the Super Hornet. It also demonstrated degraded APG-79 performance when ALQ-99 pods radiated within the AESA frequency range.
- The Navy began operational testing of the next software upgrade, SCS H12, in October 2016. Planned improvements include another phase of multi-sensor integration improvements, enhanced ALQ-218 geolocation, Communication Countermeasures Set improvements, modifications to crew to aircraft interfaces and displays to manage aircrew workload, and additional capabilities to operate in ATC-controlled airspace.

System

F/A-18E/F Super Hornet

- The Super Hornet is the Navy's premier strike-fighter aircraft and is a more capable follow-on replacement to the F/A-18A/B/C/D and the F-14.
- F/A-18E/F Lot 25+ aircraft provide functionality essential for integrating all Super Hornet Block 2 hardware upgrades, which include:
  - Single pass multiple targeting for GPS-guided weapons
  - Use of off-board target designation
  - Improved datalink for target coordination precision
  - Implementation of air-to-ground target aim points
- Additional systems include:

  - APG-73 (Lots 21-24) or APG-79 radar (Lots 25+)
  - Advanced Targeting Forward Looking Infrared Systems
  - AIM-9 infrared-guided missiles and AIM-120 and AIM-7 radar-guided missiles
  - Multi-functional Information Distribution System for Link 16 tactical datalink connectivity
  - Joint Helmet-Mounted Cueing System
  - Integrated Defensive Electronic Countermeasures

EA-18G Growler

- The Growler is the Navy's land- and carrier-based, radar and communications jamming aircraft.
- The two-seat EA-18G replaces the four-seat EA-6B Prowler. The ALQ-218 receiver, improved connectivity, and linked displays are the primary design features implemented to reduce the operator workload in support of the EA-18G's two-person crew.
- The Airborne Electronic Attack (AEA) system includes:
  - Modified EA-6B Improved Capability III ALQ-218 receiver system
  - Advanced crew station
  - Legacy ALQ-99 jamming pods
  - Communication Countermeasures Set System
  - Expanded digital Link 16 communications network
  - Electronic Attack Unit
  - Interference Cancellation System that supports communications during jamming operations
  - Satellite receiver capability via the Multi-mission Advanced Tactical Terminal
- Additional systems include:
  - APG-79 AESA radar
  - Joint Helmet Mounted Cueing System
  - High-speed Anti-Radiation Missile
  - AIM-120 radar-guided missiles

System Configuration Set (SCS) Software

- Growler and Super Hornet aircraft include SCS operational software to enable major combat capabilities. All EA-18G

and Block 2 F/A-18E/F (production Lot 25+) use high-order language (HOL) "H-series" software, while F/A-18E/F prior to Lot 25 and all legacy F/A-18A/B/C/D aircraft use "X-series" software.
  - The Navy released SCS H10 in October 2015 and began operational testing of SCS H12 in October 2016.
  - The Navy released SCS 25X on legacy Hornet and older Super Hornet aircraft in October 2015.

Mission
- Combatant Commanders use the F/A-18E/F to:
  - Conduct offensive and defensive air combat missions.
  - Attack ground target with most of the U.S. inventory of precision and non-precision weapons.
  - Provide in-flight refueling for other tactical naval aircraft.
  - Provide the fleet with an organic tactical reconnaissance capability.
- Combatant Commanders use the EA-18G to:
  - Support friendly air, ground, and sea operations by countering enemy radar and communications

- Jam integrated air defense systems
- Support non-integrated air defense missions and emerging non-lethal target sets
- Enhance crew situational awareness and mission management
- Enhance connectivity to national, theater, and tactical strike assets
- Provide enhanced lethal suppression through accurate High-speed Anti-Radiation Missile targeting
- Provide the EA-18G crew with air-to-air self-protection with the AIM-120

Major Contractors
- The Boeing Company, Integrated Defense Systems – St. Louis, Missouri
- Raytheon Company – Forest, Mississippi
- General Electric Aviation – Evendale, Ohio
- Northrop Grumman Corporation – Bethpage, New York

Activity
- The Navy released SCS H10 to the F/A-18E/F and EA-18G fleets in 2016.
- The Navy began testing SCS H12 on both platforms in October 2016 in accordance with a DOT&E-approved test plan. Testing will continue into 2017.
- The Navy delivered SCS H10 improvements for the Super Hornet including improved multi-sensor integration, aircrew displays, short-range tracking, combat identification, and the ability to operate more easily in ATC-controlled airspace.
- The Navy delivered SCS H10 improvements for the Growler including the addition of the Joint Tactical Terminal Receiver, enhanced combat identification, expanded jamming assignments, and the ability to operate more easily in ATC-controlled airspace.
- The Navy completed testing and released SCS 25X to the fleet in 2016 for use in F/A-18 A-D and early lot F/A-18E/Fs that do not have HOL computers. The Navy plans to use the remaining non-HOL Super Hornets primarily for training.

Assessment
- Although capability enhancements in SCS H10 resulted in incremental changes in the ability of the Super Hornet to complete missions, DOT&E did not expect this software release to add significant mission capability. The F/A-18E/F remains operationally effective in some threat environments and ineffective in particular air warfare environments noted in classified reports. Though SCS H10 has begun to address some of those long-standing deficiencies in air warfare, the Super Hornet requires further improvements. Software false alarms in SCS H10 impose a maintenance burden on unit personnel.

- SCS H10 testing showed improved AESA reliability, and while it demonstrated the highest reliability to date since introduction of the AESA in 2006, it fell short of its reliability requirement. Although the AESA provides improved performance compared to the legacy mechanically-steered radar, DOT&E has assessed the radar as not operationally suitable since the 2006 IOT&E because of poor software stability and BIT performance. Fault identification and isolation functionality have improved, but the AESA false alarm rate remains high. Additionally, the F/A-18 has demonstrated interoperability deficiencies with on- and off-board sensor inputs.
- DOT&E continues to assess the EA-18G as operationally effective and suitable subject to the same threat limitations as the Super Hornet. The radar performance degradation occurs when ALQ-99 pods radiate in AESA frequencies, affecting Growler operational effectiveness.
- Because the Navy did not include an end-to-end multiple AIM-120 missile test during SCS H10, testing has been deferred to SCS H12 FOT&E. The Navy will not have successfully demonstrated that the AESA can support this required capability until this test is successfully completed.
- The Navy's F/A-18 fleet relies more heavily on Lot 25+ E and F aircraft compared to the Navy's operational test squadron, VX-9, which includes more F/A-18C and D aircraft and older E and F aircraft that lack HOL mission computers and APG-79 AESA radars, making test conditions less operationally representative.

Recommendations
- Status of Previous Recommendations. Per previous recommendations, the Navy should continue to improve the

APG-79 radar reliability, false alarm performance, and, for the EA-18G, geolocation timeliness with jammers off, and should continue to develop and characterize the full electronic warfare capability of the AESA radar. DOT&E continues to recommend that the Navy conduct an operationally representative end-to-end missile test to demonstrate APG-79 radar and system support for a multiple AIM-120 missile engagement. The Navy should continue to focus on improvements that will allow the Super Hornet and Growler to be operationally effective in all threat environments.

- FY16 Recommendation.
  1. The Navy should upgrade the Super Hornet aircraft used during operational testing to better reflect fleet composition in terms of number of aircraft with HOL mission computers and APG-79 radars.