Status and Modernization of the US Global Positioning System

Munich Satellite Navigation Summit 2012
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Global Positioning Systems Directorate
Global Positioning System (GPS)

Mission:
Acquire, deliver and sustain reliable GPS capabilities to America’s warfighters, our allies, and civil users.

Deliver and Sustain Global Navigation and Timing Service
Civil Cooperation
- 1+ Billion civil & commercial users
- Search and Rescue
- Civil Signals
  - L2C (2nd Civil Signal)
  - L5 (Safety of Life)
  - L1C (International)

Spectrum
- World Radio Conference
- International Telecommunication Union
- Bilateral Agreements

Department of Defense
- Services (Army, Navy, AF, USMC)
- Agencies (NGA, DISA, etc.)
- US Naval Observatory
- PNT EXCOMS, NPEF, etc…
- GPS Partnership Council

Maintenance/Security
- All Level I and Level II Worldwide Infrastructure
- Develop & Publish ICDs Semi-Annually
- ICWG: Worldwide Involvement
- Update GPS.gov Webpage

International Cooperation
- Deconflict PRN usage for 8 global PNT systems
  - 63 for US and 147 for other GNSS
- 25+ Years of Cooperation with 50+ Nations
- GNSS
  - China – COMPASS (BeiDou)
  - Europe – Galileo/EGNOS
  - India – IRNSS/GAGAN
  - Japan – QZSS/MSAS
  - Russia – GLONASS/SDCM

Department of Transportation
- Federal Aviation Administration

Department of Homeland Security
- U.S. Coast Guard

GPS Enterprise View

<table>
<thead>
<tr>
<th>Satellite</th>
<th>Quantity</th>
<th>Avg Life</th>
<th>Oldest</th>
</tr>
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<tbody>
<tr>
<td>GPS IIA</td>
<td>10</td>
<td>18.0</td>
<td>21.3</td>
</tr>
<tr>
<td>GPS IIR</td>
<td>12</td>
<td>10.2</td>
<td>14.6</td>
</tr>
<tr>
<td>GPS IIR-M</td>
<td>7</td>
<td>4.6</td>
<td>6.4</td>
</tr>
<tr>
<td>GPS IIF</td>
<td>2</td>
<td>1.2</td>
<td>1.8</td>
</tr>
<tr>
<td>Constellation</td>
<td>31</td>
<td>10.9</td>
<td>21.3</td>
</tr>
</tbody>
</table>

AS OF 1 MAR 12

34 Satellites/31 Set Healthy Baseline Constellation: 24 Satellites

2012 03 14 Munich Satellite Navigation Summit Final
GPS Constellation

- Very robust constellation
  - 31 space vehicles (SVs) currently in operation
    - 10 GPS IIA
    - 12 GPS IIR
    - 7 GPS IIR-M
    - 2 GPS IIF
  - 3 additional satellites in residual status
- Global GPS civil service performance commitment met continuously since Dec 1993
GPS IIF Status

• Launched GPS IIF-2 on 16 Jul 11
  • Satellite Vehicle Number 63, PRN 1
  • Set healthy 14 Oct 11
  • Second operational L5 signal
  • Increases the enhanced GPS clock performance coverage

• 2 total IIFs on orbit
  • Best accuracies so far; 0.38 m RMS across family

• 10 more GPS IIFs in the pipeline
  • SVs 3-4 in storage
  • SVs 5-8 are in assembly, integration and test

• Next GPS IIF Launch scheduled for Sep 2012
GPS III Status

• Newest block of GPS satellites
  • First GPS satellite to broadcast common L1C signal
  • Multiple civil and military signals; L1 C/A, L1 P(Y), L1M, L1C, L2C, L2 P(Y), L2M, L5
  • Three Rubidium clocks

• Completed Critical Design Review for SVs 1-8

• Program granted Milestone C approval for SVs 1-8

• Prototype and engineering unit build/test underway
  • Completed 57 of 59 Manufacturing Readiness Reviews
  • Completed 47 of 59 Test Readiness Reviews

• GPS Nonflight Satellite Testbed (GNST) powered up 10 Jan 12
  • Integration underway; full navigation panel turned on 7 Feb 12

• Completed System Design Review for SVs 9+
Ground Segment Status

- **Current system Operational Control Segment (OCS)**
  - Currently flying GPS IIA/IIR/IIR-M/IIF constellation
  - Added the capability for anomaly resolution and disposal ops for IIF (LADO)

- **Next Generation Operational Control System (OCX) Phase B continues on track**
  - Preliminary Design Review completed Aug 2011
  - Completed first Hardware Critical Design Review 1 Mar 12
  - Delivered 2 of 7 software iterations
  - OCX Block I deployment planned for 2015

Monitor Station

Master Control Stations at Schriever AFB, Colorado

Ground Antenna
Recent International Participation

- **World Radio Conference (WRC-12) Jan-Feb 2012**
  - GPS actively participated in coordinating international spectrum usage
- **International Astronautical Federation (IAF) Oct 2011**
  - GPS honored with the IAF 60th Anniversary Award
- **Resolution 609 Consultation Meeting Sept 2011**
  - Consulted with other GNSS providers to ensure protection of aeronautical receivers in L5 band
- **International Committee on GNSS (ICG-6) Sept 2011**
  - Continued collaboration between GNSS providers to ensure compatibility and interoperability

**President Obama’s National Space Policy of 2010 states:**

“Engage with foreign GNSS providers to encourage compatibility and interoperability, promote transparency in civil service provision…”
• GPS has continuously met its commitments to all users

• Modernization of all GPS Segments is on track

• Striving to continually improve navigation and timing services while maintaining backward compatibility with legacy equipment

• GPS is committed to open and transparent cooperation with the international GNSS community

Maintaining And Improving GPS Services For All Users Is Job #1
Questions?