



**SPACE-BASED POSITIONING
NAVIGATION & TIMING**

NATIONAL COORDINATION OFFICE

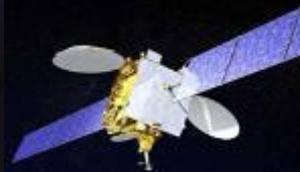
U.S. Space-Based Positioning, Navigation and Timing: A Policy and System Update

November 16, 2011

Maureen Walker

**State Department Representative to the
National Coordination Office for Space-Based PNT**

GNSS APPLICATIONS



**Satellite
Operation**



**Surveying &
Mapping**



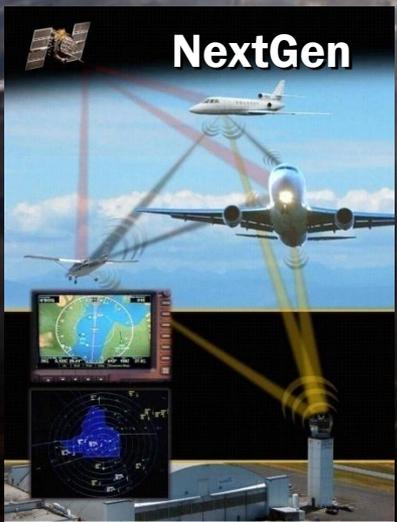
**Power
Grids**



Precision Agriculture



**Transit
Operations**



NextGen



**Trucking &
Shipping**



IntelliDrive



Telecom



Disease Control



Oil Exploration



Fishing & Boating



Overview



- **U.S. Space-Based Positioning, Navigation and Timing (PNT) Policy**
- **GPS Constellation Update**
- **International Cooperation Activities**



2004 U.S. Space-Based PNT Policy

(Excerpts focused on International Relations)



Goals:

- U.S. space-based PNT systems and services remain essential components of internationally accepted PNT services
- Promote U.S. technological leadership in applications involving space-based PNT services

To achieve this, the United States Government shall:

- Encourage foreign development of PNT services/systems based on GPS
 - Seek to ensure foreign space-based PNT systems are **interoperable** with civil GPS and augmentations
 - At a minimum, ensure **compatibility**

The Secretary of State shall:

- Promote the use of civil aspects of GPS and its augmentation services and standards with foreign governments and other international organizations
- Lead negotiations with foreign governments and international organizations regarding civil PNT matters



