

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

**International Colloquium on Equatorial and Low Latitude Ionosphere  
18 – 23 September 2022, Abuja, Nigeria**



# GNSS: Global Navigation Satellite Systems

## *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
- 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

## **ICG Providers' Forum**

A venue for **coordination and cooperation** to improve overall service provision



## ICG: Providers' Forum

- Established in 2007, provides ways and means of promoting communication among system providers on key technical issues and operational concepts such as the GNSS ***spectrum protection, orbital debris, and orbit de-confliction***
- Agreement that all GNSS signals and services must be ***compatible*** and open signals and services should be ***interoperable*** to the maximum extent possible in order to maximize benefit to all GNSS users
- Consensus reached on ***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

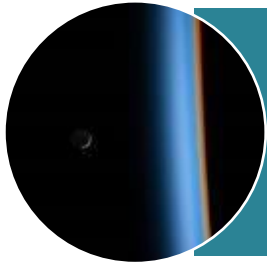


## ICG: International Committee on GNSS

- Established in 2005, 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 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**
- **UNOOSA** serves as the **Executive Secretariat** of ICG and its Providers' Forum
- Membership: 13 Members and 21 International Organizations
- *Open to all countries and entities that are either GNSS providers or users of GNSS services, and are interested and willing to actively be engaged in ICG work*



## UNOOSA: Supporting Member States



**Capacity Builder:** UNOOSA provides access to cutting edge space-data and information and builds capacity to use such data to accelerate sustainable development



**Convener:** UNOOSA facilitates international cooperation among UN Member States to develop new space policy



**Gateway:** UNOOSA - the sole UN agency dedicated to space affairs - coordinates UN activities using space-related technology to support sustainable development



## ICG: International Committee on GNSS

- ICG Working Groups:
  - **Systems, Signals and Services** (*USA and RF*): Compatibility and spectrum protection; interoperability and service standards; system-of-system operations
  - **Enhancement of GNSS Performance, New Services and Capabilities** (*India, China and ESA*): Future & novel integrity solutions; implementation of interoperable GNSS SSV and its evolution; examination of performance of atmospheric models
  - **Information Dissemination and Capacity Building** (*UNOOSA*): Focused on education and training programmes, promoting GNSS for scientific exploration
  - **Reference Frames, Timing and Applications** (*IAG, IGS and FIG*): Focused on monitoring and reference station networks
- 15<sup>th</sup> Meeting of ICG, 27 September – 1 October 2021, Vienna



## ICG WG S: 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 WG S: Space, Signals and Services

### ▪ **Interoperability and Service Provision Subgroup**

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

*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

### ▪ **Interoperable Time – Focus on System Time Offsets**





## ICG WG B: Enhancement of GNSS Performance, New Services and Capabilities

- Space User Subgroup
  - 2<sup>nd</sup> 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:

