U.S. GNSS International Policy and Cooperation Activities

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Overview

- U.S. Space-Based PNT Policy
- GNSS and International Cooperation Objectives
- Bilateral Discussions
- Multilateral Discussions
- Summary

Need for A New U.S. Space Policy

- Since 2006, various domestic and international developments have changed the opportunities, challenges, and threats facing the U.S., including its space capabilities
- **New opportunities for international cooperation; evolving/maturing commercial capabilities and options**
  - **More space actors, increased debris, need for enhanced transparency and stability**
- The U.S. National Space Policy accounts for those changes and reflects the integral role space plays in U.S. economic, national, and homeland security
- Continuity of fundamental policy precepts
- Every President since President Eisenhower has issued a space policy

U.S. National Space Policy

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

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

U.S. Policy Promotes Global Use of GPS Technology

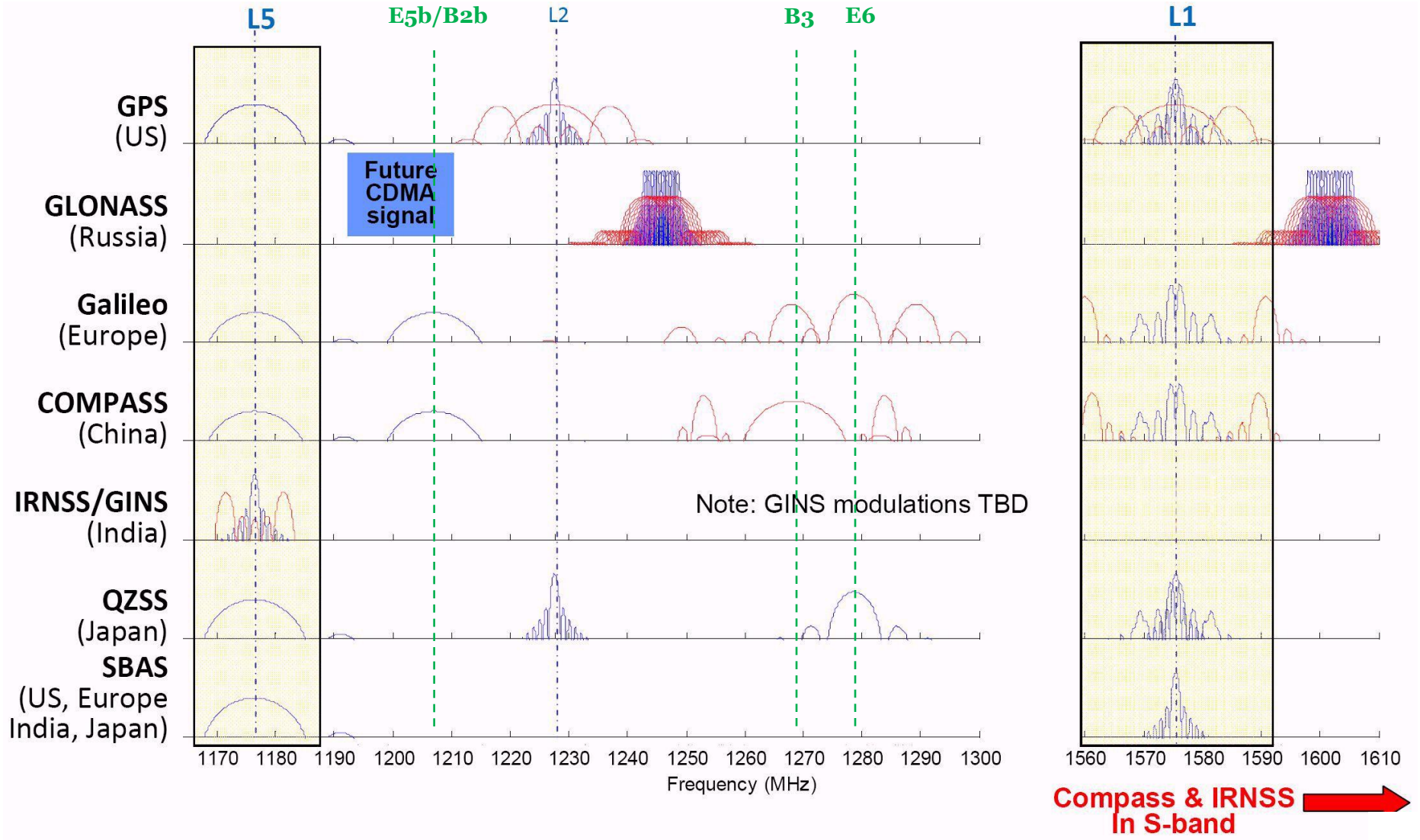
- No direct user fees for civil GPS services
  - Provided on a continuous, worldwide basis
- Open, public signal structures for all civil services
  - Promotes equal access for user equipment manufacturing, applications development, and value-added services
  - Encourages open, market-driven competition
- Global compatibility and interoperability with GPS
- Service improvements for civil, commercial, and scientific users worldwide
- Protection of radionavigation spectrum from disruption and interference

Planned GNSS

- Global Constellations
  - **GPS (24+)**
  - GLONASS (30)
  - Galileo (27+3)
  - Compass (27+3 IGSO + 5 GEO)
- Regional Constellations
  - QZSS (3)
  - IRNSS (7)

- Satellite-Based Augmentations
  - **WAAS (3)**
  - MSAS (2)
  - EGNOS (3)
  - GAGAN (2)
  - SDCM (2)