U.S. National Space Policy

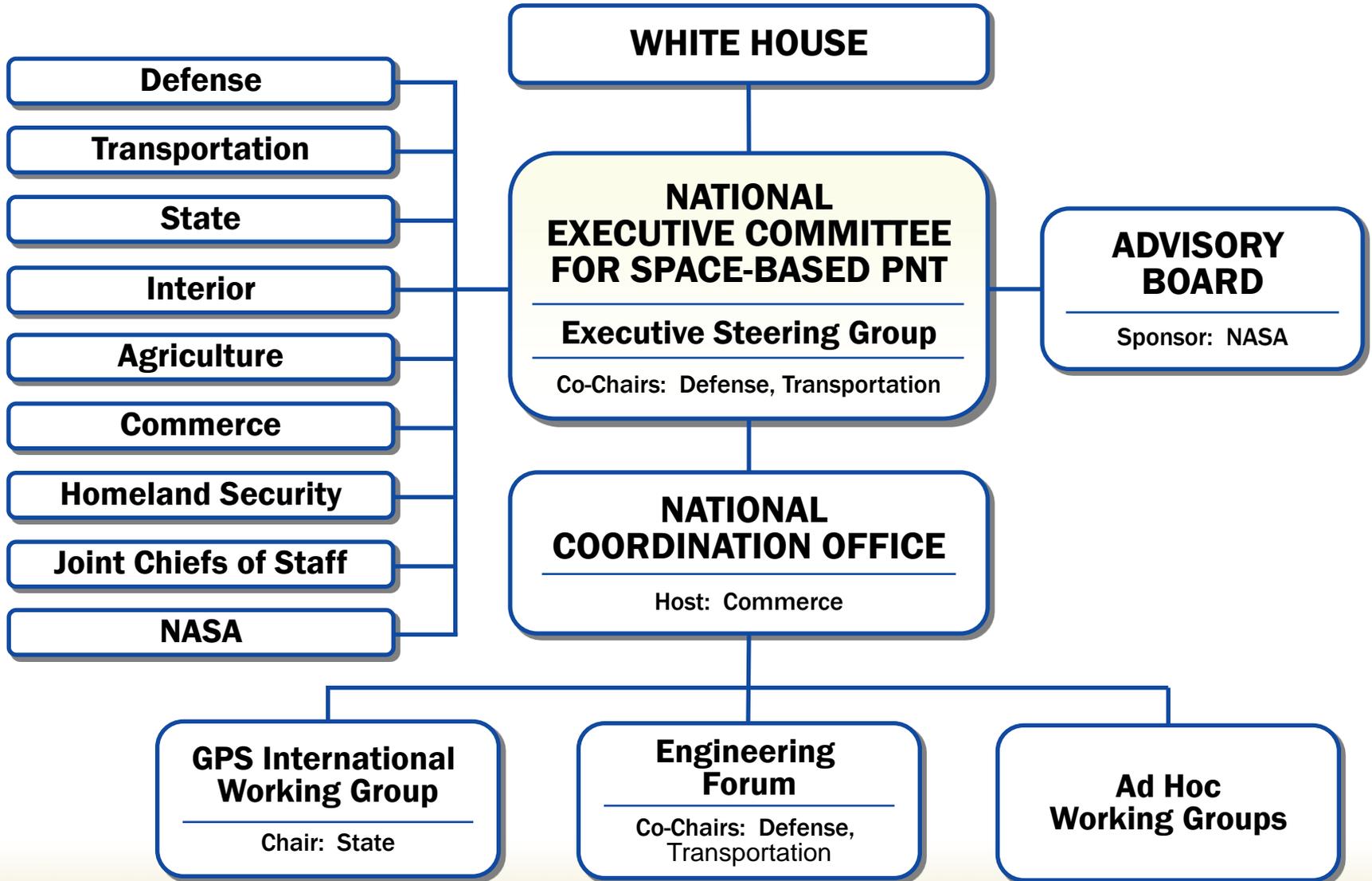


- Provide civil GPS services, free of direct user charges
 - Available on a continuous, worldwide basis
 - Maintain GPS constellation consistent with published performance standards and interface specifications
 - Foreign PNT may be used to augment and strengthen resiliency
- Engage with International GNSS providers
 - Encourage *compatibility* and *interoperability*
 - Promote *transparency* in civil service provision
- Enable market access to industry
- Support international activities to detect and mitigate harmful interference

Space-Based PNT Guideline: Maintain leadership in the service, provision and use of GNSS