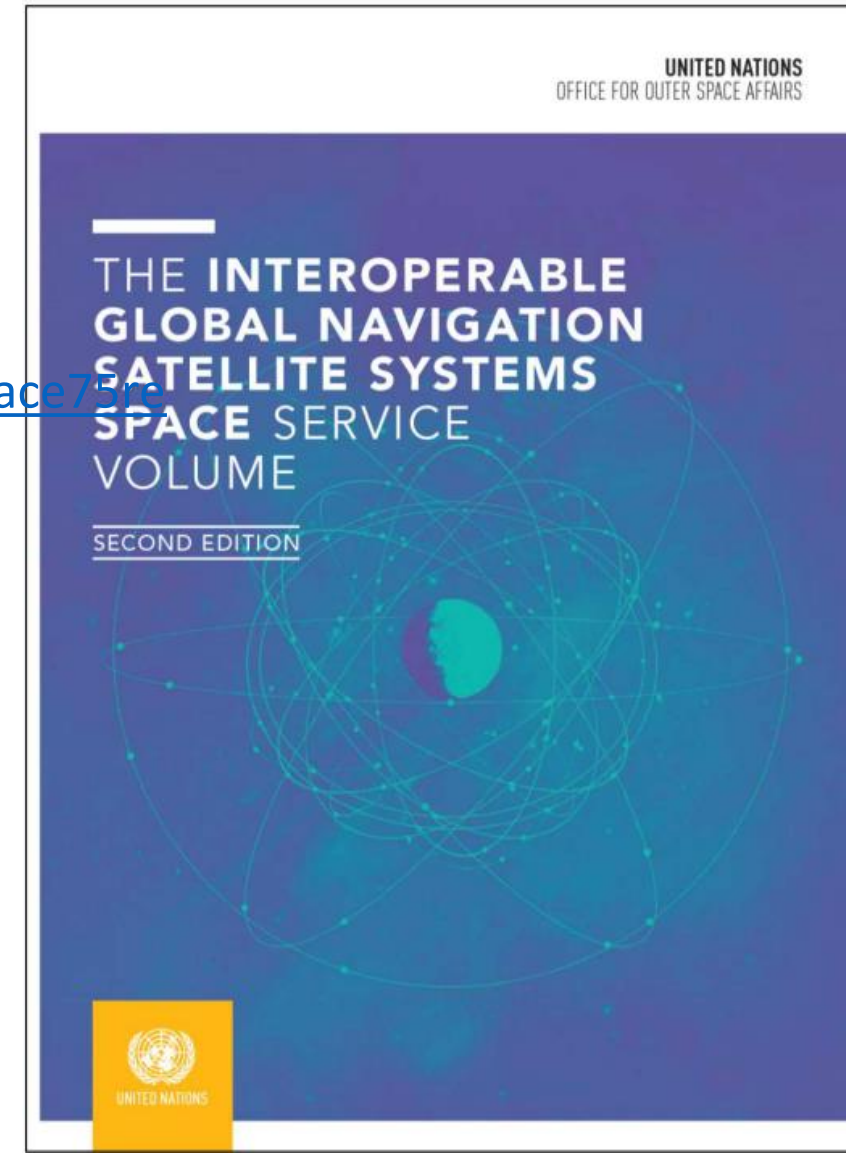
- Latest GNSS constellation data
- Discussion and analysis of geometric aspects in SSV
- Addition of profiles of five real-world SSV and multi-GNSS missions

<https://www.unoosa.org/res/oosadoc/data/documents/2021/stspace/stspace75rev01E.pdf>

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

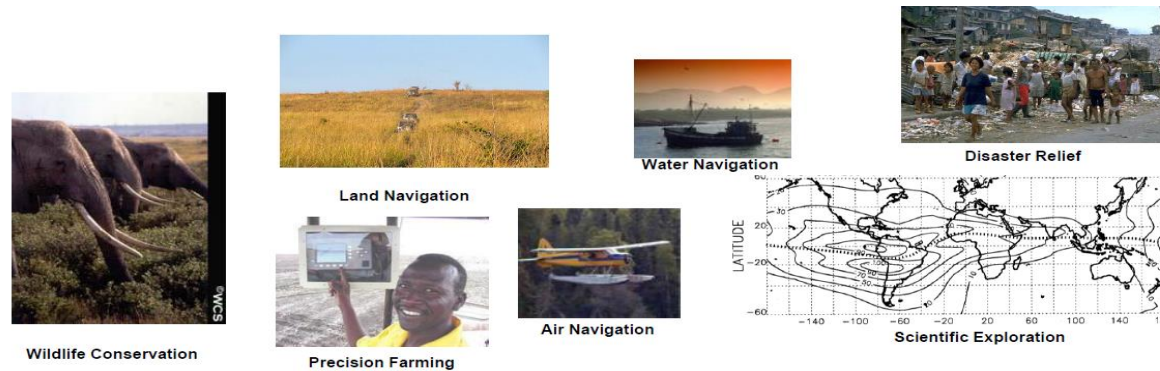
- conveys utility & benefits of a multi-GNSS SSV,
- describes its transformative use to navigate in space
- shows how it will impact humanity—in space and on Earth

