



*National Space-Based PNT
Coordination Office*

Global Positioning System: A Policy and Modernization Review

United Nations
International Committee on GNSS
1-2 December, 2005

Michael E. Shaw
Director
National Space-Based PNT Coordination Office



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Overview

- U.S. Space-Based PNT Policy
- GPS Modernization
- The Way Ahead



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Need for Updated U.S. Policy

- **In past decade, GPS has grown into global utility**
 - Integral to economic growth, transportation safety, homeland security, and critical infrastructure
 - Essential element of worldwide economic infrastructure
- **GPS is critical to U.S. national security**
 - Integrated into virtually every facet of U.S. military ops
- **Expanding number of GNSS systems and their augmentations**
- **Need to improve existing management mechanisms for GPS and its augmentations**



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U.S. Policy

- **U.S. Space-Based Positioning, Navigation, and Timing (PNT) Policy**
 - Signed on 8 Dec 04; publicly released on 15 Dec 04
 - Updated U.S. policy while retaining prior GPS principles
- **Established a stronger National Space-Based PNT Executive Committee; IGEB disestablished**
 - Chaired by Deputy Secretaries of Defense and Transportation
 - Membership includes: State, Commerce, Homeland Security, JCS, and NASA
 - Supported by a new National Coordination Office



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Policy: Objectives

- **Provide uninterrupted access to U.S. space-based PNT services for U.S./allied national security capabilities**
- **Provide space-based civil PNT services free of direct user fees on a continuous, worldwide basis**
 - Civil, commercial, homeland security and scientific use
- **Provide open, free access to information necessary to use these civil services**
- **Improve capabilities to deny hostile use of any space-based PNT services**
 - Without unduly disrupting civil and commercial access



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Policy: Objectives (cont'd)

- **Maintain the GPS as a component of multiple sectors of the U.S. Critical Infrastructure**
- **Improve the performance of space-based PNT**
 - Includes robust resistance to interference for civil, commercial, homeland security, and scientific users worldwide
 - Ensure civil services exceed, or are at least equivalent to, those of foreign civil space-based PNT services
- **Ensure that foreign PNT systems are interoperable with GPS**
 - Or, at a minimum, are compatible



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Implementation Actions

- **Set-Up National Space-Based PNT Coordination Office**
 - Director, Deputy Director, and 6 staff
- **Initiate National Space-Based PNT Advisory Board**
 - Board to conduct studies and provide advice as directed by Executive Committee
- **Prepare the following:**
 - 5-Year National Space-Based PNT Plan
 - GPS Interference Detection and Mitigation Plan



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New U.S. Policy

- **Demonstrates U.S. Government commitment to all stakeholders**
- **Provides framework for public/private decision makers**
- **Improves ability to coordinate efforts between different agencies**
- **Creates basis for meaningful dialogue between service providers and end users**
- **Promotes common standards for worldwide interoperability**



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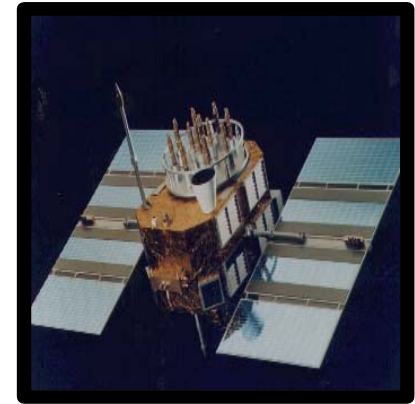


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GPS Constellation Status

28 Operating Satellites (to ensure 24)

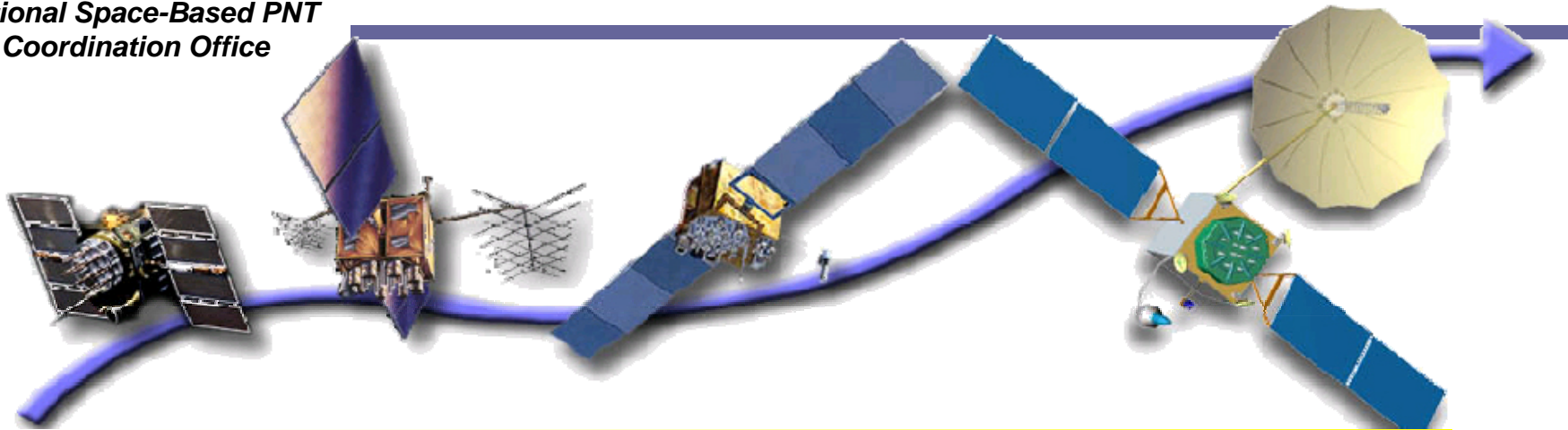
- 16 Block II/IIA satellites operational
- 12 Block IIR satellites operational
 - Modernizing up to 8 Block IIR satellites
- 1st Block IIR-M in orbit (Sep 25, 2005)
 - Check-out and evaluation is underway
- Continuously assessing constellation health to determine launch need
 - Next launch scheduled for Jan 2006
- Global GPS civil service performance commitment met continuously since Dec 93