U.S. Space-Based PNT Organizational Structure





U.S. Objectives in Working with Other GNSS Service Providers

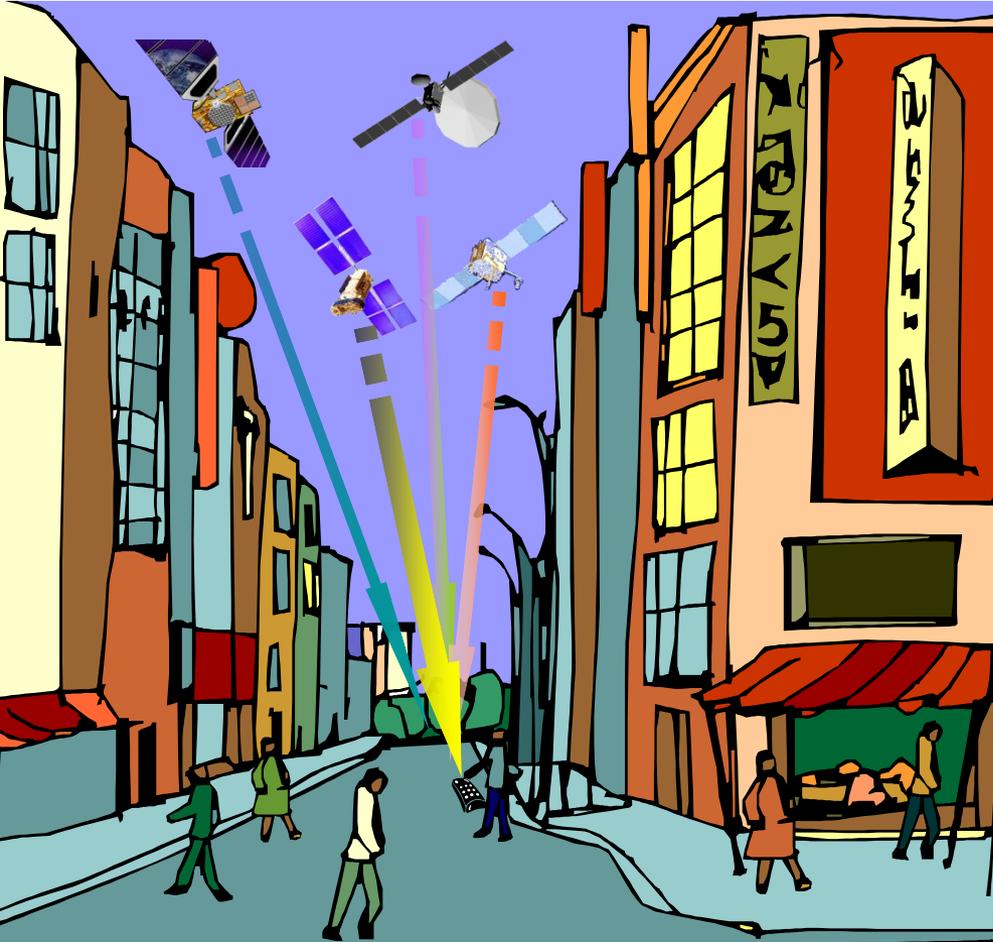


- Ensure **compatibility** — ability of U.S. and non-U.S. space-based PNT services to be used separately or together without interfering with each individual service or signal
 - Radio frequency compatibility
 - Spectral separation between M-code and other signals
- Achieve **interoperability** – ability of civil U.S. and non-U.S. space-based PNT services to be used together to provide the user better capabilities than would be achieved by relying solely on one service or signal
- Promote **transparency** in civil service provision
- Enable market access to industry

Pursue through Bilateral and Multilateral Cooperation



The Goal of RNSS Civil Interoperability



- Ideal interoperability allows navigation with one signal each from four or more systems with no additional receiver cost or complexity

Interoperable = Better Together than Separate



Overview



- **U.S. Space-Based Positioning, Navigation and Timing (PNT) Policy**
- **GPS Constellation Update**
- **International Cooperation Activities**



U.S. Air Force Receives Award

- **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.**

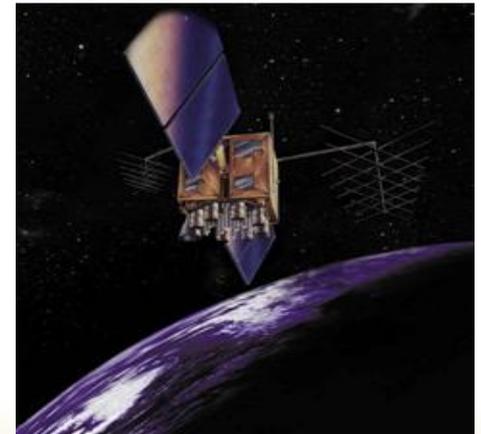




GPS Constellation Status

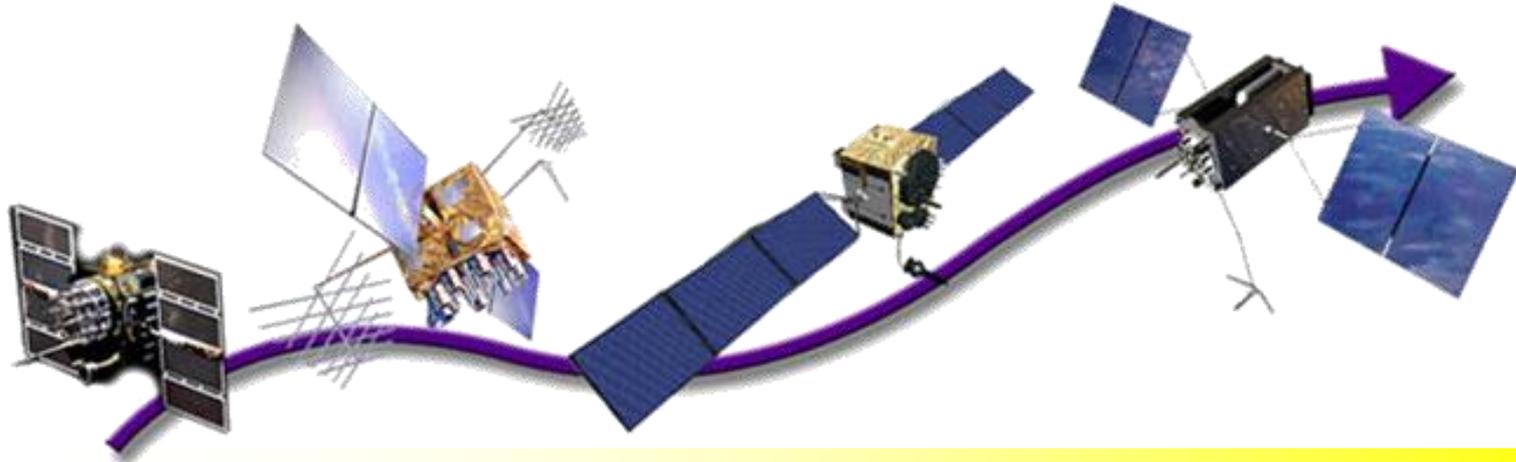
31 Operational Satellites
Baseline Constellation: 24

