

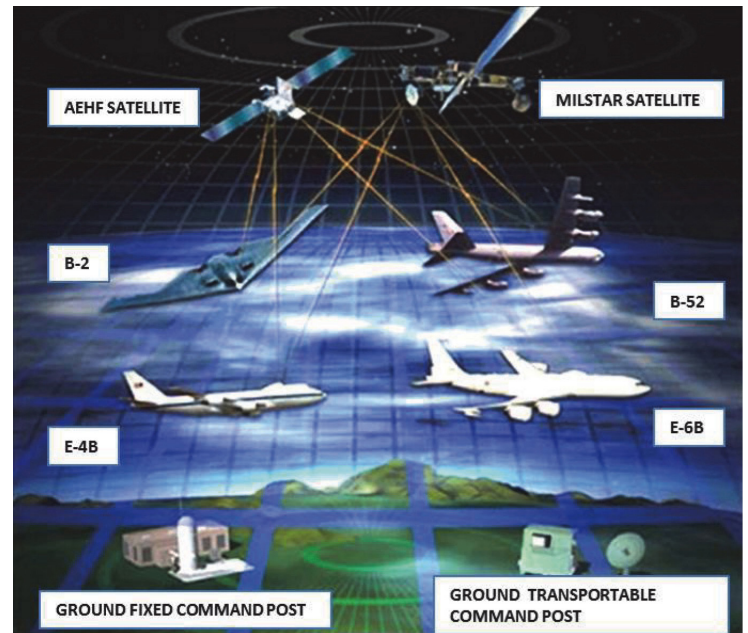
## Family of Advanced Beyond Line-of-Sight Terminals (FAB-T)

### Executive Summary

- The Air Force Operational Test and Evaluation Center (AFOTEC) conducted an Operational Assessment (OA) of the Family of Advanced Beyond Line-of-Sight Terminals (FAB-T) Command Post Terminals (CPTs) from December 5, 2014, through May 30, 2015. AFOTEC based the OA on Raytheon in-plant developmental testing and government developmental flight testing led by the Air Force's 46th Test Squadron. Testing was conducted in accordance with the DOT&E-approved Test and Evaluation Master Plan and test plan.
- During the OA, the FAB-T CPT demonstrated nuclear and non-nuclear command and control from ground-fixed, ground-mobile, and airborne terminals. The FAB-T CPT also demonstrated the ability to set up and control networks and point-to-point communication services over Milstar and Advanced Extremely High Frequency (AEHF) satellites.
- The FAB-T CPTs experienced hardware failures during the OA, and require additional reliability growth to demonstrate reaching the user requirements with 80-percent confidence. Analysis of the reliability growth tests shows a large degree of uncertainty in the Mean Time Between Critical Failure because of a sparsity of data.
- In February 2015, USD(AT&L) directed the Air Force to take responsibility for the acquisition management of the Presidential National Voice Conferencing (PNVC) capability from the Defense Information Systems Agency (DISA) to ensure integration and testing efficiency. The Air Force made the PNVC capability a separate program under the responsibility of the FAB-T program manager. DOT&E placed PNVC under its operational test and evaluation oversight in July 2015.
- USD(AT&L) conducted a Milestone C decision review for the Defense Acquisition Board on September 1, 2015, and authorized the FAB-T program to enter into low-rate initial production for the first 10 terminals.

### System

- FAB-T consists of ground and aircraft communication terminals with two terminal types—CPTs and Force Element Terminals (FETs). FAB-T is part of the terminal and control segments of the AEHF satellite system and is designed to operate with AEHF Low Data Rate (75 – 2,400 bits per second (bps)) and Extended Data Rate (up to 8.192 Megabits per second) waveforms.
- The CPT is intended to replace existing airborne (E-4B and E-6B), ground-fixed, and ground-transportable Milstar



command post terminals. The CPT will include satellite and network control functions, end-user telecommunication device interfaces, and the ability to operate the terminal from a distant location using a remote node.

- The FET is intended to be installed in airborne force elements (B-2, B-52, and RC-135). The FET is a program requirement but is currently neither funded nor on contract for development and production.

### Mission

- The President, the Secretary of Defense, Combatant Commanders, and supporting Air Force component forces will use FAB-T to provide strategic nuclear and non-nuclear command and control with EHF, wideband, protected, and survivable communications terminals for beyond line-of-sight communications.
- U.S. Strategic Command will use the FAB-T to perform satellite Telemetry, Tracking, and Commanding functions for the AEHF/constellation, including management of the satellites, communication networks, and cryptologic keys.

