The International Committee on Global Navigation Satellite Systems and its Programme on GNSS applications

Regional Workshop on GNSS and Space Weather 9 – 13 May 2022, Rabat, Morocco



Sharafat Gadimova Office for Outer Space Affairs



Global Navigation Satellite Systems (GNSS)

 A constellation of satellites providing signals from space that transmit positioning and timing data to GNSS receivers. The receivers then use this data to determine location

Global Constellations

- Global Positioning System (GPS, 24+3) of the United States,
- Global'naya Navigatsionnaya Sputnikovaya Sistema (GLONASS, 24+) of the Russian Federation,
- GALILEO (24+3) of the European Union, and
- BeiDou Navigation Satellite System (BDS, 27+3IGSO+5GEO) of China

Regional Constellations

- Indian Regional Navigation
 System/"Navigation with Indian
 constellation" (NavIC, 7) of India;
- The Quasi-Zenith Satellite System (QZSS, 4+3) of Japan.





International Committee on GNSS (ICG)

- Represents a unique combination of GNSS service providers and major user groups that seek to encourage interoperability and compatibility among the various satellite systems
- ICG Working Groups:
 - Systems, Signals and Services: Compatibility and spectrum protection; interoperability and service standards; system-of-system operations
 - Enhancement of GNSS Performance, New Services and Capabilities: Future & novel integrity solutions; implementation of interoperable GNSS SSV and its evolution; examination of performance of atmospheric models
 - Information Dissemination and Capacity Building: Focused on education and training programmes, promoting GNSS for scientific exploration
 - **Reference Frames, Timing and Applications:** Focused on monitoring and reference station networks
- Providers' Forum provides a venue for coordination and cooperation to improve overall service provision
- 15th Meeting of ICG, 27 September 1 October 2021, Vienna



Slide 2



ICG Working Groups: Space, Signals and Services

- Compatibility and Spectrum Subgroup
 - GNSS Interference Detection and Mitigation (IDM): With its proven benefits, GNSS
 has its vulnerabilities very low strength of GNSS signals received from satellites
 makes GNSS vulnerable to interference. The sources of GNSS vulnerabilities include
 unintentional interference, intentional interference, effects of the ionosphere, solar
 activity (space weather) and others

http://www.unoosa.org/oosa/en/ourwork/icg/working-groups/s/IDMIndex.html

- focusing on utilizing Automatic Dependent Surveillance Broadcast (ADS-B) and Automatic Identification System (AIS) for interference detection
- further investigate national processes for notification of interference testing
- discuss policy and technical measures regarding the resilient use of GNSS



ICG Working Groups: Space, Signals and Services

Interoperability and Service Provision Subgroup

An updated version 2.0 of the Performance Standard Guidelines document: <u>https://www.unoosa.org/oosa/en/ourwork/icg/working-groups/s/PSindex.html</u>

This document outlines guidance for creating open service performance standards for Global and Regional Navigation Satellite Systems (GNSS/RNSS). This service applies only to the signal in space and not to actual receiver, atmospheric, or local effects.

Precise Point Positioning (PPP) Interoperability task force

 Collecting information from service providers on the characteristics of their PPP services



ICG Working Groups: Enhancement of GNSS Performance, New Services and Capabilities

- Space User Subgroup
 - 2nd Edition of the Interoperable GNSS Space Service Volume
- This publication, and the work of WGB, show the significant value of GNSS SSV for a much wider scope of future space exploration activities for countries all over the world.
- GNSS SSV and its potential augmentations can enable ambitious future missions and activities in the context of space exploration going beyond low-Earth orbit to the Moon, Mars and other celestial bodies.

The Multi-GNSS Space Service Volume: Earth's Next Navigation Utility



Thoroughly reviewed and updated throughout:

- Latest GNSS constellation data
- Discussion and analysis of geometric aspects in SSV
- Addition of profiles of five real-world SSV and multi-GNSS missions

https://www.unoosa.org/res/oosadoc/data/documents/2021/stspace/stspace75re v 1 0 html/st space 75rev01E.pdf

Video (co-sponsored by NASA and National Coordination Office for PNT):

- conveys utility & benefits of a multi-GNSS SSV,
- describes its transformative use to navigate in space
- shows how it will impact humanity—in space and on Earth

https://www.unoosa.org/oosa/en/ourwork/icg/documents/videos.html

INTEROPERABLE SPACE SERVICE VOLUME SECOND EDITION



ICG Working Groups: Information Dissemination and Capacity Building



Regional Workshops/training courses on the use and applications of GNSS:

- To reinforce the exchange of information between countries and scale up the capacities in the regions for pursuing the application of GNSS solutions
- To provide updated knowledge of how GNSS operate and their applications; to describe the science of SW; and how to perform ionospheric and SW research with GNSS data
- A project team on "Space weather monitoring using low-cost GNSS receiver systems" that would develop prototype systems to explore the possibilities of using low-cost receiver systems for space weather monitoring.



ICG Working Groups: Reference Frames, Timing and Applications

Specific progress made:

- The refinement of the alignments of GNSS reference frame with the ITRF
- The information on the GNSS timing reference frames to the ITRF and the intercomparisons of GNSS time offsets
- In the provision of satellite properties by the GNSS providers in accordance with IGS' whitepaper "Satellite and Operations Information for Generation of Precise GNSS Orbit and Clock Products"
 - Access to satellite metadata is essential for enabling scientific applications and for high accuracy precise positioning
- By the BIPM towards implementation of "BIPM publication of [UTC GNSS times] and [UTC – UTC(k)_GNSS]"



ICG: Programme on GNSS applications

- Space Weather and GNSS (WGB&C): In cooperation with the Institute for Scientific Research at Boston College, the United States, and the Abdus Salam International Centre for Theoretical Physics, Italy:
 - Promotes the use of GNSS for scientific applications and space weather in developing countries
 - Increased number of students and young scientists studying and using GNSS, including increasing participation by women, and many opportunities for research (improved imaging of the ionosphere over the equatorial region, ionospheric effects on augmentation systems...)









Space Weather: A global challenge

- Space weather is increasingly becoming a central topic that requires:
- improved international coordination to respond to extreme space weather events, including an improved international data sharing





□Space weather research and collaboration may help to:

promote sustainable development through the prevention of catastrophic disruptions space critical infrastructure and space-based services



Information Centres for ICG

The Programme of Space Applications established regional centres (also acting as the ICG information centres) in each region covered by the United Nations Economic Commissions: Africa, Asia and the Pacific, Latin America and the Caribbean, and Western Asia





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Conclusion



The ICG is an important vehicle in the multi-lateral arena, as satellite-based positioning, navigation and timing becomes more and more a genuine multinational cooperative venture

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ICG-16 meeting, Abu Dhabi, UAE, 9 – 14 October 2022

hosted by the UAE Space Agency



THANK YOU



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