

Report of Working Group C: Information Dissemination and Capacity Building

1. The Working Group C on Information Dissemination and Capacity Building (WGC) held its tenth meeting in Sochi, Russian Federation, on 8, 9 and 10 November 2016 in conjunction with the eleventh meeting of the International Committee on Global Navigation Satellite Systems (ICG), 6 – 11 November 2016 under the chairmanship of the United Nations Office for Outer Space Affairs and the Russian Federation.
2. The meeting was attended by representatives of China, Italy, Russian Federation and the United Arab Emirates. The representatives of Civil Global Positioning System (GPS) Service Interface Committee (CGSIC) and the International Union of Radio Science (URSI) also participated in the meeting.
3. After introductory remarks focused on the expectations of the meeting, the Working Group reviewed and adopted its agenda. The Working Group considered the following items:
 - (a) Training for capacity building in developing countries;
 - (b) Promoting the use of global navigation satellite systems (GNSS) technologies as tools for scientific applications and space weather;
 - (c) Regional workshops on applications of GNSS;
 - (d) Information dissemination;
 - (e) Review of workplan actions and discussions on the way forward.

A. Training for capacity building in developing countries

4. Four presentations on GNSS education and training highlighted the available capacity building opportunities supported by national and international institutions.
5. The presentation “GNSS education and training progress in 2016” by *D. Yang and Y. Guo of Beihang University, Regional Center for Space Science and Technology Education in Asia and the Pacific (China), BeiDou International Exchange and Training Centre, China*, covered education and training programmes in the fields of remote sensing and geographic information systems (GIS), GNSS, Space Law and Policy. Fundamentals and details of the master’s and doctoral degrees courses on navigation technologies and applications were highlighted.
6. The presentation “GLONASS Training Course in the African Regional Centre, CRASTE-LF, Rabat, Morocco” by *D. MARESKUL, JSC Academician M.F. Reshetnev Information Satellite Systems, Russian Federation*, emphasized that it was important to advance the GLONASS technologies and share the Russian experience with other countries taking into account that GLONASS was the key part of the multi-GNSS.
7. The following two presentations “GNSS informing and learning updates from Russian Federation” by *P. KAZAKOV, Russian Space Systems Corporation, Andrey KUPRIYANOV, Moscow State University Geodesy and Cartography, Russian Federation* and “The teaching of students in the course of management within the agricultural enterprise during real time with the appliance of GNSS” by *E. SHULGA, A. KUPRIYANOV, V. HLUSTOV, V.*

BALABANOV, A. ZEILIGER, Russian State Agrarian University, Moscow Timiryazev Agricultural Academy, Moscow State University Geodesy and Cartography, Russian Federation, covered the education experience on GLONASS/GNSS technologies and system applications, and a monograph on the management of the agricultural enterprise with the appliance of space navigation means, in particular, GLONASS and distance zoned probes of the Earth.

8. In discussions, it was highlighted that the partnership of leading institutions in education and research in positioning and navigation would provide developing countries with access to a high level of expertise and a unique view on the roles and strengths of the various navigation programmes and research activities.

B. Promoting the use of GNSS technologies as tools for scientific applications and space weather

9. The presentation “Space Weather” by *P. DOHERTY, Boston College, United States*, was about the joint programme between Boston College, United States and the International Centre for Theoretical Physics (ICTP), Trieste, Italy. The programme promoted the use of GNSS for scientific applications and space weather in developing countries, in particular building a knowledgeable GNSS African workforce. This programme also encouraged the use of GNSS for societal and economic development and scientific exploration. A brief overview of the International Space Weather Initiative (ISWI) was given. The goal of ISWI was to develop the scientific insight necessary to understand the science, and to reconstruct and forecast near-Earth space weather. This included instrumentation, data analysis, modelling, education, training and public outreach.
10. The following presentation “Promote the interaction and communication between ICG and global navigation research community” by *H. WU, Academy of Opto-Electronics, Chinese Academy of Sciences, China*, highlighted the prospects and challenges of the GNSS academic exchange programmes.
11. During this session, the discussions focused on the enhancement of the cooperation with the institutions that host the largest technical meetings/conferences and showcase of GNSS technology, products and services, such as the Institute of Navigation (ION) GNSS+, China Satellite Navigation Conference (CSNC) etc.
12. In principle, the Working Group agreed with the draft recommendation prepared by the representative of China. However, it was clarified that draft recommendation was still subject of debate in the Working Group. A feedback by the referenced institutions could be considered at the next meeting of the Working Group.

C. Regional workshops on applications of GNSS

13. A brief overview of the activities to be carried out by the Office for Outer Space Affairs in 2017 in the framework of its Programme on Global Navigation Satellite Systems (GNSS) Applications was provided.

