NAVSTAR Global Positioning System (GPS)

Executive Summary
- The second NAVSTAR Global Positioning System (GPS) Block IIR-M satellite launched in 2006.
- The test planning effort by the NAVSTAR GPS test community requires substantial refinement.
- The NAVSTAR GPS Modernized System needs to integrate operational end-to-end testing of the Space, Control, and GPS modernized (Military-code) receivers on realistic combat platforms.

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 24 operational satellites in semi-synchronous orbit
  - Control Segment: the control segment consists of the GPS master control station, operational system control antennas, a pre-launch compatibility station, and geographically dispersed operational monitoring stations
  - User Segment: there are many versions of the 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.
- 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 (follow-on spacecraft)
  - 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.
- The NAVSTAR GPS provides force enhancement for combat operations and military forces in the field on a daily basis.
- It is vital to a wide variety of global strategic, operational, and tactical missions.

Activity
- Initial spacecraft orbital eclipse testing for the first Block IIR-M satellite, which launched in 2005, concluded in October 2006.
- The Air Force launched the second NAVSTAR GPS Block IIR-M (Modernized) satellite in September 2006 and conducted early-orbit testing.
- Test strategy development and test planning continued for a NAVSTAR GPS Operational Utility Evaluation scheduled for January - April 2007.
- The Integrated Test Team developed a draft Test and Evaluation Master Plan for the Block IIIA-D satellites.

Assessment
- To ensure effectiveness for combat, the NAVSTAR GPS Modernized User Equipment (MUE) receivers must be integrated into representative platforms (e.g., ships, aircraft, and land 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 requires substantial refinement to accommodate adequate Block IIR/IIR-M, Block IIF, and Block III testing. The test planning must also integrate end-to-end testing of the Space, Control, and GPS receivers (including MUE) in realistic operational environments.
- Development of modernized M-code-capable user equipment has not been synchronized with the development of the NAVSTAR GPS Space and Control Segments. This increases the risk of substantial delays in realistic operational testing and

fielding of Block IIR-M system capabilities and the Blocks IIF and III that follow.
- The second Block IIR-M satellite launched in 2006, but prototype NAVSTAR GPS MUE will not be available until at least 2010 to conduct basic Block IIR-M developmental test events. This is a schedule delay of two years from the FY05 findings.
- The operational testing for Blocks I, II, and IIA spacecraft was thorough. The new capabilities and features of the Block IIR/IIR-M, and subsequent NAVSTAR GPS spacecraft Blocks, must also complete realistic end-to-end testing to demonstrate adequate levels of effectiveness and suitability.

Recommendations

- Status of Previous Recommendations. The Air Force has made limited progress on the previous FY05 DOT&E recommendations. All five remain valid.
  FY05 #1: The Air Force should synchronize development of the three NAVSTAR GPS segments and integrate production-representative MUE onto operational platforms for OT&E.
  FY05 #2: The Air Force should refine and integrate the NAVSTAR GPS system test strategy to include more rigorous end-to-end testing of the space, control, and MUE user segments with operationally representative platforms, and then update the Test and Evaluation Master Plan.
  FY05 #3: The Air Force should integrate appropriate electronic warfare environments into testing of NAVSTAR GPS to ensure M-code capabilities are demonstrated under realistic combat conditions.
  FY05 #4: The Air Force should evaluate information assurance in realistic testing.
  FY05 #5: DOT&E continues to advocate the operational testing of new and legacy NAVSTAR GPS receivers as early in the program as possible to ensure that maximum capability is consistently provided to operational users.
- FY06 Recommendations. None.