

# Advanced Extremely High Frequency (AEHF) Satellite Communications System

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## Executive Summary

- The Advanced Extremely High Frequency (AEHF) system is making progress on the four major technology risk areas of the program.
- Additional progress is required in overall AEHF program performance and readiness for Multi-Service Operational Test and Evaluation (MOT&E).
- The synchronization of the AEHF User Segment Terminals with the other segments of the program remains essential and vital for effective mission control and MOT&E.

## System

- AEHF system will follow the Milstar program as the protected backbone of 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
  - Mission Control segment
  - Terminal (or User) segment
- The first flight of the AEHF satellite, called "Pathfinder," is expected in FY08. Pathfinder will operate initially as a Milstar II satellite in order to complete the Milstar II constellation.
- The second flight will launch in FY09. It will operate on-orbit as a fully capable AEHF satellite.
- The Defense Acquisition Board authorized:
  - Fabrication and assembly of the first three satellites, development of the Control and User segments
  - Potential advanced procurement for two additional satellites within the Future Years Defense Program



## Mission

- Combatant commanders and operational forces worldwide will use the AEHF system to provide secure, responsive, and survivable space-based military communications.
- AEHF represents the third generation of Extremely High Frequency (EHF) Satellite Communications (SATCOM) capability for strategic and tactical communications protected from nuclear effects and jamming activities for all combatant commanders.

## Activity

- The Air Force Operational Test and Evaluation Center completed an operational assessment for AEHF in October 2004 in accordance with DOT&E-approved test plans.
- The Integrated Test Team continued development of the system test and evaluation strategy for the AEHF program.
- The Test and Evaluation Working Group for the integrated AEHF system accomplished the review of user segment test resource availability for inclusion in the latest updates to the system test schedule.

## Assessment

- The system is making satisfactory progress on the four major technology risk areas: nuclear hardening and shielding,

performance of the nuller anti-jam spot beam for information assurance, performance of the phased array antenna, and electric propulsion.

- The operational assessment was that the AEHF had inconsistent overall program performance and unsatisfactory progress towards readiness for MOT&E.
- The integration and transition of Milstar spacecraft to the new AEHF Mission Control segment will require careful coordination and is adding risk to the overall program schedule and operational testing.
- Synchronization of the AEHF Space, Mission Control, and User segments remains essential for effective operation and successful MOT&E.

- The system contractor will need a more robust validation effort using test data to reduce the information assurance risks associated with using current program modeling data. The contractor also needs to expand the direct evaluation of system features such as anti-jam nuller operational performance.
- The User segment terminals are experiencing increased difficulty in retaining standardized and consistent configurations with the operational system baseline. If unresolved, the new AEHF terminals risk a lack of compatibility with both the spacecraft payload and with each other.

#### **Recommendations**

1. The Air Force should use the second operational assessment in FY07 to reassess the readiness of the AEHF Mission Control Segment to meet the demands of Milstar satellite transition and readiness for MOT&E.
2. The next operational assessment should be used by the Operational Test Agencies to evaluate the results of the developmental/operational test performed on the Pathfinder satellite payload, and verify its full capability to provide adequate operational bandwidth and function as a Milstar II low-data rate/medium-data rate satellite.
3. The Air Force should monitor the fidelity of the AEHF Universal System Test Terminal simulator, the payload simulator, and integrated payload test equipment to ensure system and terminal synchronization for both operational testing and operations.
4. Specialized modeling and simulation validation should be accomplished by the Air Force in conjunction with direct AEHF operational testing to assess the information assurance features of nuller anti-jam spot beam performance in a variety of robust single and multiple jammer scenarios.
5. The integrated Air Force testing of AEHF should exercise:
  - Increased satellite-to-satellite payload cross-links
  - Theater-to-theater communications
  - Network control interoperability
  - Spacecraft system control
  - User segment terminal configuration compatibility