- **10 Block IIA Satellites**
- **12 Block IIR Satellites**
- **7 Block IIR-M Satellites**
- **2 Block IIF Satellite**
 - *IIF-2 launched July 16, 2011*
 - *Set Healthy on October 14, 2011*
- **Next Block IIF Launch - 2012**
- **Global GPS civil service performance commitment met continuously since December 1993**





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)
- 4x better User Range Error than IIF
- Increased availability
- Increased integrity
- 15 year design life



Overview



- **U.S. Space-Based Positioning, Navigation and Timing (PNT) Policy**
- **GPS Constellation Update**
- **International Cooperation Activities**



U.S. - Europe Cooperation



- U.S.-EU agreement signed in 2004 provides solid foundation for cooperation
- EU Parliament approved Agreement on Oct 16, 2011
 - EU Council now must adopt a “decision of conclusion” and deposit its entry-into-force note – expected by end of calendar year.





U.S. - Europe Cooperation



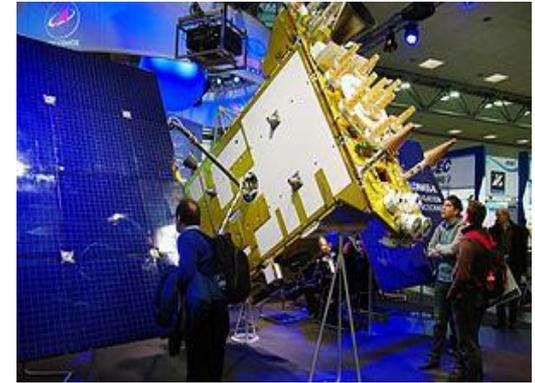
- **May 2011 Video Conference was the most recent “plenary type” meeting with the EU**
- **GPS-Galileo issues discussed at the June 2011 U.S.-EU Space Policy Dialogue in Brussels**
- **WG-A – ITU Operator-to- Operator Coordination meetings in September and planned in December 2011**
- **WG-B – October 2011 Video Conference discussed trade and commercial issues**



U.S. - Russian Federation Cooperation



- **U.S.- Russia Joint Statement issued in December 2004**
 - **Compatibility/Interoperability Working Group established**
 - **Search/rescue working group meeting held in 2011 – technical programs toward NextGen capabilities**
- **Russia provided detailed presentation on SDCM, assignment of GPS L1 C/A PRN codes and GLONASS CDMA plans**
- **Joint statement reaffirming intent to continue to cooperate on GNSS signed in September 2011**





U.S. - Japan Cooperation



- **Japan's status as a world leader in GPS applications and user equipment makes it an important partner**
- **Regular policy consultations and technical meetings on GPS cooperation have been held since 1996 and led to the 1998 Clinton-Obuchi Joint Statement**



- **Both countries have benefited from the close relationship:**
 - **QZSS is designed to be compatible and interoperable with GPS**
 - **U.S. and Japan set up QZSS monitoring stations in Hawaii and Guam**