Planned GNSS Signals



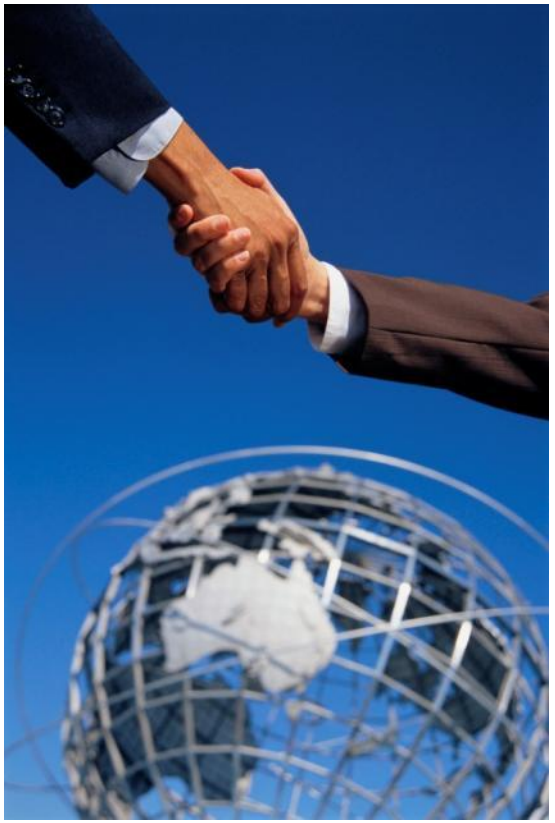
U.S. Objectives in Working with Other GNSS Service Providers

- 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 fair competition in the global marketplace

Pursue through Bi-lateral and Multi-lateral Cooperation

International Cooperation Venues

- Bilateral to include:
  - Japan
  - Europe
  - Russia
  - India
  - China
  - Others (Australia)
- Multilateral:
  - Asia Pacific Economic Cooperation
  - International Committee on GNSS



Bilateral Cooperation

- **U.S.-China** operator-to-operator coordination under ITU auspices is complete
  - Bilateral Meetings in 2007, 2008, 2009, 2010
- **U.S.-Japan** Joint Statement on GPS Cooperation 1998
  - Quasi Zenith Satellite System (QZSS) designed to be fully compatible and highly interoperable with GPS
  - Bilateral agreements set up QZSS monitoring stations in Hawaii and Guam
  - Japan to host ICG-6 in September 2011
- **U.S.-Russia** Joint Statement issued December 2004
  - Compatibility/interoperability working group established
  - Search/rescue working group meeting scheduled for September 2011 – technical progress towards NextGen capabilities

Bilateral Cooperation (continued)

- **U.S.-India** Joint Statement on GNSS Cooperation 2007
  - Technical Meetings focused on GPS-India Regional Navigation Satellite System (IRNSS) compatibility and interoperability held in 2008 and 2009
  - Continuation of ITU compatibility coordination is pending
  - Space-based PNT issues to be part of agenda for July 2011 Civil Space Joint Working Group Meeting
- **U.S.-EU** GPS-Galileo Cooperation Agreement signed in June 2004
  - Four working groups set up under the Agreement
- **U.S.-Australia** Joint Delegation Statement on Cooperation in the Civil Use of GPS in 2007
  - Bilateral meeting in Washington, D.C., October 2010
  - GNSS and applications included in expanded space cooperation, as discussed in October 2010 Joint Announcement

International Committee on Global Navigation Satellite Systems (ICG)

- Emerged 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
  - First Meeting held in 2006
  - Next meeting – September 4-9, 2011 in Japan
- Members include:
  - **GNSS Providers** (U.S., EU, Russia, China, India, Japan)
  - Other interested Member States of the United Nations
  - International organizations/associations

ICG Providers Forum

- Six space segment providers listed previously are members
- Purpose:
  - Focused discussions on **compatibility and interoperability**, encouraging development of complimentary systems
  - Exchange detailed information on systems & service provision plans
  - Exchange views on ICG work plan and activities
- Providers have agreed that all GNSS signals and services must be compatible and open signals and services should also be interoperable to the maximum extent possible
  - Working definition of **compatibility** includes respect for spectral separation between each system's authorized service signals and other systems' signals
  - **Interoperability** definition addresses signal, geodetic reference frame realization, and system time steerage considerations

Summary

- U.S. policy encourages **worldwide use of civil GPS and augmentations**
- The U.S. is actively engaged in **bilateral and multilateral cooperation** on satellite navigation issues
- **International cooperation** is a priority
  - In pursuit of systems **Compatible** and **Interoperable** with GPS

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http://www.gps.gov/
http://www.pnt.gov/

ICG Providers Forum Definition of Compatibility

Compatibility refers to the ability of global and regional navigation satellite systems and augmentations to be used separately or together without causing unacceptable interference and/or other harm to an individual system and/or service

- **The International Telecommunication Union (ITU) provides a framework for discussions on radiofrequency compatibility. Radiofrequency compatibility should involve thorough consideration of detailed technical factors, including effects on receiver noise floor and cross-correlation between interfering and desired signals.**
- **Compatibility should also respect spectral separation between each system's authorized service signals and other systems' signals. Recognizing that some signal overlap may be unavoidable, discussions among providers concerned will establish the framework for determining a mutually-acceptable solution.**
- **Any additional solutions to improve compatibility should be encouraged.**

ICG Providers Forum Definition of Interoperability

Interoperability refers to the ability of global and regional navigation satellite systems and augmentations and the services they provide to be used together to provide better capabilities at the user level than would be achieved by relying solely on the open signals of one system

- **Interoperability allows navigation with signals from different systems with minimal additional receiver cost or complexity.**
- **Multiple constellations broadcasting interoperable open signals will result in improved observed geometry, increasing end user accuracy everywhere and improving service availability in environments where satellite visibility is often obscured.**
- **Geodetic reference frames realization and system time steerage standards should adhere to existing international standards to the maximum extent practical.**
- **Any additional solutions to improve interoperability are encouraged.**