U.S. GPS/GNSS International Activities Update

Civil GPS Service Interface Committee Meeting
Portland, Oregon

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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 **G**lobal **N**avigation Satellite **S**ystem of **S**ystems

- 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

- *Vietnam:* First U.S.-Vietnam Civil Space Dialogue held in Washington – December 2014

- *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

ICG International Committee on Global Navigation Satellite Systems

http://www.unoosa.org/oosa/en/ourwork/icg/icg.html

U.S. Hosted 10th ICG Meeting (ICG-10): 1-6 November 2015

- 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)

UCAR Center Green Facility

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