



Multi-GNSS Monitoring and the International Committee on GNSS

Multi-GNSS Asia Workshop

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Overview

- ICG History and Background
- Outcomes of Recent ICG Meetings
- Recommendation from ICG-6



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)



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
 - Met annually since 2006
- Members include:
 - **GNSS Providers** — China, EU, India, Japan, Russia, United States
 - Other interested Member States of the United Nations
 - International organizations/associations



ICG Providers Forum

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



Working Group on Compatibility and Interoperability (WG-A)

- Co-chaired by the United States and the Russian Federation
- Work plan focused on assisting Providers in the pursuit of complementary systems
 - *Compatibility and Interoperability* – consider the perspective of various user applications and equipment manufacturers
 - *Open Service Information Sharing* – pursue **Principle of Transparency**: every GNSS provider should publish documentation that describes the signal and system information, the policies of provision and the minimum levels of performance offered for its open services
 - *Service Performance Monitoring* – potential cooperation in the development of the necessary ground infrastructure to monitor signal and service performance for open services
 - *Spectrum Protection – Interference Detection , and Mitigation* – develop a strategy for supporting mechanisms to detect and mitigate sources of electromagnetic interference



Other Working Groups

- Working Group on Enhancement of GNSS Services Performance (WG-B)
 - Co-chaired by India and the European Space Agency
 - Focused on system enhancements (multipath, integrity, interference, etc.) to meet future needs
- Working Group on Information Dissemination and Capacity Building (WG-C)
 - Chaired by the United Nations Office for Outer Space Affairs
 - Focused on training, promoting scientific applications, International Space Weather Initiative, and regional GNSS workshops
- Working Group on Reference Frames, Timing and Applications (WG-D)
 - Co-chaired by FIG, IAG and IGS
 - Focused on monitoring and reference station networks



ICG-4 (2009) and ICG-5 (2010) Significant Outcomes

- ICG-4
 - Endorsed the implementation of the **Multi-GNSS Demonstration Campaign** for the Asia region and encouraged participation by all Providers
 - Adopted the **Principle of Transparency**: every GNSS provider should publish documentation that describes the signal and system information, the policies of provision and the minimum levels of performance offered for its open services
- ICG-5
 - Recommendation encouraging ICG participants to contribute to the **Multi-GNSS Demonstration Campaign**
 - Continued Multilateral discussions on **GNSS Compatibility** through subgroup of the Working Group A
 - Recommendation to examine the potential for establishing a cooperative **global multi-constellation monitoring network** to support ARAIM



ICG-6 Outcomes

- The development of **Multi-GNSS monitoring** networks was a major topic of discussion
 - The Committee endorsed the IGS Multi-GNSS Experiment
 - A Subgroup of WG-A will be formed to collectively investigate international GNSS monitoring and assessment
- The Compatibility sub-group of WG-A, with participation from all interested system providers, will initiate discussions and **collaboration on Open Service GNSS performance parameters**, including definitions and calculation methods
- Templates describing geodetic and **timing references for all systems** have been completed and will be available on the ICG website
- **Interference Detection and Mitigation (IDM) Workshop** was approved by the committee



Active International GNSS Monitoring and Assessment

- Japan: Multi-GNSS Demonstration Campaign
- China: International GNSS Monitoring and Assessment System (iGMAS)
- International GNSS Service (IGS): Future plans for IGS network upgrades to include multi-GNSS receivers – in support of global monitoring and assessment
- Others (Stanford University, DLR, Information Analysis Center of Roscosmos, etc.): Achievements in GNSS signal monitoring and assessment



Recommendation from ICG-6

Recommendation 4.2: International GNSS Monitoring and Assessment

08 September 2011

Prepared by Working Group A

To monitor and assess GNSS open services worldwide, a subgroup of Working Group A, with participation from Working Group B and Working Group D should be formed to develop a proposal to optimize existing and planned capabilities, and identify additional activities necessary for international GNSS Monitoring and Assessment.

- The subgroup will be co-chaired by Japan, China and IGS



Objectives of ICG Recommendation on Multi-GNSS Monitoring

- Development and discussion of proposals to widely monitor the performance of open signals
- Provide timely updates to users regarding critical performance characteristics
 - Timing accuracy
 - Positioning accuracy
 - Service availability
- Cooperation in the development of ground infrastructure to monitor signal and service performance for open services



Summary

- ICG has met annually since 2006 with a continued focus on encouraging **compatibility and interoperability**
- ICG Working Group A has been specifically focused on pursuit of **complementary systems**
- Several important outcomes, related to **collaboration** among service providers, emerged from recent ICG meetings
- Specific recommendation on **International GNSS Monitoring and Assessment** was approved by the ICG in September 2011



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