

# Advanced Extremely High Frequency (AEHF) Satellite Communications System

## Executive Summary

- Air Force Space Command declared Initial Operational Capability (IOC) on the Advanced Extremely High Frequency (AEHF) Satellite Communications (SATCOM) system on July 28, 2015, and provided a recommendation to the U.S. Strategic Command (USSTRATCOM) Commander that the system was ready for operations.
- From October 27, 2014, to January 16, 2015, the Air Force Test and Evaluation Center (AFOTEC) conducted Multi-Service Operational Test and Evaluation (MOT&E) on the AEHF SATCOM system. The MOT&E, when combined with integrated and anti-jam scintillation testing, was adequate to support an evaluation of the system's operational effectiveness, suitability, and survivability.
- The AEHF SATCOM system is effective in providing survivable, secure, and reliable strategic communications at low data rates (LDR) and tactical communications at medium and extended data rates (MDR and XDR). The AEHF system is effective in maintaining satellite command and control (C2), planning communications, and managing satellite resources.
- DOT&E submitted an MOT&E report to Congress in May 2015.
- The AEHF SATCOM system is suitable and survivable.

## System

- The AEHF system represents the second generation of Extremely High Frequency SATCOM 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 SATCOM architecture. The AEHF constellation of four interconnected satellites is expected to increase system throughput capacity by a factor of 10.
- The AEHF system has three segments:
  - Space segment – an integrated constellation of Milstar and AEHF satellites



- Mission Control segment – includes fixed and mobile telemetry, tracking, and commanding sites; fixed and transportable communication planning elements; the test and training simulation element; and the operational support and sustainment element
- Terminal (or User) segment – includes ground-fixed, ground-mobile, man-portable, transportable, airborne, submarine, and shipboard configurations

## Mission

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

## Major Contractors

- Lockheed Martin Space Systems – Sunnyvale, California
- Northrop Grumman – Redondo Beach, California

## Activity

- AFOTEC conducted the AEHF MOT&E from October 27, 2014, to January 16, 2015, with participation from the Navy's Commander, Operational Test and Evaluation Force, the Army Test and Evaluation Command, and the Marine Corps Operational Test and Evaluation Activity. AFOTEC conducted the MOT&E in accordance with a DOT&E-approved Test and Evaluation Master Plan and test plan.
  - The Services tested the AEHF IOC capabilities to include strategic communications at LDR, tactical communications at MDR and XDR, satellite C2, communications planning, and satellite resource management.
  - AFOTEC augmented the MOT&E data with anti-jam and scintillation testing conducted from June 13, 2014, through July 18, 2014, and integrated testing conducted from July 15, 2014, to September 30, 2014.

# FY15 AIR FORCE PROGRAMS

- AFOTEC, in coordination with the Massachusetts Institute of Technology's Lincoln Laboratory, performed threat representative jamming of AEHF's strategic communication capability and the nulling capability for tactical communications. Nulling is a capability that blocks out strong jammer signals in a specific geographical area so the collocated tactical user's communications signals can be heard.
- Three Army locations, two Marine Corps locations, two Navy destroyers and two submarines, the E-4B National Airborne Operations Center, and the E-6B Airborne Command Post, all participated in the test.
- AFOTEC used a combination of live operations, USSTRATCOM exercise "Global Thunder," test-driven scenarios, and user surveys to evaluate strategic and tactical missions of the AEHF system. The test team tested various tactical networks, including a representative Army Corps network, a Marine Corps Air-Ground Task Force network, Navy Time Division Multiple Access Interface Processor and broadcast networks.
- DOT&E wrote and submitted an MOT&E report to Congress in May 2015.
- Air Force Space Command declared IOC on the AEHF SATCOM system on July 28, 2015, and provided a recommendation to the USSTRATCOM Commander that the system was ready for operations.
- The AEHF SATCOM system is effective in providing survivable, secure, and reliable strategic communications at LDR and tactical communications at MDR and XDR. The AEHF SATCOM system is effective in maintaining satellite C2, planning communications, and managing satellite resources.
- The Air Force deferred the XDR capability supporting strategic forces until the Final Operational Capability is available, as these networks can only be transitioned from LDR to XDR when all terminals on the strategic networks are XDR-capable. AFOTEC will operationally test XDR for strategic services in the FOT&E, tentatively planned for FY21.
- The AEHF SATCOM system is suitable. The AEHF ground control systems meet their threshold reliability requirements. The AEHF satellites and ground systems meet their dependability requirements. Maintenance repair times for ground control systems exceeded threshold requirements in almost all areas and need improvement; however, the long maintenance repair times did not adversely affect system dependability. DOT&E rated human factors, system usability, training, and documentation favorably.
- The AEHF SATCOM system is survivable in the presence of uplink jamming, scintillation, and external cyber attack. Strategic communications were not degraded by a threat-representative jammer. The nuller antenna performance can be enhanced with operational procedures.

## Assessment

- Operational testing of the AEHF SATCOM IOC capability, when combined with integrated and anti-jam scintillation testing, was adequate to support an evaluation of the system's operational effectiveness, suitability, and survivability.

## Recommendations

- Status of Previous Recommendations. The Air Force has made satisfactory progress on addressing all previous recommendations.
- FY15 Recommendations. None