



U.S. Space-Based PNT International Cooperation

**Asia Pacific Economic Cooperation
GNSS Implementation Team-12**

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Alice A. Wong

Senior Advisor for GNSS Issues
Office of Space and Advanced Technology
U.S. Department of State



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
 - And, as appropriate in coordination with the SECDEF, military PNT matters



Planned GNSS

- **Global Constellations**
 - GPS (24+)
 - GLONASS (24)
 - Galileo (27)
 - Compass (35)
- **Regional Constellations**
 - QZSS (3)
 - IRNSS (7)
- **Satellite-Based Augmentations**
 - WAAS (3)
 - MSAS (2)
 - EGNOS (3)
 - GAGAN (3)
 - SDCM (2?)



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
 - Primary focus on the common L1C and L5 signals

Pursue through Bi-lateral and Multi-lateral 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



U.S. - Europe Cooperation

- U.S.-EU agreement signed in 2004 provides solid foundation for cooperation
- Action is now divided among four working groups set up by the agreement:
 - Technical, trade, and security issues working groups have met
- Improved new civil signal (MBOC) adopted in July 2007



June 26, 2004, press conference at U.S.-EU Summit in Ireland (U.S. Sec. of State Colin Powell, Irish Foreign Minister Brian Cowen, EU Vice-President Loyola De Palacio)



U.S. - Russian Federation Cooperation

- **U.S.- Russia Joint Statement issued in December 2004**
- **Several very productive technical working group meetings have been held:**
 - **Russia WG-1 chair proposed adopting two new civil CDMA signals at L1, L5 to be interoperable with GPS**
 - **Still under discussion within the Russian Government**
- **Negotiations for a U.S.-Russia Agreement on satellite navigation cooperation have been underway since late 2005**



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. working with Japan to set up QZSS monitoring stations in Hawaii and Guam



U.S. - India Cooperation

- **Policy and technical consultations on GPS cooperation underway since 2005**
 - 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.-India Joint Statement on GNSS Cooperation issued in February 2007 in Washington**
 - Bi-lateral meeting held in Bangalore in September 2007
 - Technical Meeting focused on GPS-IRNSS compatibility and interoperability held in January 2008



U.S. - Australia Cooperation

- Long history of GPS cooperation between U.S. and Australia
- U.S.-Australia Joint Delegation Statement on Cooperation in the Civil Use of GPS signed April 19, 2007
 - Cooperation expands upon existing efforts to ensure interoperability between GPS and Australia's Ground-based Regional Augmentation System (GRAS) and Ground Based Augmentation System (GBAS)
- U.S. Coast Guard NAVCEN posts a daily Position Dilution of Precision (PDOP) report in response to Australia's concerns over planned GPS outages



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
- Members include:
 - GNSS providers (U.S., EU, Russia, China, India, Japan)
 - Other Member States of the United Nations
 - International organizations/associations





2nd 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. Interaction with monitoring & reference station network organizations
- **U.S. will host the 3rd ICG in December 2008**



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

<http://www.unoosa.org/oosa/en/SAP/gnss/icg.html>



Summary

- As new space-based GNSS are emerging globally, interoperability is the key to “success for all”
- U.S. is actively engaged in bi-lateral, regional, and multi-lateral cooperation on space-based navigation issues
- International cooperation in the context of National Space-Based PNT Policy principles is a top priority for the U.S. Government



Contact Information

Alice A. Wong

**Senior Advisor for GNSS issues
Office of Space and Advanced Technology
U.S. Department of State**

**1990 K Street NW, Suite 410
Washington, D.C. 20006
202-663-2388 (office)
wongAA@state.gov**

<http://www.state.gov/g/oes/sat/>