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GPS Modernization



Increasing System Capabilities ♦ *Increasing Defense / Civil Benefit*

Block IIA/IIR

Basic GPS

- Std Service (16-24m SEP)
 - Single frequency (L1)
 - Coarse acquisition (C/A) code navigation
- Precise Service (16m SEP)
 - 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)
 - Eliminates SA for denial

IIF: IIR-M capability plus

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

Block III

Block IIIA:

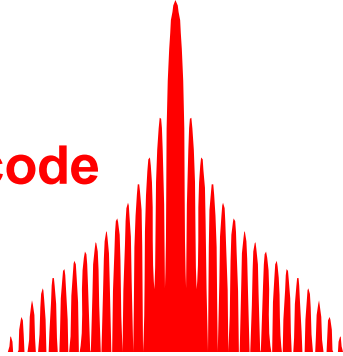
- Increased anti-jam power
- Increased security
- Increased accuracy
- Navigation surety
- Backward compatibility
- Assured availability
- Controlled integrity
- System survivability
- 4th civil signal (L1C)



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Second Civil Signal (L2C)

L2C code



Begins with IIR-M sats
First launch: Sep 2005
24 Satellites: 2012

- Improves service for ~ 50,000 current scientific/commercial dual-frequency users
- Will enable higher civilian accuracy when combined with existing civil GPS signal (L1 C/A)
- Overcomes some limitations of L1 C/A
 - Improved data structure will reduce interference
- First L2C capable satellite (IIR-M) currently on orbit going through test and evaluation
 - Signal defined in ICD-GPS-200D



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Third Civil Signal (L5)

L5 code



Begins with IIF sats
First launch: 2007
24 Satellites: 2015

- New signal structure for enhanced performance
- Higher power than other GPS civil signals
 - Higher power (no less than -154.9 dBW)
 - Wider bandwidth (1176.45 MHz +/- 10 MHz)
 - Improves resistance to interference
- Co-primary allocation with Aeronautical Radionavigation Services (1164-1215MHz)
- Signal defined in IS-GPS-705



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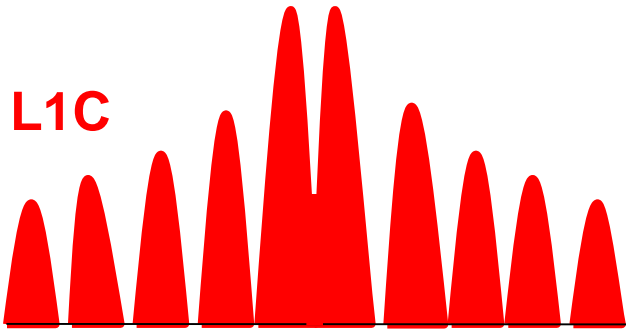
GPS III Civil Benefits

- **Significant increase in system accuracy**
- **Improved availability of accuracy with integrity**
- **Backward compatibility with existing receivers**
- **Operational capability for L2C and L5**
 - **In combination with GPS IIR-M and IIF satellites**
- **Flexibility to respond to evolving requirements with limited programmatic impacts**
- **Opportunity to converge with Galileo Open Service**



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Fourth Civil Signal (L1C)



**Begins with GPS III sats
First launch: ~ 2013**

- **Modernized L1 civil signal**
 - In addition to C/A code for backward compatibility
 - Binary Offset Carrier [BOC] (1,1) modulation
 - Increased robustness and potentially accuracy for civil users
- **Establishes a common baseline L1 open service signal for GPS & Galileo**

For additional information contact: L1C_GPS@USGS.gov



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Summary

- **First GPS IIR-M launch -- Sep 25, 2005**
- **First GPS IIF launch in 2007**
- **GPS III – study contracts ongoing since Jan 04**
- **Ops Control Segment – study contracts in Jul 05**
- **6 NGA Monitor Stations brought on line in GPS Master Control Station in Aug 05**
 - 5 more to follow next year
- **Implementing space-based and ground-based GPS augmentations**
 - WAAS commissioned in July 2003
 - NDGPS single coverage of CONUS at 92%



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The Way Ahead

- **Implementing U.S. National Space-Based PNT Policy**
 - Coordination Office activated on November 1st
- **First new civil/military GPS signals currently undergoing test and evaluation**
 - Further enhancements continuing through GPS III
 - Fielding of GPS augmentations continuing
- **Other GNSS systems are being implemented**
 - US-EC GPS-Galileo Working Groups
 - Compatibility and Interoperability are critical



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