UNITED NATIONS
Office for Outer Space Affairs

INFORMATION NOTE

United Nations/Mongolia Workshop on the Applications of Global Navigation Satellite Systems (HYBRID FORMAT)

Organized jointly by
The United Nations Office for Outer Space Affairs and
The Mongolian Geospatial Association

Co-organized and co-sponsored by
The International Committee on Global Navigation Satellite Systems and
The Agency for Land Administration and Management, Geodesy and Cartography of the Government of Mongolia

Hosted by
The Mongolian Geospatial Association

Supported by
The Institute of Astronomy and Geophysics and the Institute of Geography and Geo-ecology of the Mongolian Academy of Sciences

Ulaanbaatar, Mongolia

25 – 29 October 2021

1. Introduction

Global navigation satellite system (GNSS) is a general term describing any satellite constellation that provides positioning, navigation, and timing (PNT) services on a global or regional basis. Current global systems include the Global Positioning System (GPS) of the United States, the Global Navigation Satellite System (GLONASS) of the Russian Federation, the European Satellite Navigation System (Galileo) of the European Union and the BeiDou Navigation Satellite System (BDS) of China. At the regional level, the Indian Regional Navigation Satellite System, known as "Navigation with Indian Constellations" (NavIC) of India and the Quasi-Zenith Satellite System (QZSS) of Japan, together with several regional augmentation systems, are also available.

The availability of GNSS and other space-based systems is creating an unprecedented opportunity, bringing benefits in the areas of emergency management, marine and land monitoring or fleet control to name a few. Due to this availability, the development of integrated applications is an area in rapid

expansion. To address a wide array of GNSS applications for socioeconomic benefits and to focus on initiating pilot projects and strengthening the networking of GNSS-related institutions in the region, **a five-day Workshop will be held in hybrid format in Ulaanbaatar from 25 to 29 October 2021**.

This workshop is being organized by the United Nations Office for Outer Space Affairs in cooperation with the Mongolian Geospatial Association and the Agency for Land Administration and Management, geodesy and Cartography of the Government of Mongolia as part of the activities of the United Nations Programme on Space Applications and the Programme on GNSS applications of the International Committee on GNSS (ICG). The workshop will be hosted by the Mongolian Geospatial Association and supported by the Institute of Astronomy and Geophysics, and the Institute of Geography and Geo-ecology of the Mongolian Academy of Sciences. The workshop is co-sponsored by ICG.

2. Background

The Office for Outer Space Affairs is the United Nations Office responsible for promoting international cooperation in the peaceful uses of outer space and, among other responsibilities, is the Executive Secretariat of ICG and its Providers Forum. Detailed information is available at the website (www.unoosa.org)

ICG was established in 2005 under the umbrella of the United Nations to encourage and facilitate compatibility, interoperability and transparency between all satellite navigation systems, to promote and protect the use of their open service applications and thus, benefit the global community while increasing their use to support sustainable development, particularly in the developing nations. ICG also serves to assist GNSS users with their development plans and applications, by encouraging coordination and serving as a focal point for information exchange. Detailed information is available via the ICG information portal at the website of the Office for Outer Space Affairs (http://www.unoosa.org/oosa/en/ourwork/icg/icg.html).

The Office for Outer Space Affairs, in its capacity as the Executive Secretariat of ICG and its Providers' Forum, is promoting the use of GNSS throughout its programme on GNSS applications and related capacity building activities. In particular, support is provided to the regional centres for space science and technology education affiliated to the United Nations, which also act as information centres for ICG. The ICG information centres are working towards the establishment of a network of institutions involved or interested in GNSS. They are also identifying new applications that could be developed in the regions based on GNSS services. The centres coordinate their activities closely with ICG and its Providers' Forum through the ICG Executive Secretariat. The detailed information is available at the website of the Office for Outer Space Affairs (http://www.unoosa.org/oosa/en/ourwork/psa/regional-centres/index.html).

At the regional level (Africa, Latin America and the Caribbean, West Asia, Europe, and Asia and the Pacific), applications of GNSS technologies are increasingly being used in geo-information applications, services and products. With the increased use and application of GNSS and the requirement to relate GNSS solutions to existing mapping products based on local and national coordinates reference systems, there is an urgent need to establish and determine transformation data to and from such systems to GNSS reference systems. This will be achieved by the full realization of the regional reference frames known as the African Geodetic Frame (for Africa), the Geocentric Reference System for the Americas (for Latin America and the Caribbean), the IAG Reference Frame Sub-Commission for Europe (EUREF) and the European Position Determination System (EUPOS) (for Europe), and Asia-Pacific Reference Frame (for Asia and the Pacific). The Executive Secretariat of ICG is utilizing those regional reference frames as the second-tier cooperation partners in the implementation of the ICG workplan at the regional level. The detailed information is available at the website (http://www.unoosa.org/oosa/en/ourwork/icg/resources/Regl-ref.html).