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





## ICG WG C: 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
- to provide information on the importance of planning and its link to the “why, what and how” of developing long-term capability with respect to GNSS and geospatial infrastructure and related activities



## ICG WG C: Information Dissemination and Capacity Building

- to prepare a ***handbook on high-accuracy GNSS data processing***, summarizing data processing techniques, error analysis and various concepts relating to the set-up of base stations, rover units and software
- 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
- **Expert meeting on GNSS , Vienna, 5 – 9 December 2022**
  - ICG’s role in GNSS spectrum protection and interference detection and mitigation
  - Provide updated knowledge of how GNSS operate and their applications



## ICG WG D: Reference Frames, Timing and Applications

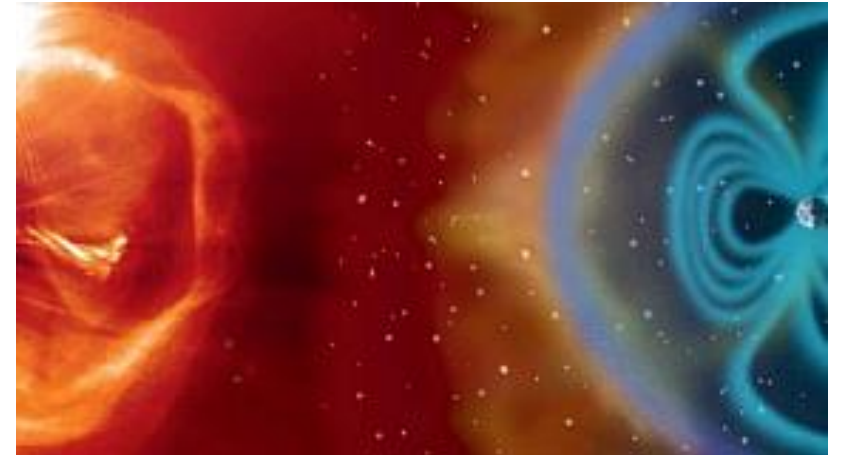
- The refinement of the alignments of GNSS reference frame with the ITRF
- The information on the GNSS timing reference frames to the ITRF and the inter-comparisons of GNSS time offsets
- In the provision of satellite properties by GNSS providers in accordance with IGS' whitepaper "Satellite and Operations 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]"



## 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



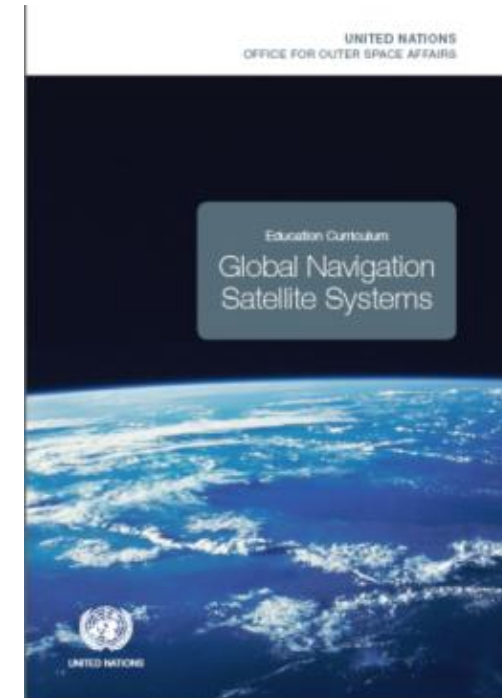
❑ Space weather research and collaboration may help to: promote sustainable development through the prevention of catastrophic disruptions space critical infrastructure and space-based services





## 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





UNITED NATIONS  
Office for Outer Space Affairs



ICG-16

9 – 14 October 2022

Abu Dhabi, United Arab Emirates

[WWW.UNOOSA.ORG](http://WWW.UNOOSA.ORG)

[WWW.UNOOSA.ORG/OOSA/EN/OURWORK/ICG/ICG.HTML](http://WWW.UNOOSA.ORG/OOSA/EN/OURWORK/ICG/ICG.HTML)



# THANK YOU



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