Policy Update

Munich Satellite Navigation Summit
Munich, Germany

6 March 2018

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United States of America
U.S. National Space Policy

**Space-Based PNT Guideline: Maintain leadership in the service, provision, and use of GNSS**

- Provide continuous worldwide access to GPS for peaceful uses, free of direct user charges
- Engage with foreign GNSS providers on compatibility, interoperability, transparency, and market access
- Operate and maintain GPS constellation to satisfy civil and national security needs
  - Foreign PNT may be used to strengthen resiliency
- Invest in domestic capabilities and support international activities to detect, mitigate, and increase resiliency to harmful interference
GPS Overview

Civil Cooperation
• 3+ Billion civil & commercial users worldwide
• Search and Rescue
• Civil Signals
  – L1 C/A (Original Signal)
  – L2C (2nd Civil Signal)
  – L5 (Aviation Safety of Life)
  – L1C (International)

Department of Defense
• Services (Army, Navy, AF, USMC)
• Agencies (NGA & DISA)
• US Naval Observatory
• PNT EXCOMS
• GPS Partnership Council

International Cooperation
• 57 Authorized Allied Users
  – 25+ Years of Cooperation
• GNSS
  – Europe - Galileo
  – China - Beidou
  – Russia - GLONASS
  – Japan - QZSS
  – India - NAVIC

Civil Cooperation

35 Satellites / 31 Set Healthy
Baseline Constellation: 24 Satellites

<table>
<thead>
<tr>
<th>Satellite Block</th>
<th>Quantity</th>
<th>Average Age</th>
<th>Oldest</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS IIR</td>
<td>12</td>
<td>15.9</td>
<td>20.3</td>
</tr>
<tr>
<td>GPS IIR-M</td>
<td>7</td>
<td>10.3</td>
<td>12.2</td>
</tr>
<tr>
<td>GPS IIF</td>
<td>12</td>
<td>3.8</td>
<td>7.5</td>
</tr>
<tr>
<td>Constellation</td>
<td>31</td>
<td>10.0</td>
<td>20.3</td>
</tr>
</tbody>
</table>

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Department of Transportation
• Federal Aviation Administration

Department of Homeland Security
• U.S. Coast Guard

Spectrum
• World Radio Conference
• International Telecommunication Union
• Bilateral Agreements
• Adjacent Band Interference

Maintenance/Security
• All Level I and Level II
  – Worldwide Infrastructure
  – NATO Repair Facility
• Develop & Publish ICDs Annually
  – Public ICWG: Worldwide Involvement
  – Materials Available at: gps.gov/technical/icwg
• Update GPS.gov Webpage
• Load Operational Software on over 970,000 SAASM Receivers
• Distribute PRNs for the World
  – 120 for US and 90 for GNSS

International Cooperation

GPS Signal in Space (SIS) Performance (CM)

Best Week: 29 Nov 16, 44.1
Best Day: 26 Jan 17, 35.0
Worst Day: 15 Jun 17, 69.7

Best Week Ever: 29 Nov 16, 44.1

SIS values are Root Mean Square (RMS)
WAAS Overview

- Final Investment Decision for Phase IV Segment 1 (2014-2019) Dual Frequency Operations (DFO) approved
  - Segment 1 (2014-2019) - Develop infrastructure improvements to support L5 & Tech Refresh
  - Segment 2 (2019–2023) – Sustainment of L1 Coarse/Acquisition WAAS Service; MOPS and Standard and Recommended Practices (SARPs) Development; WAAS Service Improvements
- Implementation of L1/L5 user capability; Transition from use of L2 P(Y) to L5 within 2 years of GPS L5-signal Full Operational Capability (FOC)
- GEO sustainment will occur during both segments
- Future considerations
  - Dual-Frequency Multi-constellation Capability
    - International Focus is on taking advantage of other GPS like constellations
  - User Equipment Standards for Dual-Frequency Operations
    - FAA working with Interoperability Working Group (IWG) on definition document that provides the basis for interface design and MOPS development for L1/L5 and multi-constellation
  - Advanced RAIM (ARAIM)
    - Avionics-centric approach to dual-frequency multi-constellation
• Phase IV Segment 1 (2014-2019)
  – Combination of infrastructure improvements and tech refresh in support of operational system and future incorporation of dual frequency
  – Focus of the Segment is on the replacement of obsolete system hardware components in addition to integration of two replacement GEO satellites
  – Segment 1 is planned for deployment over the course of five releases, with approximately one release per year
  – Each release modification is developed by the WAAS prime contractor (DFO) and delivered to NASE who then conducts a final system test before deploying the release into the operational WAAS
On June 30, 2017, President signed an executive order which revived the National Space Council (NSpC)
- Advise and assist on National Space Policy and Strategy
- Chaired by Vice President
- October 5, 2017, first NSPC Meeting

February 21, 2018, second NSpC meeting
- Testimony from:
  - Civil Space
  - Commercial Space
  - National Security space Industry
National Space-Based PNT Organization

WHITE HOUSE

NATIONAL EXECUTIVE COMMITTEE FOR SPACE-BASED PNT

Executive Steering Group
Co-Chairs: Defense, Transportation

NATIONAL COORDINATION OFFICE
Host: Commerce

ADVISORY BOARD
Sponsor: NASA

Defense
Transportation
State
Interior
Agriculture
Commerce
Homeland Security
Joint Chiefs of Staff
NASA

Civil GPS Service Interface Committee
Chair: Transportation
Deputy Chair: Coast Guard

GPS International Working Group
Chair: State

Engineering Forum
Co-Chairs: Defense, Transportation

Ad Hoc Working Groups
EXCOM Strategic Focus Areas

- GPS Sustainment and Modernization
- International Cooperation
- Spectrum Management
- Critical Infrastructure
- PNT Resilience
- Outreach
The Airwaves Are Not Safe

- Computers and the Internet: Once Upon a Time...
  - A GPS receiver is more computer than radio...
- GPS relies on spectrum – no longer a safe haven
- GPS receivers lack cyber resilience
- Policy directs PNT resiliency (NSPD-39, PPD-4, PPD-21)
- Jan 6, 2017 - DHS released Best Practices document now available on GPS.gov:
  "Improving the Operation and Development of Global Positioning System (GPS) Equipment Used by Critical Infrastructure"

**Protect GPS and Critical Infrastructure that Relies on GPS**
- How accurate is GPS?
- How vulnerable is GPS to malicious jamming?

**Featured Content**

- What is GPS?
- How GPS Works
- Truckers: Don't Use Consumer GPS Devices!
- GPS Jamming is Illegal

**Guidance for Critical Infrastructures**

- Best Practices for Improving the Operation and Development of GPS Equipment Used by Critical Infrastructure (PDF)
- Best Practices for Improved Robustness of Time and Frequency Sources in Fixed Locations (PDF)
- Best Practices for Leap Second Event Occurring on 31 December 2016 (us-cert.gov)

**Useful Content**

- Service Outages & Status Reports
- Civil GPS Performance Data
- Interface Specifications
- Other Technical Documentation
- Public Presentations
- Congressional Legislation & Funding
Thank You

www.GPS.gov provides detailed information on legislation pertinent to GPS, such as:

- Program Funding, specifically information on Defense and Transportation appropriations, as well as Defense Authorization (NDAA). The website has archival information going back to Fiscal Year 2009.

- You may also find information on legislation related to Geolocation Privacy, and previous Enacted Laws.

- Subscribe to the GPS Bulletin

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