

## F-15E Radar Modernization Program (RMP)

### Executive Summary

- The Air Force Operational Test and Evaluation Center conducted IOT&E from March through September 2013 to assess the system's operational effectiveness, suitability, and mission capability.
- DOT&E published a classified report on the operational effectiveness, suitability, and mission capability of the F-15E Radar Modernization Program (RMP) system upon completion of IOT&E data analysis. The system entered full-rate production in March 2014.
- IOT&E results demonstrated:
  - The F-15E RMP is operationally effective with significant improvements in air-to-air capabilities.
  - RMP operating modes and pilot-vehicle interfaces are functionally equivalent to those of the legacy APG-70 radar.
  - APG-82(V)1 hardware operational reliability and maintainability support F-15E operational availability requirements.
  - Additional monitoring of system suitability will be required in order to fully assess system reliability and maintainability metrics due to the limited flight hours and low failure rate observed during IOT&E.
- At the conclusion of the IOT&E, there were unresolved RMP system supportability and deployability shortfalls. The Air Force has yet to resolve long-term support equipment provisioning, functionality, and overall APG-82(V)1 spares posture necessary to support the deployment of RMP-equipped F-15E operational squadrons.

### System

- The F-15E is a twin-engine, tandem-seat, fixed-wing, all-weather, multi-role fighter aircraft. The F-15E has a fully-missionized cockpit and a multimode air intercept and air-to-ground radar, giving the aircrew the capability to employ air-to-air and air-to-ground munitions, a 20 mm cannon, and countermeasures for evading enemy fire.
- The RMP replaces the F-15E legacy APG-70 mechanically-scanned radar with an active electronically-scanned array (AESA) system designated the APG-82(V)1. The RMP is designed to retain functionality of the legacy radar system while providing expanded mission employment capabilities to include:
  - Near-simultaneous interleaving of selected air-to-air and air-to-ground functions
  - Enhanced air-to-air and air-to-ground combat identification capabilities
  - Longer range air-to-air target detection and enhanced track capabilities



- Longer range and higher resolution air-to-ground radar mapping
- Improved ground moving target track capability
- The RMP upgrade is also intended to address legacy F-15E radar system suitability shortfalls including: poor reliability, parts obsolescence, and high sustainment costs. The Air Force intends to retrofit the RMP across the existing F-15E fleet.
- The RMP APG-82(V)1 design leverages capabilities from currently fielded AESA radar systems. The APG-82(V)1 antenna and power supply are currently in use on the F-15C APG-63(V)3 program, and the radar receiver/exciter and Common Integrated Sensor Processor are based on the F/A-18E/F APG-79 AESA system.
- Other hardware and software modifications comprising the RMP effort include a more powerful Environmental Control System, updates to the aircraft Operational Flight Program and Electronic Warfare software, a new radio frequency tunable filter, and aircraft modifications to include a new wideband radome and wiring changes.

### Mission

A unit equipped with the F-15E conducts all weather, day and night missions to include:

- Offensive and Defensive Counterair
- Conventional Air Interdiction and Nuclear Strike
- Close Air Support and Strike Coordination and Reconnaissance
- Suppression of Enemy Air Defenses
- Combat Search and Rescue

### Major Contractors

- The Boeing Company – St. Louis, Missouri
- Raytheon – El Segundo, California

## Activity

- The Air Force Operational Test and Evaluation Center conducted the F-15E RMP IOT&E, which completed in September 2013, in accordance with the DOT&E-approved Test and Evaluation Master Plan and IOT&E plan.
- In March 2014, DOT&E published a classified report on the operational effectiveness, suitability, and mission capability of the F-15E RMP system upon completion of the IOT&E data analysis.
- The F-15E RMP entered full-rate production in March 2014.

## Assessment

- DOT&E assesses that the F-15E RMP:
  - Is operationally effective and operating modes and pilot-vehicle interfaces are functionally equivalent with those of the legacy APG-70 radar system.
  - Provides significantly improved capability in the air-to-air operational environment compared to that of the legacy APG-70 radar system.
  - Demonstrated comparable air-to-ground radar performance compared with that of the legacy system and improvements in target location accuracy.
  - Software stability did not meet the Air Force Mean Time Between Software Anomaly criteria of 30 hours during IOT&E. However, post-IOT&E flight testing of a subsequent radar software version corrected the single anomaly that resulted in 6 of 12 observed software stability events encountered in IOT&E.
  - Hardware operational reliability and maintainability support F-15E operational availability requirements. However, limited flight hours and the low failure rate observed throughout the evaluation period precluded DOT&E's ability to confirm, with confidence, that the APG-82(V)1 hardware reliability, maintenance man-hours per flight hour, mean repair time, and built-in test fault diagnostics requirements were met. Therefore, additional monitoring of system suitability will be required in order to fully assess system performance in these areas.

- At the conclusion of the IOT&E, there were unresolved RMP system supportability and deployability shortfalls to include:
  - The Air Force currently lacks a long-term programmatic solution for providing ground-cooling carts to service the APG-82(V)1 at operational unit locations.
  - The Gore® communications cables that connect the radar Common Integrated Signal Processor to the receiver/exciter cannot be functionally checked with the Joint Services Electronic Combat Systems Tester.
  - The Air Force has yet to define the Readiness Spares Package provisioning necessary to determine the number of 436L pallets and Gore® communications cables needed to support the deployment of RMP-equipped operational F-15E squadrons.

## Recommendations

- Status of Previous Recommendations. The Air Force is addressing RMP software stability issues previously identified in the FY12 and FY13 Annual Report.
- FY14 Recommendations. The Air Force should:
  1. Correct the anomalies identified in IOT&E that resulted in software reliability events to ensure F-15E RMP software stability meets Air Force requirements.
  2. Provide a long-term solution for APG-82(V)1 ground cooling carts, Gore® communications cable spares posture and ground test set compatibility, and Readiness Spares Package provisioning and deployment pallet posture, in order for the F-15E RMP system to be fully supportable and deployable.
  3. Continue to monitor installed system reliability, availability, and maintainability metrics to confirm, with confidence, that APG-82(V)1 hardware reliability, maintenance man-hours per flight hour, mean repair time, and built-in test fault diagnostics performance meet the Air Force requirements.