

NAVSTAR Global Positioning System (GPS)

Executive Summary

- The first NAVSTAR Global Positioning System (GPS) Block IIR-M satellite was launched in 2005.
- The test planning effort by the NAVSTAR GPS test community requires substantial refinement.
- The NAVSTAR GPS Modernized System needs to integrate end-to-end testing of the space, control, and GPS receivers on combat platforms.

System

- The NAVSTAR GPS consists of three operational segments:
 - Space Segment: the NAVSTAR GPS spacecraft constellation consists of 24 operational mission satellites in semi-synchronous orbit.
 - The Control Segment: the GPS master control station, operational system control antennas, a pre-launch compatibility station, and geographically dispersed operational monitoring stations.
 - The User Segment: there are many versions of the NAVSTAR GPS mission receivers hosted on a multitude of operational systems and combat platforms.
- The Air Force Space Command has launched three blocks of NAVSTAR GPS satellites:
 - Block I (1982-1992)
 - Block II/IIA (1990-1997)
 - Block IIR/IIR-M (Modernized) (1997-present)



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 is an Air Force-managed Joint Service Program that 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

- The Integrated Test Team updated the test strategy for the Block IIR-M spacecraft.
- The Air Force launched the first NAVSTAR GPS Block IIR-M satellite in September 2005, and conducted the early-orbit checkout.
- The NAVSTAR GPS test planning process continued.

Assessment

- To ensure combat effectiveness, 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 development and integration of the NAVSTAR GPS control segment software continues to be a moderate to high-risk area with an ambitious schedule. The test planning by the NAVSTAR GPS test community requires substantial refinement to accommodate adequate Block IIR-M testing of variable satellite signal power settings, increases in signal

strength, and the integrated end-to-end testing of the space, control, and GPS receivers in combat.

- Development of 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 overall operational user availability for the Block IIR-M system capabilities and the Blocks IIF and III that follow.
- The first Block IIR-M satellite has been launched in 2005, but prototype NAVSTAR GPS MUE is not available until 2008 at the earliest to evaluate the program for even basic Block IIR-M developmental test events.
- The operational testing for Blocks I, II, and IIA spacecraft was extremely thorough. However, the new capabilities (to include information assurance) and features of the Block IIR-M and subsequent NAVSTAR GPS spacecraft Blocks must also complete realistic end-to-end testing to demonstrate adequate levels of effectiveness and suitability of the system for combat.

Recommendations

The Air Force should:

1. Synchronize development of the three NAVSTAR GPS segments and integrate production representative MUE onto operational platforms for OT&E.
2. 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.
3. Integrate appropriate electronic warfare environments into testing of NAVSTAR GPS to ensure M-code capabilities are demonstrated under realistic combat conditions.
4. Evaluate information assurance in realistic testing.
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.