D. Information dissemination

14. Four presentations were made during the final session. A description of “GLONASS User Support Center of ROSCOSMOS by T. MIRGORODSKAYA, Information and Analysis Center for Positioning, Navigation and Timing, Russian Federation was given. User Information Support System (www.glonass-iac.ru) Web Portal and Mobile Instrumentation and Diagnostics Laboratory (MIDL) were highlighted.
15. It was noted that in the future, including Beidou and Galileo into the product line of User Information Support System would expand information product line, and modernization of MIDL would include interference detection capabilities, 3D terrain imaging and others.
16. The presentation “Beyond Project: GNSS Performance Assessment and Data Recording Guidelines in Aviation” by P. VANNI, ENAV and R. RONCHINI, Telespazio, Italy, provided an overview of the BEYOND (Building EGNSS Capacity On EU & Neighbouring multimodal Domains) project. The project was a part of the European H2020 framework of projects funded by the European Commission, managed by the European GNSS Agency (GSA) and led by the European Satellites Service Provider (ESSP), the EGNOS Service Provider. It was highlighted that a Performance Monitoring Methodology had been used to support the ICAO KPIs verification & validation and proved their implementation feasibility. The Methodology was built around the ICAO KPIs Validation Test-Bed (IKVT) developed by Telespazio for their calculation and the verification of the related requirements.
17. The Working Group took note of a textbook (Global Positioning System: Signals, Measurements and Performance (Second Edition) by Pratar Misra and Per Enge) that was distributed for use by the ICG Information Centres (Regional Centers for Space Science and Technology Education, affiliated to the United Nations). A brief overview of the book was provided by R. HAMILTON, Executive Secretariat, Civil GPS Service Interface Committee (CGSIC).
18. The following presentation was about “The status of NAVIPEDIA” by R. L. RODRIGUEZ, European Space Agency. The Working Group recalled that in line with the ICG-7 (2012, China) recommendation on NAVIPEDIA (www.navipedia.org), ESA had been maintaining and developing further NAVIPEDIA with up-to-date information.
19. It was noted that NAVIPEDIA was extensively used by universities and Galileo application developers. An APP version of NAVIPEDIA (for both Android and iOS operational systems) was currently under development and expected to be ready by the end of 2016.
20. At the conclusion of the presentations, the Working Group reviewed past recommendations and took note of a summary of the implementation status of recommendations from nine reports of the Working Group C meetings held from 2007 through 2015. The Working Group was also informed that the report should be used by members of the ICG, and that it could be made available at the ICG information portal.
21. The recommendations, which emanated from the deliberations of the Working Group meeting, are listed in Attachment 1 of this report.

ATTACHMENT 1**Recommendation 1 for Committee Decision**

Prepared by: Working Group C

Date of Submission: 10 November 2016

Issue Title: **Training for Capacity Building and Information dissemination**

Background/Brief Description of the Issue:

Specialists representing Russian space industry and higher educational institutes organized the training course on GLONASS/GNSS.

GLONASS – is the key part of the multi-GNSS, therefore it is important to advance the GLONASS technologies and share the Russian experience with other countries.

Joint Stock Company "Russian Space Systems" and the Moscow State University of Geodesy and Cartography are working actively to inform users about the GLONASS-GNSS technologies and their applications through the training courses/workshops/seminars.

Discussion/Analyses:

It is proposed to highlight an experience of Russian Space Systems and Moscow State University of Geodesy and Cartography and inform the interested universities, information and education centers about the educational GNSS activities in Russian Federation.

Recommendation for Committee Action:

Working group C noted the experience of Russian Space Systems company and Moscow State University of Geodesy and Cartography in informing users on the GLONASS-GNSS technologies and recommends that the ICG Information Centres and other organizations use the educational potential of these entities.

Working Group C recognizes the experience of the Timiryazev Academy and Moscow State University of Geodesy and Cartography in precision agriculture and appreciates the benefit of the monograph "The management of the agricultural enterprise with the appliance of space navigation means (GLONASS) and distance zoned probes of the Earth" to be used in the ICG Information Centres.

Recommendation 2 for Committee Decision

Prepared by: Working Group C

Date of Submission: 10 November 2016

Issue Title: ICAO GNSS Monitoring guidelines for Aviation

Background/Brief Description of the Issue:

During ICAO Navigation System Panel#2 held on December 2015, guidelines for States were approved on GNSS Monitoring for Aviation (GNSS performance verification and data recording). Such guidelines have been reflected on a proposal of amendment to ICAO Annex 10 (SL 16-061) to be effective from November 2018 and on an update of ICAO Doc9849 GNSS Manual to be published on the next months.

ENAV and Telespazio, in the framework of BEYOND project funded by EC under H2020 programme, has investigated and validated some methodologies for calculation of ICAO GNSS parameters.

Discussion/Analyses:

ICAO GNSS Monitoring concept for Aviation has been presented explaining the mean of “Performance Assessment”, “Data recording” and “Operational Status Monitoring”. Concerning the performance assessment, a set of 6 GNSS Key Performance Indicators on the range and position domain have been presented. Proposed methodologies and validation steps carried on by Beyond project has been discussed.

Recommendation for Committee Action:

The Working Group C takes note of recent developments in ICAO and proposes to:

- Disseminate “Aviation GNSS Monitoring concept” among related communities;
 - Invite nation states to publish and share ICAO KPI reports;
 - Create synergies among stakeholders;
- Coordinate with other ICG Working Groups.*