



GPS Overview

International Committee on GNSS

Working Group A

Gold Coast, Australia

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Captain Anil Hariharan, United States



GPS Constellation Status



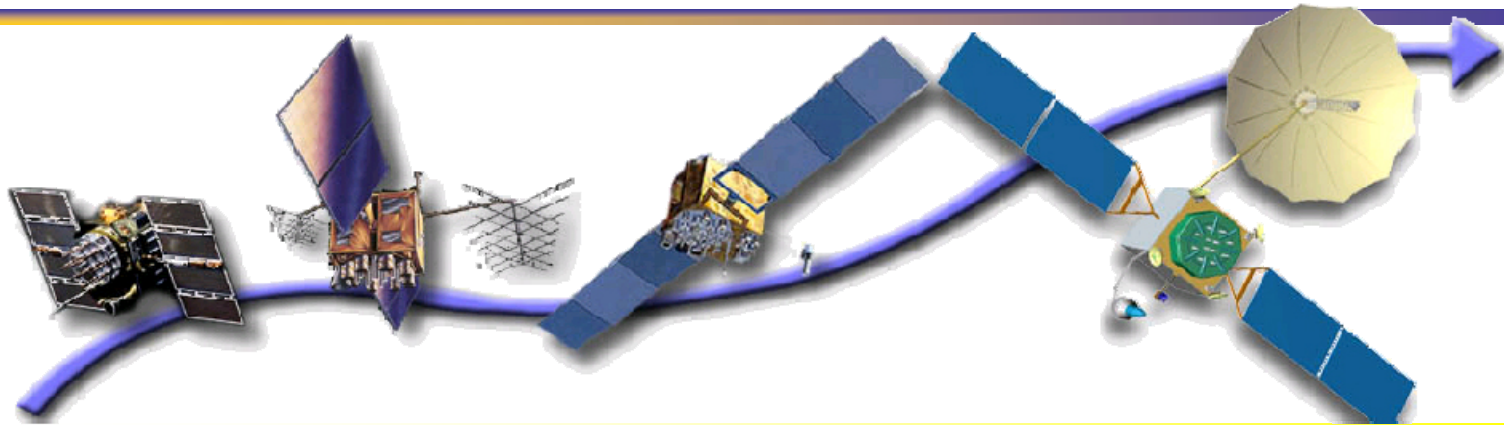
30 Operational Satellites (Baseline Constellation: 24)

- 11 Block IIA
- 12 Block IIR
- 7 Block IIR-M
 - Transmitting new second civil signal
 - 1 GPS IIR-M in on-orbit testing
- 3 additional satellites in residual status
 - Next launch: IIF ~ June 2010
- Global GPS civil service performance commitment met continuously since December 1993





GPS Modernization Program



Increasing System Capabilities ♦ Increasing Defense / Civil 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: IIA/IIR capabilities plus

- **2nd civil signal (L2C)**
- **M-Code (L1M & L2M)**

IIF: IIR-M capability plus

- **3rd civil signal (L5)**
- **Anti-jam flex power**

Block III

- **Backward compatibility**
- **4th civil signal (L1C)**
- **Increased accuracy**
- **Increased anti-jam power**
- **Assured availability**
- **Navigation surety**
- **Controlled integrity**
- **Increased security**
- **System survivability**



GPS Modernization – New Civil Signals



- 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-of-life
 - Uses highly protected Aeronautical Radio Navigation Service (ARNS) band
 - On orbit broadcast 10 APR 2009 on IIR-20(M) secured ITU frequency filing
 - Full capability: 24 satellites ~2018



GPS Modernization – Fourth Civil Signal (L1C)



Under Trees



Urban Canyons

- 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



Recent Program Successes



Space Segment

- SVN 49 launched in March 09
 - L5 demo payload secured frequency filing
 - Signal distortion investigation still underway
- SVN 50 launched in August 09
 - Set healthy
 - Completed GPS Delta II launches
- GPS IIF completed Pathfinder testing
- GPS IIIA completed Preliminary Design Reviews



Ground Segment

- Delivered new version of OCS (AEP 5.5) to final regression testing with SAASM capability
- Completed successful OCX, SDR, Modernized Capability Demo and RFP release





Main Benefit of Interoperability



Geometry

- More Satellites → Better Geometry → Improves:
 - **Satellite coverage** → navigate where could not before
 - **Dilution of Precision** → accuracy is better everywhere
 - Eliminates DOP holes (with open sky)
 - **RAIM*** → integrity checked everywhere, all the time
 - Eliminates RAIM holes (with open sky)
 - **Phase ambiguity resolution** for survey and machine control applications

* **Receiver Autonomous Integrity Monitoring**



Important for Interoperability



- Common Center Frequency
 - Like L5 & E5a
- Same Antenna Polarization

Essential (cost driver)

Important (no time bias or filter issues)

- Common Signal Spectrum
 - Identical receiver time delay with common spectrum
- Same coherent integration period for acquisition
 - Usually related to symbol rate
 - Different symbol rates may require separate search correlators for acquiring signals

Desirable (ASIC gate count)



Thank You