U.S. GPS/GNSS International Activities Update

Civil GPS Service Interface Committee Meeting
Portland, Oregon

Jeffrey Auerbach
Office of Space and Advanced Technology
U.S. Department of State
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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
GNSS: A Global Navigation Satellite System of Systems

- **Global Constellations**
  - **GPS (24+3)**
  - GLONASS (24+)
  - GALILEO (24+3)
  - BDS/BEIDOU (27+3 IGSO + 5 GEO)

- **Regional Constellations**
  - QZSS (4+3)
  - IRNSS/NAVIC (7)

- **Satellite-Based Augmentations**
  - WAAS (3)
  - MSAS (2)
  - EGNOS (3)
  - GAGAN (3)
  - SDCM (3)
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 Bilateral and Multilateral Cooperation**
Bilateral Cooperation

China

• First bilateral space-based PNT related meeting on civil cooperation held May 2014 in Beijing

• Second bilateral space-based PNT meeting held June 2015 in Washington, D.C.

• Working Group and Subgroups focused on Interoperability, Aviation and Service Center Cooperation continue to meet as needed

India

• U.S.–India Joint statement signed in 2007

• ITU compatibility coordination completed between GPS and IRNSS/NAVIC

• U.S.-India Civil Space Joint Working Group (CSJWG) met in September 2015, in Bangalore
Bilateral Cooperation (cont)

Europe

- GPS-Galileo Cooperation Agreement signed in 2004
- ITU compatibility coordination completed under Working Group A in July 2014
- Working Group B (Trade & Civil Applications) met March 2016 in Munich
- Working Group C (Next Generation GNSS) met April 2016 in Spain
- 8th U.S.-EU Space Dialogue hosted by U.S. in December 2015

Japan

- Civil Space Dialogue held in Tokyo in September 2015
- U.S. continues to host QZSS monitoring stations in Hawaii and Guam
- ITU compatibility coordination between GPS and QZSS (four satellite configuration) completed in 2015
Additional Bilateral Cooperation Related to Space and PNT

- **Canada**: Civil GNSS meeting held in Ottawa – May 2015
  - Agreed to expand cooperation on interference detection and mitigation, jammer enforcement, and geodetic network ground station coverage in Canada
- **Republic of Korea**: 2nd bilateral Civil Space Dialogue held in Seoul – April 2016
  - Discussion about Korea’s development of their SBAS
- **Australia**: Joint Delegation Statement on Cooperation in the Civil Use of GPS in 2007
  - Last formal space bilateral meeting held in October 2010
  - Informal discussions held regularly
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

[Image: ICN Navigator]

[Website Link]
Meeting held in Boulder, Colorado at University Corporation for Atmospheric Research (UCAR)

More than 200 participants
  - Representatives from 28 countries/organizations
  - Representation from all 6 GNSS Providers

Panel of Experts Session
  - GNSS: Today and Preparing for the Future

Applications and Experts Session
  - Observing Earth Processes using GNSS

Local Tours Included:
  - National Space Weather Prediction Center
  - Time and Frequency Laboratory
  - UNAVCO (facilitates geoscience research and education using geodesy)
ICG-10: Significant Accomplishments and Recommendations

- Interference Detection and Mitigation (IDM) & Spectrum Protection
  - Recommendation for Providers to promote the implementation of protection measures of GNSS operations around the world
  - Recommendation for ICG presentation to UN Committee on the Peaceful Uses of Outer Space (COPUOS) - Focused on National Efforts to protect RNSS Spectrum, and pursue Interference Detection and Mitigation in Member States

- Interoperability
  - Discussion about GNSS system time and signals, based on 5 system provider workshops held between 2013 and 2015

- International Multi-GNSS monitoring (IGMA)
  - Existing civil service centers working to establish a link to a new ICG web portal allowing users to easily find GNSS monitoring information and products
  - Recommendation to initiate a trial project between the ICG and IGS to demonstrate a global GNSS Monitoring and Assessment capability
• Space Service Volume (SSV)
  – Progress on developing definitions and assumptions for an interoperable SSV
  – Providers to report on new Spaceborne GNSS receiver developments within their region

• Space Weather
  – Presentation/discussion on new U.S. Space Weather Strategy (includes section on international cooperation)

• Orbital Debris Mitigation
  – U.S. presentation on orbital debris strategies in Medium Earth Orbit (MEO)

• Service Center Cooperation
  – Recommendation to develop a template for cooperation between GNSS provider user information centers

ICG-11: Hosted by the Russian Federation in Sochi, 7-11 November 2016
ICG Experts Meeting and Seminar on Spectrum Protection & IDM

- Organized by UN Office for Outer Space Affairs (OOSA), through its Program on GNSS Applications
  - Held at UN Vienna International Centre, December 14-18, 2015
  - Approximately 60 experts participated, representing 33 countries/organizations

- Two Day Seminar on Spectrum Protection and IDM
  - Organized and presented by experts from U.S., EU, Japan & ITU
  - Objective: Provide an overview of GNSS spectrum protection and management with a focus on developing nations and other non-GNSS providers
  - Agenda topics included
    - Introduction to GNSS
    - Spectrum Management
    - Spectrum Protection
    - Interference Detection and Mitigation
Other International Activities/Events

The U.S. participated in the following GNSS Related events in 2016:

• International GNSS Service (IGS) 2016 Workshop in Sydney, Australia – February 2016
• Munich Satellite Summit – March 2016
• APEC GNSS Implementation Team Meeting in Papua New Guinea – April 2016
• Royal Institute of Navigation Vulnerabilities Conference in Baska, Croatia – May 2016
• China Satellite Navigation Conference in Changsha, China – May 2016
• International Committee on GNSS (ICG) Intersessional Meetings and Providers’ Forum Meeting, Vienna, Austria – June 2016
Summary

• U.S. policy encourages the worldwide use of civil GPS services and cooperation with other GNSS providers
  – Compatibility, interoperability, and transparency in civil service provision are priorities

• U.S. hosted ICG-10 meeting was a success with progress on multilateral cooperation in the areas of interference detection and mitigation, interoperability and civil signal monitoring

• International outreach is a priority, through participation in public events and multilateral fora