Global Positioning System Status

Anita Eisenstadt
State Department Advisor

APEC GIT 16
Bangkok, Thailand

February 15-17, 2012
Overview

• GPS Constellation Status
• GPS Performance
• GPS Modernization
• Summary
GNSS is Essential to Our Economies
U.S. Policy Promotes
Global Use of GPS Technology

• No direct user fees for civil GPS services
  – Provided on a continuous, worldwide basis

• Open, public signal structures for all civil services
  – Promotes equal access for user equipment
    manufacturing, applications development, and value-added services
  – Encourages open, market-driven competition

• Global compatibility and interoperability with GPS

• Service improvements for civil, commercial, and scientific users worldwide

• Protection of radionavigation spectrum from disruption and interference
GPS Constellation Status

31 Healthy Satellites
Baseline Constellation: 24 + 3

- 10 Block IIA Satellites
- 12 Block IIR Satellites
- 7 Block IIR-M Satellites
- 2 Block IIF Satellites
  - IIF-2 healthy as of October 16, 2011
  - Next IIF launch scheduled mid-2012
- Global GPS civil service performance commitment met continuously since December 1993
Standard Positioning Service (SPS)
Signal-in-Space Performance

System accuracy exceeds published standard

2001 Performance Standard
(6.0 m RMS overall SPS SIS URE)

2008 Performance Standard
(4.0 m RMS worst-case SPS SIS URE)

Decreasing range error, increasing accuracy

Signal-in-Space User Range Error is the difference between a GPS satellite's navigation data (position and clock) and the truth, projected on the line-of-sight to the user.
GPS Modernization Program

Increasing System Capabilities • Increasing User Benefit

Block IIA/IIR

- Basic GPS
  - Standard Service
    - Single frequency (L1)
    - Coarse acquisition (C/A) code navigation
  - Precise Service
    - Y-Code (L1Y & L2Y)
    - Y-Code navigation

Block IIR-M, IIF

IIR-M – Basic GPS capability plus
- 2nd civil signal (L2C)
- M-Code (L1M & L2M)
IIF – IIR-M capability plus
- 3rd civil signal (L5)
- 2 Rb + 1 Cs Clocks
- 12 year design life

Block III

- Backward compatibility
- 4th civil signal (L1C)
- Improved User Range Error
- Increased availability
- Increased integrity
- 15 year design life
The International Astronautical Federation bestowed its 60th Anniversary Award to the U.S. GPS program at a ceremony held October 4, 2011 in Cape Town, South Africa.

“...provided the greatest human benefit over the history of the space age”
GPS continues to meet or exceed our performance commitments to worldwide users

- Performance is better than ever and will continue to improve with planned modernization

Modernization of all segments is on track
For Additional Information...

www.GPS.gov
Contact Information

Anita Eisenstadt
State Department Representative to the National Coordination Office for Space-Based Positioning, Navigation, and Timing
+1-202-482-5809
anita.eisenstadt@pnt.gov

www.gps.gov
BACKUPS
U.S. Policy History

- 1983: President announces civilian access to GPS
- 1994: U.S. offers free civil GPS service to International Civil Aviation
- 1996: First U.S. GPS Policy establishes joint civil/military management
- 1997: Civil GPS access free of direct user fees codified in U.S. statute
- 2000: President ends use of Selective Availability
- 2004: President issues U.S. Policy on Space-Based PNT
- 2004: Agreement signed on GPS-Galileo Cooperation
- 2007: President announces Selective Availability eliminated from future GPS III satellites
- 2010: New National Space Policy includes specific PNT guidance
Civil Capability Improvements

Second civil signal “L2C”
- Designed to meet commercial needs
- Higher accuracy through ionospheric correction
- Available since 2005 without data message
  - Currently, 7 IIR-Ms transmitting L2C
- Full capability: 24 satellites ~2016

Third civil signal “L5”
- Designed to meet demanding requirements for transportation safety
- Uses highly protected Aeronautical Radio Navigation Service (ARNS) band
- Operational on 2 GPS IIF satellites
- Full capability: 24 satellites ~2018

After 2020, with L2C and L5 online, the USG will no longer support semi-codeless access to military GPS signals
Civil Capability Improvements

Fourth civil signal “L1C”

- Designed with international partners for interoperability
- Modernized civil signal at L1 frequency
  - More robust navigation across a broad range of user applications
  - Improved performance in challenged tracking environments
  - Original signal retained for backward compatibility
- Specification developed in cooperation with industry recently completed
- Launches with GPS III in 2014
- On 24 satellites by ~2021
GPS IIR/IIR-M Status

• All GPS IIR and IIR-M satellites are on orbit
  – Current backbone of the GPS constellation

• Excellent on-orbit performance
  – SIS URE of .50 meters
    (1 yr performance Jul 11)

• Excellent life expectancy
  – Solar array capacity far exceeds specification
  – No clock failures to date
GPS IIF Status

• Excellent on-orbit performance for IIF-1
  – SIS URE of .30 meters
    (1 yr performance Jul 11)

• Launched GPS IIF-2 on 15 Jul 11
  – SVN 63, PRN 1
  – Set healthy 14 October 2011
  – Second operational L5
  – Increases the enhanced GPS clock performance coverage

• 10 more IIFs in the pipeline
  – SVs 3-8 are in Assembly, Integration & Test

• IIF-3 Initial Launch Capability in Feb 12
GPS III Status

• Newest block of GPS satellites
  – First GPS satellite to broadcast 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

• Prototype and engineering unit build/test underway
  – Completed 57 of 59 Manufacturing Readiness Reviews
  – Completed 43 of 59 Test Readiness Reviews

• GPS Nonflight Satellite Testbed (GNST) integration underway

• Initiated Capability Insertion Program for SV-9+
Control Segment Status

• **Operational Control Segment (OCS)**
  - Now flying Block IIA/IIR/IIR-M/IIF constellation
  - Added the capability for anomaly resolution and disposal ops for IIF

• **Next Generation Operational Control System (OCX)**
  - Preliminary Design Review concluded August 2011
  - OCX Block I deployment planned for August 2015
  - New Launch and Checkout System will control first GPS III satellites prior to OCX Block I