Program and Policy Update

14th Meeting
of the
International Committee on GNSS
Bangalore, India

9 December 2019

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Director
National Coordination Office
# GPS Constellation Status

**35 Satellites • 30 Set Healthy**  
Baseline Constellation: 24 Satellites

<table>
<thead>
<tr>
<th>Satellite Block</th>
<th>Quantity</th>
<th>Average Age (yrs)</th>
<th>Oldest</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS IIA</td>
<td>(2*)</td>
<td>25.9</td>
<td>26.0</td>
</tr>
<tr>
<td>GPS IIR</td>
<td>11</td>
<td>17.8</td>
<td>22.3</td>
</tr>
<tr>
<td>GPS IIR-M</td>
<td>7 (1*)</td>
<td>12.1</td>
<td>14.1</td>
</tr>
<tr>
<td>GPS IIF</td>
<td>12</td>
<td>5.8</td>
<td>9.5</td>
</tr>
<tr>
<td>GPS III</td>
<td>(2*)</td>
<td>0.6</td>
<td>0.9</td>
</tr>
</tbody>
</table>

*Ops capable; not set healthy

As of 13 Nov 19

**GPS Signal in Space (SIS) Performance**  
From 14 Nov 18 to 13 Nov 19

<table>
<thead>
<tr>
<th>Average URE*</th>
<th>Best Day URE</th>
<th>Worst Day URE</th>
</tr>
</thead>
<tbody>
<tr>
<td>51.4 cm</td>
<td>36.2 cm (21 Sep 19)</td>
<td>66.6 cm (13 Oct 19)</td>
</tr>
</tbody>
</table>

*All User Range Errors (UREs) are Root Mean Square values
GPS Modernization

**Space Segment**

- **GPS IIA/IIR**
  - Basic GPS
  - Nuclear Detonation Detection System (NDS)

- **GPS IIR-M**
  - 2nd Civil Signal (L2C)
  - New Military Signal
  - Increased Anti-Jam Power

- **GPS IIF**
  - 3rd Civil Signal (L5)
  - Longer Life
  - Better Clocks

- **GPS III (SV01-10)**
  - Accuracy & Power
  - Increased Anti-Jam Power
  - Inherent Signal Integrity
  - 4th Civil Signal (L1C)
  - Longer Life
  - Better Clocks

- **GPS IIF (SV11-32)**
  - Unified S-Band Telemetry, Tracking & Commanding
  - Search & Rescue (SAR) Payload
  - Laser Retroreflector Array
  - Redesigned NDS Payload

**Control Segment**

- **Legacy (OCS)**
  - Mainframe System
  - Command & Control
  - Signal Monitoring

- **Architecture Evolution Plan (AEP)**
  - Distributed Architecture
  - Increased Signal Monitoring Coverage
  - Security
  - Accuracy

- **OCX Block 0**
  - GPS III Launch & Checkout System

- **GPS III Contingency Ops (COps)**
  - GPS III Mission on AEP

- **M-Code Early Use (MCEU)**
  - Update OCS to operationalize Core M-Code

- **OCX Block 1**
  - Fly Constellation & GPS III
  - Begin New Signal Control
  - Upgraded Information Assurance

- **OCX Block 2+**
  - Control all signals
  - Capability On-Ramps
  - GPS IIF Evolution

**User Segment**

- **Continued support to an ever-growing number of applications**
  - Annual Public Interface Control Working Group (ICWG)
  - Standard Positioning Service (SPS) Performance Standard Updates
  - Sustained commitment to transparency
  - Visit GPS.gov for more info

- **Modernized Civil Signals**
  - L2C (Various commercial applications)
  - L5 (Safety-of-life, frequency band protected)
  - L1C (Multi-GNSS interoperability)
WAAS Current Status

Current WAAS provides high availability service to aviation user in North America
  • 4031 Localizer Performance with Vertical Guidance (LPV) approaches in the NAS
    • Over 1000 LPVs are LPV-200’s which provides CAT I equivalent instrument approach performance

Preparing WAAS to take advantage of Dual Frequency service that will be provided by GPS
  • To continue high availability of WAAS vertical service during ionospheric disturbances

GEO Sustainability
  • Currently maintaining 3 GEO’s (Anik F1R [CRE], Eutelsat 117 WB [GEO 5], SES-15 [GEO 6])
  • Developing future GEO’s 7/8/9 to replace legacy GEO’s upon lease expiration
    • GEO 7 is Intelsat at 125 West

WAAS Modernization Efforts
  • Dual Frequency Multi-Constellation (DFMC)
  • Advanced Receiver Integrity Monitoring (ARAIM)
WAAS Avionics Equipage Status

- Over 130,000 WAAS equipped aircraft in the NAS
  - WAAS receivers provided by companies such as: Garmin, Universal, Rockwell Collins, Honeywell, Avidyne, Innovative Solutions & Support (IS&S), Thales and Genesys Aerosystem (Chelton)
- Since 2006, aircraft equipage rates have increased each year
- All classes of aircraft are served in all phases of flight
- Enabling technology for NextGen programs
  - Automatic Dependent Surveillance Broadcast (ADS-B)
  - Performance Based Navigation (PBN)
The U.S. must maintain its leadership in the service, provision, and use of Global Navigation Satellite Systems (GNSS)

- Continuous, worldwide, free of direct user fees
- Encourage compatibility and interoperability with foreign GNSS services and promote transparency in civil service provisioning
- Operate and maintain constellation to satisfy civil and national security needs
  - Foreign PNT services may be used to augment and strengthen the resiliency of GPS
- Invest in domestic capabilities and support international activities to detect, mitigate and increase resiliency to harmful interference
U.S. Policy

• NSPD-39, the Space-Based Positioning, Navigation, and Timing Policy from 2004, is in the process of being updated by the National Space Council

• Remarks by DOT General Counsel at the 6th Meeting of the National Space Council:
  – Under National Security Presidential Directive 39, issued in December 2004, the United States is committed to developing, maintaining and a modernizing the global positioning system, or GPS, and other satellite-based navigation systems, including backup capability in the event of a disruption of GPS.
  – ...”Working closely with the Commerce Department, NTIA, and the FCC,” DOT’s adjacent band compatibility study “shows we need strong, consistent policies to ensure protection for satellite-based navigation.”
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
Thank You

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GPS: Accessible, Accurate, Interoperable