As society becomes increasingly dependent on space-based systems, it is vital to understand how space weather, caused by solar variability, could affect, among other things, space systems and human space flight, electric power transmission, high-frequency radiocommunications, GNSS signals, as well as the

well-being of passengers in high altitude aircraft. For GNSS users, space weather is the single largest contributor to the single frequency GPS error budget, and a significant factor for differential GNSS users. As more and more nations of the world are becoming dependent on GNSS systems and signals, it is increasingly important to inform and educate users about the threat of space weather on GNSS. Additional information is available on the website of the International Space Weather Initiative (ISWI) (www.iswi-secretariat.org).

3. Objectives and Expected Outcomes

The main objective of the workshop is to reinforce the exchange of information between countries and scale up the capacities in the region pursuing the application of GNSS technology solutions.

The specific objectives of the workshop are:

- to introduce GNSS and its applications to transport and communications, aviation, surveying, mapping and Earth science, management of natural resources, the environment and disasters, precision agriculture; high precision mobile application, as well as space weather effects on GNSS and dual-frequency receivers;
- to promote greater exchange of actual experiences with specific applications;
- to focus on appropriate GNSS applications projects at national and/or regional levels;
- to encourage greater cooperation in developing partnerships and GNSS networks, in the framework of the regional reference frames; and
- to define recommendations and findings to be forwarded as a contribution to the Office for Outer Space Affairs and ICG, particularly, in forging partnerships to strengthen and deliver capacity-building on satellite navigation science and technology.

The expected outcomes of the workshop are:

- recommendations and findings on discussed topics to be adopted by the workshop participants;
- preliminary agreement of cooperation between countries in the region and the GNSS continuously operating reference station (CORS) networks;
- training courses on GNSS and space weather to be conducted;
- action plan addressing identified issues/concerns.

The discussions at the workshop will also be linked to the 2030 Agenda for Sustainable Development and to its targets set out for Sustainable Development Goals, such as,

- *SDG3*: *Good health and wellbeing* - GNSS positioning enables individual patients, staff or equipment to be monitored, and response teams directed more efficiently;
- *SDG 7: Affordable and clean energy* - GNSS reflectometry techniques can produce scatterometry models to assist in the optimum positioning of off-shore wind farms;
- *SDG 9: Industry, Innovation and Infrastructure* - GNSS signals can be used for navigation and positioning of in-orbit space operations particularly from low-Earth orbit to cis-Lunar); and
- *SDG 11*: *Sustainable Cities and Communities* - GNSS is widely used for urban planning in order to pinpoint structures and reference points for cadastral and urban planning purposes.

4. Preliminary programme of the workshop

The workshop programme will include plenary sessions and sufficient time for discussions among participants to identify the priority areas where pilot projects should be launched and examine possible partnerships that could be established. A half-day technical tour will be arranged by the Local Organizing Committee during the workshop. As a preliminary suggestion the following sessions will be organised:

Thematic Sessions

Session 1: Current and planned GNSS and satellite-based augmentation systems

- Programme updates on GNSS and satellite-based augmentation systems: Global Positioning System (GPS) and Wide-Area Augmentation System (WAAS), GLObal NAvigation Satellite System (GLONASS) and System of Differential Correction and Monitoring (SDCM), European Satellite Navigation System (GALILEO) and the European Geostationary Navigation Overlay Service (EGNOS), BeiDou Navigation Satellite System (BDS), Indian Regional Navigation System (NAVIC) and GPS Aided Geo-Augmented Navigation (GAGAN), and Quasi-Zenith Satellite System (QZSS).

Session 2: GNSS-based applications focusing on, but not limited to

- Advances and performance benefits due to multi-sensor integration of GNSS applications in surveying and geodesy;
- The use of GNSS for aviation, including integration of satellite navigation technology into air traffic management and airport surface navigation and guidance;
- The use of navigation and timing systems for road, rail, and engineering applications, including vehicle guidance, geographic information system (GIS) mapping, and precision farming;
- Navigation systems operation in marine environment, including waterway navigation, harbour entrance/approach, marine archaeology, fishing, and recreation;
- Commercial applications of GNSS;
- The use of GNSS signals for navigation and positioning of in-orbit space operations, particularly from low-Earth orbit to cis-Lunar.

