United Nations/Mongolia Workshop on
the Applications of Global Navigation Satellite Systems

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

Co-organized 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

Ulaanbaatar, Mongolia, 25 - 29 October 2021

PROGRAMME

Supported by
**The Institute of Astronomy and Geophysics of the Mongolian Academy of Sciences and
The Institute of Geography and Geo-ecology of the Mongolian Academy of Science**
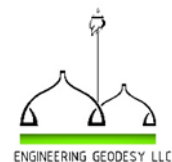
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Time: Ulaanbaatar time (UTC+8 hours)	
Monday, 25 October 2021	
13:30 - 14:00	**Opening and Welcome Remarks** *Moderator: Dr. B. BAYARTUNGALAG, Mongolian Geospatial Association, Mongolia*
	N. ANKHBAYAR, State Secretary of Foreign Affairs of Mongolian Government, Mongolia
	M. BUYANDELGER, *General Deputy of the Agency of the Land Management, Geodesy and Cartography, Mongolia*
	Major-General J. GURRAGCHAA, *Cosmonaut*
	Dr. M. SAANDARI, *MonMap LLC.*
	Sharafat GADIMOVA, *United Nations Office for Outer Space Affairs (UNOOSA)*
14:00 – 16:40	**Session 1 - GNSS Update and GNSS-based applications** *Moderator: Sharafat GADIMOVA, UNOOSA*
14:00	Galileo, the European GNSS System, *Dominic HAYES, European Commission*
14:20	(*pre-recorded*) Global Navigation Satellite System (GLONASS) Status and Prospects of Development, *Ivan REVNIVYKH, Russian Federation*
14:40	(*pre-recorded*) Global Positioning System (GPS) Status, *Jeffrey AUERBACH, United States*
15:00	Development of BeiDou Navigation Satellite System (BDS), *Gucang CHEN, China*
15:20	EGNOS Performance in Algeria: Real and Simulation Studies, *Lahouaria TABTI, Algeria*
15:40	Application of BeiDou/GNSS System in Spacecraft Autonomous Navigation, *Shuangna ZHANG, China*
16:00	Adoption of SBAS Technology in Aviation Sector at Continental Level of Africa, *Lasisi Salami LAWAL, Nigeria*
16:20	GNSS Network Development in Mongolia, *D. MUNKHTSETSEG, Mongolia*
16:40 – 16:50	*Coffee Break*
16:50 – 18:30	**Session 2 – Space Weather** *Moderator: Sharafat GADIMOVA, UNOOSA*
16:50	Space Weather Science and GNSS System, *Bin WANG, China*

17:10	Ionosphere TEC Anomalies over Mongolia as Detected by GPS Observations, *Sh. AMARJARGDAL, Mongolia*
17:30	Tropospheric Delay Models Analysis for NavIC, *Shweta SHAH, India*
17:50	Multi-scale Size Ionospheric Irregularities Impacting Signal-in-Space Performance of Satellite-based Communication and Navigation Links, *Ashik PAUL, India*
18:10	Empirical Orthogonal Function Modelling of GPS TEC over Nepal Region and Comparison with the Global GIM and IRI- Predicted TEC Values, *Afsheen AMEER, Pakistan*
18:30	*Adjourn*
Tuesday, 26 October 2021	
14:00 – 16:00	**Session 3 - Seminar on GNSS Spectrum Protection and Interference Detection and Mitigation** *Moderators: Dominic HAYES and Jeffrey AUERBACH, ICG Working Group S*
	The purpose of the seminar is to highlight the importance of GNSS spectrum protection at the national level and to explain how to reap the benefits of GNSS. Discussions between the ICG experts presenting the material and the workshop participants will also be held.
	▪ Introduction and Overview ▪ Introduction to GNSS ▪ Spectrum Management
16:00 – 16:20	*Coffee Break*
16:20 – 18:40	**Session 4 – High Precision GNSS Positioning** *Moderator: Sharafat GADIMOVA, UNOOSA*
16:20	A Risk Assessment of Geomagnetic Conditions Impact on GPS Positioning Accuracy Degradation in Tropical Regions Using DST Index, *Nenad SIKIRICA, Croatia*
16:40	Low-Cost High-Accuracy GNSS Receiver System based on QZSS MADOCA Signal, *Dinesh MANANDHAR, Japan*
17:00	GNSS CORS Network and Application in Mongolia, *B. MUNKHSAIKHAN, Mongolia*
17:20	High Precision GNSS Application in Mongolia Mining, *Haiming PENG, China*
17:40	Environment-adaptive GNSS position estimation deployed in distributed GNSS software-defined radio receiver, *Renato FILJAR, Croatia*
18:00	SDR- based GNSS Acquisition Techniques, *Prateek SINGH, India*

18:20	Geodynamic study in Mongolia based on GNSS, *D. ERDENEZUL, Mongolia*
18:40	*Adjourn*

