NAVSTAR Global Positioning System (GPS)

Executive Summary
- The Air Force Operational Test and Evaluation Center (AFOTEC) completed the GPS Architecture Evolution Plan (AEP) Operational Utility Evaluation (OUE) in 4QFY07. DOT&E assessed the new Operational Control Segment (OCS) as operationally effective and operationally suitable with some limitations.
- The NAVSTAR GPS test community is addressing previously identified deficiencies by including user equipment in operational testing and has developed a comprehensive GPS Enterprise Test and Evaluation Master Plan (TEMP).
- The NAVSTAR GPS Modernized System needs to integrate operational end-to-end testing of the space, control, and GPS modernized (Military-code) receivers on representative combat platforms in realistic operational and threat environments.

System
- The NAVSTAR GPS is an Air Force-managed joint Service precision navigation and timing space program used for DoD and non-DoD operations.
- The NAVSTAR GPS consists of three operational segments:
  - Space Segment: The NAVSTAR GPS spacecraft constellation consists of a minimum of 24 operational satellites in semi-synchronous orbit.
  - Control Segment: The control segment consists of primary and backup GPS master control stations, operational system control antennas, a pre-launch compatibility station, and geographically dispersed operational monitoring stations.
  - User Segment: There are many versions of NAVSTAR GPS mission receivers hosted on a multitude of operational systems and combat platforms.
- The system is being modernized with a Military-code (M-code) enhanced capability to better meet the needs of operational users. Future GPS updates will improve service in signal interference/jamming environments; enhance military and civil signal integrity; and provide time-critical constellation status.

- The Air Force Space Command has launched three blocks of NAVSTAR GPS satellites and has two blocks of spacecraft in development:
  - Block I (1982-1992)
  - Block II/IIA (1990-1997)
  - Block IIR/IIR-M (Modernized) (1997-present)
  - Block IIF development (initial launch scheduled for FY09)
  - Block III development (replacement spacecraft)

Mission
- Combatant commanders, U.S. military forces, allied nations, and various civilian agencies use the NAVSTAR GPS system to provide highly accurate, real-time, all-weather, passive, common reference grid positional data, and time information to operational users worldwide.
- Commanders use NAVSTAR GPS to provide force enhancement for combat operations and military forces in the field on a daily basis throughout a wide variety of global strategic, operational, and tactical missions.

Prime Contractors
- Block IIR/IIR-M: Lockheed Martin
- Block IIF: Boeing

Activity
- AFOTEC completed the GPS Architecture Evolution Plan (AEP) 5.2.1 OUE in 4QFY07. Testing was conducted in accordance with the DOT&E-approved TEMP and test plans. DOT&E assessed the new OCS as operationally effective with the limitation that it could not support reliable, autonomous operations. DOT&E assessed the new OCS as operationally suitable with the limitation that frequent warm starts and hardware reboots, while sustainable during normal operations, may be unacceptable during times of higher operations tempo.
- The Program Office completed developmental testing of the OCS AEP version 5.2.2 in 3QFY08.
- The Air Force launched the sixth NAVSTAR GPS Block IIR-M (Modernized) satellite in March 2008 and completed early on-orbit testing.
- As directed, the Integrated Test Team developed a draft TEMP for the GPS Enterprise. The GPS Enterprise includes Blocks IIF and III of the satellites; the AEP upgrade to the current OCS; the next generation Operational Control

Segment (OCX); Selective Availability / Anti-Spoof Module (SAASM)-capable GPS User Equipment; and M-code capable Military GPS User Equipment (MGUE).

Assessment

- To ensure effectiveness for combat, the NAVSTAR GPS Modernized User Equipment (MUE) receivers must be integrated into production-representative MGUE hosted on representative platforms (i.e., ships, aircraft, land, and space vehicles) and tested in realistic operational environments that include appropriate electronic warfare and information assurance conditions.
- The test planning by the NAVSTAR GPS test community for all segments of GPS (Space, Control, and User) improved significantly in 2008. The Integrated Test Team now includes members from the Army, Navy, Air Force, Marines, OSD, Federal Aviation Administration, and industry. The test planning must continue to integrate end-to-end testing of the Space, Control, and GPS receivers (including MGUE) in realistic operational environments.
- The sixth Block IIR-M satellite launched in March 2008; however, prototype NAVSTAR GPS MUE will not be available to conduct basic developmental testing of Block IIR-M unique capabilities until at least 2010. While this problem affects developmental testing, the Air Force should have production-representative MUE in place for adequate operational testing scheduled for 2012.
- The synchronization of the development of the space, control, and user segments continues to be a concern; however, progress towards creating MGUE production-representative articles has improved the situation. Delays in fielding MGUE preclude operational testing of IIR-M unique capabilities, but the risk to GPS III has been mitigated by the Air Force commitment of resources and planning to test GPS III capabilities with MGUE on operational platforms.
- The new capabilities and features of the Block IIR-M/IIF, and subsequent NAVSTAR GPS spacecraft must also complete realistic end-to-end testing to demonstrate adequate levels of effectiveness and suitability.

Recommendations

- Status of Previous Recommendations. There were no recommendations in FY06 or FY07. The Air Force continues to make progress on previous FY05 DOT&E recommendations, yet four out of the five recommendations still remain valid.
- FY08 Recommendations. None.