



# General Assembly

Distr.: General  
15 December 2014

Original: English

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## Committee on the Peaceful Uses of Outer Space

### Activities carried out in 2014 in the framework of the workplan of the International Committee on Global Navigation Satellite Systems

#### Report of the Secretariat

## I. Introduction

1. Current fully operational global navigation satellite systems (GNSS) include the Global Positioning System (GPS) of the United States of America and the Global Navigation Satellite System (GLONASS) of the Russian Federation. Both the GPS and the GLONASS systems are being modernized to better respond to the challenges of today's applications. The modernizations include an increase in the number of transmission frequencies and changes to the signal components. In addition, the European Satellite Navigation System (Galileo) and the BeiDou Navigation Satellite System of China, currently being developed and deployed, will enhance the quality of services and increase the number of potential users and applications.
2. The combination of multiple GNSS can significantly improve many applications, as the increased number of satellites strengthens the orbit geometry, resulting in increased precision, accuracy, and overall availability and coverage of GNSS signals. These improvements are particularly important for applications in difficult environments where the visibility of the sky is restricted, such as in urban areas or in the vicinity of geographic formations such as mountains and canyons. Furthermore, scientific applications benefit from the additional available signals and their frequencies and the different orbital characteristics of each GNSS satellite.
3. In order to promote the greater use of GNSS capabilities, the International Committee on GNSS (ICG) was established under the umbrella of the United Nations in 2005 as an informal, voluntary forum to discuss all matters regarding GNSS on a worldwide basis. ICG holds annual meetings to review and discuss developments on GNSS. The annual meetings also address GNSS science and innovative technology applications. The ninth meeting of ICG was held in Prague



from 10 to 14 November 2014 (see A/AC.105/1083). The European Commission and the European GNSS Agency organized the meeting on behalf of the European Union.

4. The Office for Outer Space Affairs, in its capacity as the executive secretariat of ICG and its Providers' Forum, is organizing regional workshops, training courses and international meetings focusing on capacity-building in the use of GNSS-related technologies in various rapidly growing fields of science and industry. Those activities bring together a large number of experts every year, including experts from developing countries, to discuss and act on issues that are also of great relevance to ICG.

5. The present report describes the activities undertaken or supported by the Office for Outer Space Affairs during 2014 and their major results. Detailed information on the activities is available on the ICG information portal ([www.unoosa.org/oosa/en/SAP/gnss/icg.html](http://www.unoosa.org/oosa/en/SAP/gnss/icg.html)).

## **II. Activities of the International Committee on Global Navigation Satellite Systems carried out in 2014**

6. Pursuant to the ICG workplan for 2014 and its recommendations, the Office for Outer Space Affairs focused on capacity-building and information dissemination through regional workshops, training courses and technical seminars, and their follow-up projects.

### **A. Information centres hosted by the regional centres for space science and technology education, affiliated to the United Nations**

7. The ICG information centres are hosted by the regional centres for space science and technology education, affiliated to the United Nations. The regional centres are located in India for Asia and the Pacific, in Morocco and Nigeria for Africa, in Brazil and Mexico for Latin America and the Caribbean and in Jordan for Western Asia.

8. The objective of the ICG information centres is to enhance the capabilities of member States at the regional and international levels in the use of GNSS and its applications to advance their scientific, economic and social development. The ICG information centres are working towards the establishment of a network of institutions involved or interested in GNSS, as well as identifying new applications that could be developed in the regions on the basis of global navigation satellite systems and their services.

9. The centres coordinate their activities closely with the ICG executive secretariat and GNSS providers, which provide support for the development of GNSS services and applications in the regions.

10. At the African Regional Centre for Space Science and Technology Education – in French language (CRASTE-LF), located in Rabat, and the African Regional Centre for Space Science and Technology Education – in English language (ARCSSTE-E), located in Ile-Ife, Nigeria, the first session of a nine-month

post-graduate course on GNSS was completed in September 2014. Additionally, a theoretical and practical perspective, with case studies as well as an overview of the BeiDou Navigation Satellite System of China was presented at CRASSTE-LF by experts from Beihang University of China.

## **B. Promoting the use of global navigation satellite system technologies as tools for scientific applications**

### **1. Space weather effects on global navigation satellite systems**

11. Rarely occurring solar superstorms generate solar radio bursts, accelerate solar particles and cause major perturbations to the solar wind. These environmental changes can have detrimental effects on the electricity grid, satellites, avionics, signals from GNSS, mobile telephones and more. They have consequently been identified as a risk to the world economy and society.

