4. Military

Overview

GPS is a dual use system serving military and civil users. Its PNT capabilities are essential for U.S. military operations, yielding significant operational efficiencies, enabling a streamlined force structure, while reducing casualties and collateral damage. GPS is essential for military use, and we must maintain our leadership in this area.

Utilization and Benefits

Current and future military operations are dependent on reliable, accurate PNT information. Only GPS provides this securely, accurately and worldwide. Examples include:

- Ship, ground force and aircraft precise navigation and positioning
- Precise munitions delivery to minimize collateral damage
- Unmanned Aerial Vehicle (UAV) operations
- Special forces operations
- Communication network synchronization
- Satellite operations
- Rocket launch safety operations

Threats

The threat to GPS continues to evolve, increase and proliferate. The availability of systems to interfere with or deny GPS has dramatically increased over the last decade, and the competition for spectrum across a broad range of users places additional pressure on the clear use of the GPS frequencies.

- Adversaries recognize our utilization of GPS as a force multiplier and operations enhancer
- Jamming (blocking the GPS signal) and spoofing (providing false signals to GPS receivers) are available technologies that have been demonstrated by adversaries
- Jamming can also be accomplished by civilians or terrorists with available technology, impacting both military and non-military operations
- Inadvertent terrestrial and space spectrum radiofrequency interference can also impact users
- Cyber-attack threats are real and growing, especially against the ground segment
- Protecting GPS ground stations from physical and cyber threats is also essential, as well as accounting for threats to on-orbit spacecraft
- Other commercial and civil users seek to utilize frequencies very close to GPS operating frequencies, placing at risk clear reception of the GPS signal

Recommended Actions

<u>GPS Space Segment</u>:

It currently consists of approximately 30 operational satellites of differing configuration, up through GPS Block IIF. These satellites transmit both military and civil signals, supporting military operations in threat environments, and commercial/civil/aviation utilization. GPS III is the next generation of satellites, currently in production. The following actions are recommended:

- Provide higher power (regional military protection) M-Code (GPS military signal) to improve robustness in challenging environments and against threats
- Operationalize the GPS military signal (M-Code) to provide more secure and robust performance
- Support procurement of GPS Block III and IIIF satellite vehicles, providing satellites that deliver signals three times more accurate than current GPS spacecraft and provide more power for military users, improve signal acquisition and tracking capability, and faster data downloads
- Given existing and future threats, military users must continue to exercise in challenging PNT environments and develop best practices to ensure mission success while under jamming and spoofing conditions

GPS Ground Segment:

It consists of a global network of ground facilities that track the GPS satellites, monitor their transmissions, perform analyses, and send commands and data to the constellation. The current operational control segment includes a master control station, an alternate master control station, 11 command and control antennas, and 15 monitoring sites. OCX is essential to fully utilizing GPS system capabilities. It provides the following key enhancements:

- New Kalman filter that is at the heart of the GPS OCX navigation solution will double the accuracy of the signal in space
- GPS OCX will allow control of more satellites, providing better geometry in hard-to-reach areas such as urban canyons and mountainous terrain
- All critical OCX external interfaces will employ digital signatures, protecting information from tampering so users can trust it

The following actions are recommended:

- Upgrade the current ground segment to securely control GPS III satellites and enable monitoring of modernized GPS signals—required to bridge between current ground segment and OCX
- Maintain utilization of NGA monitor stations to enhance signal status information and investigate use of other worldwide monitoring capabilities to enhance robustness of signal information
- Add monitoring of international GNSS signals at GPS monitoring sites to enhance solution integrity
- Support advancement of civil ground systems to support GBAS and SBAS systems
- Continue/increase U.S. technical and scientific leadership in international GNSS monitoring, data analysis, product generation and dissemination

U.S. Military GPS Receivers:

Military GPS User Equipment (MGUE) is a joint service program to develop a modernized set of M-code capable military GPS receivers delivering improved capabilities to allow for accurate, reliable and available positioning, navigation, and timing service where current non-M-Code receiver performance might be compromised or unavailable. The following actions are recommended:

- Affirm continued support for the Joint Program developing MGUE
- Rapidly develop MGUE Increment 2, providing enhanced anti-jam and anti-spoof processing, to improve synchronization between spacecraft capability and MGUE procurement and fielding
- Demonstrate utility of using international GNSS signals including open signals, to augment military receiver capability, distinct from the MGUE Increment 2 program
- Accelerate the implementation and deployment of the latest generation of anti-jam technology to further enhance GPS-aided military operations in a hostile electronic warfare environment

Summary

- Military use of GPS is critical for current and future military operations
- No other system provides the coverage, ease of access, reliability and performance
- Essential to support on-going modernization of Space, Ground and User Segments to ensure leading edge capabilities
- Military users must be protected from inadvertent jamming through careful spectrum management and the 1 dB interference criteria
- The DoD and Air Force have been excellent stewards of GPS capability and continue to provide additional civil/commercial signals and capability to enhance this global utility