

NAVSTAR Global Positioning System (GPS)

Executive Summary

- The Air Force launched the seventh NAVSTAR GPS Block IIR-M (Modernized) satellite in March 2009 and the eighth, and final, IIR-M satellite in August 2009. However, prototype M-code capable Military GPS User Equipment (MGUE) will not be available to conduct basic developmental testing of Block IIR-M unique capabilities until at least 2014.
- Contractor development problems delayed the delivery of the GPS Architecture Evolution Plan (AEP) Version 5.5 until November 2009.
- The GPS Integrated Test Team successfully drafted an Enterprise-level Test and Evaluation Master Plan (TEMP). The lack of an approved Initial Capabilities Document or Capability Development Document for the user segment precludes the TEMP from addressing the full scope of testing.

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 2QFY10)
- 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 Space Systems, Sunnyvale, California
- Block IIF: The Boeing Company, Integrated Defense Systems, Seal Beach, California

Activity

- The Air Force launched the seventh NAVSTAR GPS Block IIR-M (Modernized) satellite in March 2009. The vehicle has not yet been declared “healthy” for use by civil and military users, due to problems with an experimental payload intended to demonstrate a new civilian frequency

signal. The Air Force launched the eighth, and final, IIR-M satellite in August 2009. The Air Force Space Command completed the on-orbit checkout of the space vehicle and declared it “healthy.”

AIR FORCE PROGRAMS

- Contractor development problems delayed the delivery of the GPS AEP Version 5.5 until November 2009.
- As directed by OSD, 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 Operational Control Segment; the next generation Operational Control Segment; Selective Availability / Anti-Spoof Module (SAASM) capable MGUE.

Assessment

- The seventh Block IIR-M satellite launched in March 2009 and the eighth satellite launched in August 2009; however, prototype MGUE will not be available to conduct basic developmental testing of Block IIR-M unique capabilities until at least 2014. This problem affects both developmental and operational testing. The Services should plan resources to have production-representative M-code capable MGUE in place for adequate operational testing scheduled for 2015. These satellites will be on orbit for at least five years before the user community will be able to exploit their full capability.
- The test planning for all segments of GPS (space, control, and user) improved in 2009. The Integrated Test Team now includes members from all Services, OSD, Federal Aviation Administration, and industry. Planning must focus on end-to-end testing of the space and control segments with GPS receivers (including ground equipment) that are capable of receiving and processing the new modernized signals and are hosted on representative platforms (i.e., ships, aircraft, land, and space vehicles), in realistic operational environments.
- The synchronization of the development of the space, control, and user segments continues to be a concern. The

GPS Integrated Test Team drafted an Enterprise-level TEMP. However, the lack of an approved Initial Capabilities Document or Capability Development Document for the user segment precludes the TEMP from addressing the full scope of testing.

- Air Force Space Command is developing a Concept of Operations and a software mission planning tool for new GPS capabilities including the SAASM and over-the-air-rekey functions. Based upon current progress, the mission planning tool may not be available for the Multi-Service Operational Test and Evaluation (MOT&E) in FY10. Without these tools, there will be significant limitations on the operational realism of the MOT&E.
- The Control Segment relies on input from external sources to maintain GPS performance. However, information assurance testing of these interfaces has been significantly constrained.

Recommendations

- Status of Previous Recommendations. There were no recommendations in FY06 or FY07. While the Air Force continues to make progress on previous FY05 DOT&E recommendations, four out of the five recommendations still remain valid.
- FY09 Recommendations. The Air Force should:
 1. Establish agreements to ensure comprehensive information assurance testing of all external interfaces that support GPS operations and performance.
 2. Synchronize the development of the Mission Planning Tool with the three segments of GPS to provide end-to-end SAASM and modernized capabilities for OT&E.