12. Within the framework of the ICG workplan, the Office for Outer Space Affairs, together with the Abdus Salam International Centre for Theoretical Physics and Boston College (United States) co-organized the “African school on space science: related applications and awareness for sustainable development of the region”, held in Kigali from 30 June to 11 July 2014. The University of Rwanda College of Science and Technology hosted the workshop.

13. The school integrated formal lectures with hands-on practice to learn about the physical phenomena of the solar magnetosphere-ionosphere coupling and their impact on the near-Earth space environment, including space weather and its impact on advanced technologies (e.g. precision of GNSS measurements).

14. A total of 63 scientists, engineers, educators and students in the field of GNSS and space weather from East African countries participated in the school. Funds provided by the European Commission and the United States through ICG were used to defray the costs of air travel for 24 participants.

### **2. Reference frames and timing**

15. The use of positioning technology is growing rapidly in industries such as mining, agriculture and construction, as well as emergency services. The applications of the users of that technology have been shown to need centimetre-level or better geodetic infrastructure. In order to respond to that need, consistent, continually refined and easily accessible reference frames are needed.

16. The ninth AfricaArray workshop was held at the University of the Witwatersrand in Johannesburg, South Africa, from 19 to 31 January 2014. It was organized in the framework of the research and capacity development programme established in 2004. The AfricaArray project continues to grow in scope and size, including through: (a) the deployment of new multi-sensor stations as part of the “backbone” network; (b) the initiation of several follow-up initiatives, such as investigations of lithospheric structure in Botswana and seismic hazards in East African countries; (c) and the development of a doctoral programme to pursue in-depth research in a broad variety of critical application areas.

17. Over the course of two training programmes and three workshops carried out in 2014, the participants were taught by international experts in GNSS on the following topics: (a) the operation of AfricaArray stations; (b) a complete set of SEISAN programmes for locating earthquakes; (c) engineering seismology; (d) the Global Earthquake Model; and (e) the development of a seismotectonic map for Africa. A total of 46 papers were presented by the workshop participants during the scientific meeting held on 20 and 21 January 2014 on the following topics: (a) reports on the current status of and future plans for the observational networks; (b) research and educational activities; (c) structure and tectonics of the African plate; (d) African geodesy and stress, seismic monitoring and seismic hazard assessment; (e) mining-induced and engineering seismicity; and (e) initiatives associated with AfricaArray.

18. The Workshop was attended by 73 participants from 24 countries. Funds provided by the United States, through ICG, were used to defray the costs of air travel for nine experts from Africa.

### C. Regional workshops on global navigation satellite system applications

19. The United Nations/Abdus Salam International Centre for Theoretical Physics Workshop on the Use of Global Navigation Satellite Systems for Scientific Applications was held in Trieste, Italy, from 1 to 5 December 2014 (see A/AC.105/1087). It was organized by the Office for Outer Space Affairs and the International Centre for Theoretical Physics, and was hosted by the International Centre. The main objective of the Workshop was to discuss signal science applications, which included troposphere, ionosphere and space weather applications, and navigation and positioning science applications, such as geodesy and seismology. The Workshop included plenary sessions and wide-ranging discussions among participants to determine priority areas for pilot projects and possible partnerships.

20. The Workshop participants focused on several points, emphasizing the need to strengthen national capacity in GNSS science and applications that are appropriate for the regional context, specifically through targeted training courses and workshops, taking advantage of existing regional structures and specialized centres of excellence. This also included GNSS data-processing and analysis using open-source software tools, identifying and promoting appropriate data formats and metadata standards, and facilitating data retrieval, data storage and near-real-time data exchange. A detailed programme of the Workshop proceedings is available on the website of the Office for Outer Space Affairs ([www.unoosa.org/oosa/en/SAP/gnss/index.html](http://www.unoosa.org/oosa/en/SAP/gnss/index.html)).