Session 3: GNSS spectrum protection and interference detection and mitigation

- ICG activities and its role in spectrum protection and interference detection and mitigation

Session 4: GNSS and space/atmospheric weather monitoring

- Atmospheric monitoring (troposphere) to improve numerical weather predictions
- Space weather monitoring (ionosphere) for space situation awareness

Session 5: GNSS reference frames/systems and reference station networks

- Programme updates on regional and national reference frames/systems and perspectives for a regional cooperative mechanism
- International GNSS Service (IGS) and other initiatives, CORS network and multi-GNSS environment

Session 6: Capacity building, training and education in the field of GNSS

- GNSS education opportunities at different levels/needs
- The strengthening of a specialized master's programmes for long-term professional education and support to PhD training and networking in GNSS
- GNSS education tools/open source software

Discussion Sessions

- Issues, concerns and approaches for pilot projects/initiatives, requirements of implementing, mechanisms and resources of implementing
- Possible follow-up projects and initiatives and proposals for future workshops/training courses/technical seminars

Technical Tour

- Visit the AstroPark: https://iag.mn/en/index.php?pid=97

5. Working methods

Participants of the workshop are requested to deliver a presentation paper and materials covering information on the use of GNSS technology, case studies/projects in GNSS applications in their respective countries. Each speaker is allocated 20 minutes for the presentation. It is also necessary to submit an abstract of presentation with a maximum of 600 words including the following details: *Paper Title, Author (s) Name(s), Affiliation(s), and e-mail address* for the presenting author. **Applicants are requested to *use* the *template* to present an *abstract* in the required format.**

Presentations made at the workshop will be published on the website of the Office for Outer Space Affairs (www.unoosa.org) approximately two weeks after the workshop.

6. Sponsorship of the workshop

The United Nations Office for Outer Space Affairs and the Mongolian Geospatial Association are responsible for organizing the workshop. ICG is a co-sponsor of the workshop. **Sponsorship of the workshop is still open to interested entities.**

7. Expected participants

The workshop is being planned for a total of 75 participants including scientists, engineers, university educators, and policy-and-decision makers and senior experts from the following groups: international, regional, national and local institutions, United Nations agencies, intergovernmental and non-governmental organizations, research and development institutions, and also from industry.

8. Participation requirements

Participants should be in senior managerial or decision-making responsibility at governmental agencies, national and regional institutions, intergovernmental and non-governmental organizations or industry.

The Office for Outer Space Affairs is committed to achieving 50/50 gender balance in its programs and ensuring a balanced representation from different perspectives. ***Women are encouraged to apply***.

9. Language of the workshop

The working language of the workshop will be English.

10. Financial support

Within the limited financial resources available, a limited number of selected participants will be offered financial support to attend the workshop. This financial support will defray the cost of travel (a round trip airticket – most economic fare – between the airport of international departure in their home country and Ulaanbaatar, Mongolia) and/or the room and board expenses for the duration of the workshop. The co-

sponsors of the workshop will jointly select participants on a competitive basis. Successful applicants will be notified of the outcome within two weeks after the deadline.

11. Deadline for submission of applications and abstracts

The completed application form together with the presentation abstract should be submitted on-line, to the Office for Outer Space Affairs, **no later than Sunday, 27 June 2021.** Only complete applications with all the requested information and signatures will be considered by the workshop organizing committee. Please note that on-line application form is available on the web site of the Office for Outer Space Affairs at the following address: https://forms.office.com/Pages/ResponsePage.aspx?id=2zWeD09UYE-9zF6kFubccAiOPlMdD9xBh9lcdTTfu19UNTNOMVRIMVIxUjg5RkFNUExVQVdYU0E4NC4u

12. Life and health insurance

Life/major health insurance for each of the selected participants is necessary and **is the responsibility of the candidate or his/her institution or Government.** The co-sponsors will not assume any responsibility for life and major health insurance, nor for expenses related to medical treatment or accidents.

13. Further information and contact details

For information regarding the submission of nominations for attendance and funding, please contact Mr. Patrick GINDLER, United Nations Office for Outer Space Affairs, at the following e-mail address: (patrick.gindler@un.org).

For information regarding the workshop programme, please contact Ms. Sharafat GADIMOVA, United Nations Office for Outer Space Affairs, at: (sharafat.gadimova@un.org).

The focal point for Mongolia, Ms. Terbish OTGONJARGAL, Chair, the Local Organizing Committee, Mongolian Geospatial Association, can be contacted at: (otgonjargal@geomedeelel.mn or info@geomedeelel.mn).