U.S. - India Cooperation



- **In July, 2011, the U.S. and India convened the third U.S.-India Joint Working Group on Civil Space Cooperation in Bangalore and agreed to resume work on interoperability between GPS and the Indian GPS Aided Geo Augmented Navigation System (GAGAN) and the proposed Indian Regional Navigational Satellite System (IRNSS)**
- **Policy and technical consultations on GPS cooperation underway since 2005, including a U.S.-India Joint Statement on GNSS Cooperation 2007, Bilateral meetings in Bangalore in 2007 and technical Meetings focused on GPS-IRNSS compatibility and interoperability held in 2008 and 2009**
 - **One aim is to ensure interoperability between GPS augmentation system WAAS and India's planned GAGAN augmentation system based on GPS**
 - **Another important topic is ionospheric distortion and solutions**



U.S. China Cooperation



- **Government officials from both nations participated in a bilateral U.S. National Academy of Engineering and Chinese Academy of Engineering GNSS workshop held in Shanghai in May 2011**
- **U.S. and China concluded International Telecommunications Union Operator-to-Operator coordination on signal compatibility between GPS and Compass in September 2010**
 - **Bilateral meetings held 2007, 2008, 2009 and 2010**
- **China will host the 7th Meeting of the International Committee on Global Navigation Satellite System in Beijing in 2012**



U.S. - Australia Cooperation



- **U.S.-Australia Joint Delegation Statement on Cooperation in the Civil Use of GPS signed in 2007**
 - The U.S. and Australia will work closely together to facilitate broad and effective use of GNSS augmentation systems that may be considered for use as civil regional augmentations to the GPS.
- **U.S. Coast Guard NAVCEN posts a daily Position Dilution of Precision (PDOP) report in response to Australia's concerns over planned GPS outages**
- **GNSS and applications included in expanded space cooperation, as reflected in 2010 Joint Announcement**
- **Australia hosted the 15th Meeting of the APEC GNSS Implementation Team in Brisbane in June 2011**



APEC GNSS Implementation Team



- **Established by the APEC Transportation Working Group in 2000**
- **Mission is to promote implementation of regional GNSS augmentation systems to enhance inter-modal transportation, by:**
 - **Expediting the implementation of GNSS in all economies**
 - **Advancing the development of an Asia Pacific approach to GNSS implementation to encourage cooperation that will enhance safety and enhance safety and efficiency**
 - **Seeking from all economies the expertise to ensure the success of GNSS implementation**
 - **Cooperating with non-APEC organizations as necessary to provide for seamless implementation**
 - **Russia hosted a Workshop on “GNSS Applications for Seamless Transport Supply Chain Connectivity in APEC” in October, 2011**



International Committee on Global Navigation Satellite Systems (ICG)



- **Emerg**ed from 3rd UN Conference on the Exploration and Peaceful Uses of Outer Space July 1999
 - Promote the use of GNSS and its integration into infrastructures, particularly in developing countries
 - Encourage compatibility and interoperability among global and regional systems
- **Members include:**
 - GNSS providers (U.S., EU, Russia, China, India, Japan)
 - Other Member States of the United Nations
 - International organizations/associations





International Committee on Global Navigation Satellite Systems (ICG)



- ICG-2 held in September, 2007, in Bangalore, India
- Established **Providers Forum** to address common issues
- Began implementation of the ICG Work Plan within established working groups:
 - A. Interoperability and compatibility
 - B. Enhancement of performance of GNSS services
 - C. Information dissemination, education, outreach & coordination
 - D. Reference frames, Timing and Applications
- **Next ICG meeting in 2012, China**



ICG Providers Forum



- Six space segment providers listed previously are members
- Purpose:
 - Focused discussions on **compatibility and interoperability**, encouraging development of complimentary systems
 - Exchange of detailed information on systems and service provision plans
 - Exchange views on ICG work plan and activities
- Consensus reached at the first meeting on general definitions for compatibility and interoperability
 - Including spectral separation between each system's authorized service signals and other systems' signals

www.icgsecretariat.org



Summary

- **International cooperation is a priority**
 - *Compatibility, Interoperability, Transparency are critical*
 - *U.S. policy permits use of foreign PNT to augment GPS and increase resiliency*
- **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*

Policy stability and transparency improve industry confidence and investment



Contact Information

Maureen Walker

State Department Representative to the
National Coordination Office for Space-Based
Positioning, Navigation, and Timing

202-482-5809 (office)

Maureen.Walker@PNT.gov

www.PNT.gov

www.GPS.gov