### Major Contractor

Raytheon Net-Centric Systems – Marlborough, Massachusetts

## Activity

- AFOTEC conducted an OA of the FAB-T CPT from December 5, 2014, to May 30, 2015. AFOTEC based the OA on Raytheon in-plant developmental testing and government developmental flight testing led by the Air Force's 46th Test Squadron. Testing was conducted in accordance with the DOT&E-approved Test and Evaluation Master Plan and test plan.
- DOT&E submitted an OA report on the FAB-T CPT on July 23, 2015.
- The contractor conducted reliability growth testing in the lab simulating the operational mission profile in accordance with the FAB-T program manager's-approved plan from February through July 2015. The program manager tested the ground-fixed CPT for 1,947 hours and the airborne CPT for 1,396 hours. Reliability testing for the ground-transportable CPT and remote capability was not performed during the OA; however, the program manager is planning to conduct this reliability testing after the OA test period.
- The 92nd Information Operations Squadron conducted a Cybersecurity Cooperative Vulnerability and Penetration Assessment from December 16 – 18, 2014, on the ground-fixed CPT at the Raytheon contractor facility in Marlborough, Massachusetts.
- The program updated the DOT&E-approved the Test and Evaluation Master Plan on August 21, 2015.
- In February 2015, USD(AT&L) directed the Air Force to take responsibility for the acquisition management of the PNVC capability from DISA to ensure integration and testing efficiency. Therefore, DISA is now supporting the Air Force with PNVC baseband equipment development and engineering expertise for end-to-end testing of strategic conferencing services.
- In May 2015, the Air Force made the PNVC capability a separate program under the responsibility of the FAB-T program manager. DOT&E placed PNVC under its operational test and evaluation oversight in July 2015.
- USD(AT&L) conducted a Milestone C decision review for the Defense Acquisition Board on September 1, 2015, and authorized the FAB-T program to enter into low-rate initial production for the first 10 terminals.
- USD(AT&L) tasked the FAB-T Program Office to work with DOT&E and the Deputy Assistant Secretary of Defense for Developmental Test and Evaluation to determine the appropriate amount of reliability growth testing for the next phase of the program.

## Assessment

- During the OA, the FAB-T CPT demonstrated nuclear and non-nuclear command and control from ground-fixed, ground-mobile, and airborne terminals. The FAB-T CPT

- also demonstrated the ability to set up and control networks and point-to-point communication services over Milstar and AEHF. The FAB-T CPT did not have the satellite Telemetry, Tracking, and Commanding functions available to test.
- Government developmental flight testing during the OA revealed instances where nuclear emergency action messages were either not received or contained corrupted content. Failures in reception occurred after the ground-fixed FAB-T CPT transitioned from one satellite agile beam to another. Failures also occurred with messages created by the government-furnished Milstar Messaging Application connected to the ground-fixed CPT. Missed or inaccurate reproduction of the original message can cause significant problems in the command and control of nuclear assets during operations.
- The FAB-T program manager performed root cause analysis and determined the problems experienced during flight testing were caused by faulty software. The contractor fixed most of the software problems and the 46th Test Squadron conducted additional flight testing on June 24, 2015, to verify the fixes. The 46th Test Squadron determined most of the problems were fixed, but new ones were found.
- The FAB-T CPTs experienced hardware failures during the OA, and require additional reliability growth to successfully demonstrate reaching the user requirements with 80-percent confidence. Analysis of the reliability growth tests shows a large degree of uncertainty in the Mean Time Between Critical Failure because of a sparsity of data.
- The program manager used a non-standard methodology for reliability growth planning and analysis, whereas DOT&E OA reliability analysis employed the Army Materiel Systems Analysis Activity methodology, which resulted in lower reliability estimates.

## Recommendations

- Status of Previous Recommendations. The Air Force has addressed all previous recommendations.
- FY15 Recommendations. The Air Force should:
  1. Continue to use reliability growth test periods to surface more failure modes and correct them to grow reliability and confidence in system performance.
  2. Update the reliability growth curves with results from DOT&E's OA for both ground-fixed and airborne CPTs. Updated curves would allow the program manager to determine how much more reliability testing is needed given the performance demonstrated during the OA.
  3. Work with DOT&E and the Deputy Assistant Secretary of Defense for Developmental Test and Evaluation to determine the appropriate amount of reliability growth testing for the next phase of the program.