## III. Technical advisory services

21. To present the work of the Office for Outer Space Affairs in the framework of ICG and its programme on GNSS applications, as well as the future role of ICG in a multi-constellation GNSS, and to receive feedback from a diverse GNSS

community, the Office participated in and contributed to the following international conferences and symposiums:

- (a) Munich Satellite Navigation Summit 2014, held in Munich, Germany from 25 to 27 March 2014;
- (b) Eighth International Satellite Navigation Forum, held in Moscow on 23 and 24 April 2014;
- (c) Thirty-fourth session of the Inter-Agency Meeting on Outer Space Activities (UN-Space), held in New York on 13 and 14 May 2014;
- (d) Fourteenth plenary meeting of the United Nations Geographic Information Working Group, held in New York from 14 to 16 May 2014;
- (e) Fifty-fourth meeting of the Civil Global Positioning System Service Interface Committee, held in Tampa, Florida, United States, on 8 and 9 September 2014.

22. The Office for Outer Space Affairs also organized the preparatory meetings for the ninth meeting of ICG, chaired by the European Union, and the twelfth meeting of the Providers' Forum, co-chaired by China and the European Union, held in Vienna on 17 February 2014 and on 10 June 2014, respectively. Those preparatory meetings were held on the margins of the fifty-first session of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space and the fifty-seventh session of the Committee. At the meetings, it was emphasized that the ICG working groups were playing a key role in the implementation of the workplan of ICG. The ICG Providers' Forum focused on the issues related to open service information dissemination and service performance monitoring, as well as compatibility and interoperability of GNSS.

23. The Office for Outer Space Affairs, in its capacity as the executive secretariat of ICG, organized the interim meetings of the ICG working groups that formed the basis for views and recommendations on spectrum protection, open service performance and the monitoring of open services, as well as on monitoring the progress of the interoperable GNSS space service volume and reviewing existing user position integrity concepts for further action. The following ICG intersessional meetings and workshops were organized in 2014:

- (a) Workshop on GNSS spectrum protection and interference detection and mitigation, held in Geneva on 14 and 15 July 2014. The Workshop was hosted by the International Telecommunication Union (ITU);
- (b) Meeting of Working Group A on compatibility and interoperability of global and regional navigation satellite systems and satellite-based augmentations, held in Geneva from 16 to 18 July 2014;
- (c) Meeting of Working Group C on capacity-building and information dissemination, held at the Polytechnic School in Paris from 1 to 3 October 2014.

24. In the framework of the ICG Working Group C workplan action "Promoting the use of GNSS technologies as tools for scientific applications in developing countries, with emphasis on Africa", the Office for Outer Space Affairs held a meeting with representatives of the International Centre for Theoretical Physics and Boston College to discuss education and training programmes for end users in

various disciplines, such as geodesy, geophysics, space weather and meteorology, and the benefits of such programmes for African countries, including projects related to real-time dual-frequency GPS stations for ionospheric studies in Africa, and the implementation of the training project on the European Geostationary Navigation Overlay Service in Africa, aimed at assisting Africa's aviation sector. The meeting was hosted by the International Centre for Theoretical Physics in Trieste, Italy, on 9 and 10 October 2014.

#### **IV. Voluntary contributions**

25. The activities of ICG in 2014 were successfully implemented thanks to the support and voluntary contributions (financial and in-kind) of member States:

- (a) The Government of the United States provided \$240,000 to support capacity-building and technical advisory services and arranged for experts to make technical presentations and participate in discussions during activities described in the present report;
- (b) The European Union provided 100,000 euros to support capacity-building and technical advisory services and arranged for experts to make technical presentations and participate in discussions during activities described in the present report;
- (c) The European Union also provided a sponsorship for two staff members of the Office for Outer Space Affairs to participate in and contribute to the ninth meeting of ICG and its planning meetings;
- (d) The Government of the Russian Federation, the Government of the United States, the European Union and the European Space Agency provided sponsorships for experts to make technical presentations and participate in the activities carried out in the framework of the GNSS priority thematic area of the United Nations Programme on Space Applications.

26. The Office for Outer Space Affairs also organized a symposium on the theme "Commercial applications of global navigation satellite systems", held on 17 February 2014, during the fifty-first session of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space, in Vienna. The symposium was moderated by China, as a co-chair of the ICG Providers' Forum in 2013 and 2014. The presentations given at the symposium are available on the website of the Office for Outer Space Affairs: [www.unoosa.org/oosa/en/COPUOS/stsc/2014/gnsssymposium.html](http://www.unoosa.org/oosa/en/COPUOS/stsc/2014/gnsssymposium.html).