Wednesday, 27 October 2021	
14:00 – 17:00	**Session 5 - Seminar on GNSS Spectrum Protection and Interference Detection and Mitigation (continues)** *Moderators: Dominic HAYES and Jeffrey AUERBACH, ICG Working Group S*
	- Spectrum Protection - Interference Detection and Mitigation - Summary and Interactive discussions
17:00 – 17:20	*Coffee Break*
17:20 – 19:00	**Session 6 – Timing, Frequency and Applications** *Moderator: Otgonjargal TERBISH, Mongolia*
17:20	GNSS Time and Frequency Transfer and Applications, *Thayathip THONGTAN, Thailand*
17:40	Radio Frequency Regulation and Monitoring in Mongolia, *T. NARANMANDAKH, Mongolia*
18:00	FPGA Implementation of a NavIC Disciplined 10MHz Reference for SATCOM Networks, *Kriti KHATRI, India*
18:20	The Use of Space-based Systems and Equipment in Air Navigation Services of Mongolia, *B. BOLDBAYAR, Mongolia*
18:40	Applications of BeiDou System in Transportation, *Song ZHEN, China*
19:00	*Adjourn*

Thursday, 28 October 2021	
14:00 – 16:00	**Session 7 - Geodetic Reference Networks** *Moderator: Lkhamjav OCHIRKHUYAG, Mongolia*
14:00	Using the Method of Trilateration for Uzbekistan Tectonics, *Vazira MAKHAMATOVA, Uzbekistan*
14:20	A GNSS Processing Approach to Establish a Large Geodetic Network (RGSH2020) for Petroleum Applications, *Hicham DEKKICHE, Algeria*
14:40	Review of Continuously Operating Reference Stations Activities in India: Way Forward, *Subhalakshmi KRISHNAMOORTHY, India*

15:00	Application of GNSS for Forest Surveying and Mapping in Indonesia, *Emba Tampang ALLO, Indonesia*
15:20 – 16:00	Q&A
16:00 – 16:20	*Coffee Break*
16:20 – 18:20	**Session 8 – GNSS applications: National Programmes and Projects** *Moderator: Otgonjargal TERBISH, Mongolia*
16:20	Construction of An Integrated Intelligent Supervision Platform for Mongolian Mining Based on BeiDou Short Messages, *Xu LI, China*
16:40	BeiDou International Application – Dam Deformation Monitoring in Salez Lake, *Rui TU, China*
17:00	Employment and Use of GNSS in the Republic of Cuba, *Rebeca Parada BENAVENTE, Cuba*
17:20	The GNSS Landscape in Pakistan, *Amer Sarfraz AHMAD, Pakistan*
17:40	Update of DBS/GNSS International Education and Capacity Building in RCSSTEAP, *Jingnong WENG, China*
18:00	The Use of GNSS System in the Geodesy Management of the National Registry, *Antonia LÓPEZ, El Salvador*
18:20 – 19:00	**Discussion Session: Capacity Building and Information Dissemination** *Moderator: Sharafat GADIMOVA, UNOOSA*
	▪ Promoting the use of global navigation satellite system technologies as tools for scientific applications: (i) Reference Frames and Timing; and (ii) Space Weather and GNSS (*pre-recorded*) A Geodesy and Positioning Thematic Layer – Identifying tools to connect the GGRF and the United Nations GGIM Integrated Geospatial Information Framework (IGIF), *Alison CRADDOCK, United States, Graeme BLICK, New Zealand, Ryan KEENAN, Australia, Mikael LILJE, Sweden and Robert SARIB, Australia* ▪ Information dissemination through the information centres hosted by the regional centres for space science and technology education, affiliated to the United Nations
19:00	*Adjourn*
Friday, 29 October 2021	
14:00 – 16:00	**Session 9 – GNSS-applications: Case Studies**

	Moderator: Sharafat GADIMOVA, UNOOSA
14:00	iMap with Navigation System, *A. BATTAMIR, Mongolia*
14:20	Education and Research Activities Related to GNSS Performed in the Graduate Program in Engineering at INPE, *Antonio BETRACHINI, Brazil*
14:40	Compact GNSS Modules for GNSS Research and Training, *Somnath MAHATO, India*
15:00	Application of Beidou in Precision Agriculture, *Caicong WU, China*
15:20	Assessment of the GPS receiver in the Venezuelan Remote Sensing Satellite to Get Radio Occultation Information, *Francisco Varela MUZZATI, Venezuela*
15:40	Navigation GNSS Surveying Introduction, *L. BAT-ERDENE, Mongolia and Chuck CHEN, China*
16:00 – 16:20	*Coffee Break*
16:20 – 18:00	**Session 10 - GNSS Applications: Reports from the ICG Working Group B, Application Subgroup** *Moderator: Izumi MIKAMI and Jun SHEN, ICG Working Group B Applications Subgroup*
16:20	Introduction of Application Subgroup Activity and Goal, *Izumi MIKAMI, Japan*
16:30	GNSS Quality Control for ITS Applications, *Rui SUN, China*
16:50	Application Status of Quasi-Zenith Satellite System in Japan, *YASUSHI Sakurai, Japan*
17:10	EUSPA Enabling GNSS Applications and Monitoring the market and User Technology, *Marketa GLADYSEV, European Union*
17:30	High-precision BDS/GNSS Applications: A UniStrong Approach, *Jun SHEN, China*
17:50	GNSS Signal Authentication Applications, *Nishkam JAIN and Hem Raj SHAU, India*
18:10 – 18:30	**Concluding Remarks** ▪ *Sharafat GADIMOVA, United Nations Office for Outer Space Affairs* ▪ *B. BAYARTUNGALAG, Mongolian Geo-Spatial Association and Institute of Geography and Geo-ecology, MAS, Mongolia*