

## Advanced Extremely High Frequency (AEHF) Satellite Communications System

### Executive Summary

- The Air Force Operational Test and Evaluation Center (AFOTEC) conducted test planning for the upcoming Operational Utility Evaluation (OUE) in the 3QFY10. The OUE will focus on the Advanced Extremely High Frequency (AEHF) Mission Control Segment. The Air Force will field the Mission Control Segment to assume control of the Military Strategic, Tactical, and Relay (Milstar) constellation in advance of the launch of the first AEHF satellite.
- The Program Manager conducted additional thermal vacuum testing on Space Vehicle 1 to complement other inter-segment tests and confirm correction of all technical issues identified late in FY08.

### System

- AEHF represents the third generation of Extremely High Frequency Satellite Communications capability protected from nuclear effects and jamming activities.
- The AEHF system will follow the Milstar program as the protected backbone of the DoD's integrated military satellite communications architecture. The AEHF is expected to increase system throughput capacity by a factor of 10.
- The overall AEHF system has three segments:
  - Space segment: The space segment comprises an integrated constellation of Milstar and AEHF satellites.
  - Mission Control segment: The control segment includes fixed and mobile telemetry, tracking, and commanding sites; fixed and transportable communication planning elements; and the common user interface with the Space Ground-Link Subsystem and the Unified S-Band capability.
  - Terminal (or User) segment: The terminal segment includes ground-fixed, ground-mobile, man-portable, transportable, airborne, submarine, and shipboard configurations.
- The first AEHF satellite is to have the capabilities of a Milstar II satellite at launch, but the software will be upgraded to full AEHF capability after the launch of the second satellite, which will be launched as a fully capable AEHF satellite.



- The Defense Acquisition Executive authorized fabrication and assembly of the first four satellites and development of the Control and User segments. The Defense Acquisition Executive directed the Air Force to plan for the acquisition of satellite vehicles five and six. The exact number of satellites in the AEHF constellation is yet to be determined. The operational AEHF constellation is defined as four interconnected satellites per the AEHF Operational Requirements Document, dated October 2, 2000.

### Mission

Combatant Commanders and operational forces worldwide will use the AEHF system to provide secure, responsive, and survivable space-based, strategic, and tactical military communications.

### Prime Contractor

Lockheed Martin Space Systems, Sunnyvale, California

### Activity

- The program manager conducted additional thermal vacuum testing on Space Vehicle 1 to complement other inter-segment tests and confirm correction of all technical deficiencies identified during an Executive Review in December 2008.
- Government developmental software testing has identified major problems with software maturity, particularly in the

Mission Planning Element. The government is systematically verifying software quality as the contractor corrects each deficiency. The program manager plans for a comprehensive test of the software in FY10.

# AIR FORCE PROGRAMS

- AFOTEC is planning the OUE of the Mission Control Segment, scheduled for 3QFY10, and for the IOT&E, scheduled for FY12.
- The Program Executive Officer has submitted a revised Test and Evaluation Master Plan (TEMP) revision that addresses the changes to the acquisition and test strategies that have occurred since DOT&E approved the TEMP in FY01.
- AFOTEC cancelled the development of the jamming simulator.

## Assessment

- The combined contractor and government developmental test team has been successful in identifying problems prior to entry into operational testing. The program manager's decision to add an additional thermal vacuum test substantially reduced risk by identifying potential problems earlier in the integration process.
- AFOTEC, through its space operational test and evaluation model, has identified increased opportunities for early involvement to inform acquisition and operational decision makers on the progress of the program.
- The operational testers are developing a modeling and simulation strategy to assess nulling antenna performance in order to supplement operational testing.
- Immature ground control software, insufficient sparing, and immature logistic support concepts pose risks to a successful OUE in 3QFY10. Additionally, the transportable interim Command and Control vehicles are not designed to meet the High Altitude Electromagnetic Pulse requirement and Department of Transportation wide-load requirements.

- Delays in the satellite vehicle development have enabled the Service terminal programs to better align with the AEHF program. This provides an opportunity to conduct pre-launch interoperability testing of the Family of Advanced Beyond Line-of-Sight Terminals, Minimum Essential Emergency Communications Network Terminals, and Minute Man Essential Emergency Communications Network Program Terminals.
- The Air Force is analyzing an alternative strategy for testing the anti-jam capability of AEHF. The AEHF IOT&E will be inadequate without an anti-jam test capability.

## Recommendations

- Status of Previous Recommendations. The Air Force has made satisfactory progress to all previous DOT&E recommendations.
- FY09 Recommendations. The Air Force should:
  1. Conduct interoperability testing of all available terminal variants during planned integrated and dedicated operational test events. If necessary, additional test events should be inserted into the test schedule to integrate terminals as they become available.
  2. Assess the interim command and control facilities against all operational requirements to fully inform operational decision makers regarding both the capabilities and the limitations of these interim facilities.
  3. Provide a new strategy for operational testing of the AEHF anti-jam capability in the pending TEMP revision.