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Committee on the Peaceful Uses of Outer Space

Activities carried out in 2011 in the framework of the workplan of the International Committee on Global Navigation Satellite Systems

Report of the Secretariat

I. Introduction

1. In 2001, pursuant to the resolution entitled “The Space Millennium: Vienna Declaration on Space and Human Development” adopted by the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE-III), the Committee on the Peaceful Uses of Outer Space established the Action Team on Global Navigation Satellite Systems (GNSS), under the leadership of Italy and the United States of America. The deliberations of the Action Team on GNSS led to the establishment of the International Committee on GNSS (ICG).

2. To continue reviewing and discussing developments in GNSS, ICG held its sixth annual meeting in Tokyo from 5 to 9 September 2011. During the meeting, ICG addressed GNSS technology applications for agriculture, fishery, information technology construction (precision positioning), geographic information systems, disaster mitigation, intelligent transportation systems and location-based services.¹

3. In 2011, to mark a milestone achievement by providers and users of positioning, navigation and timing services in promoting GNSS, the Office for Outer Space Affairs of the Secretariat, in its capacity as the executive secretariat of ICG, produced a brochure entitled “10 years of achievement of the United Nations on Global Navigation Satellite Systems” (ST/SPACE/55).

4. GNSS consist of constellations of satellites that provide continuously optimized location and time information, transmitting a variety of signals on multiple frequencies that are available worldwide. GNSS are the Global Positioning

¹ See A/AC.105/1000.



System (GPS) of the United States, the Global Navigation Satellite System (GLONASS) of the Russian Federation, Galileo of the European Union and Compass/BeiDou of China. India and Japan have developed regional GNSS capability by launching a number of satellites into space that augment the capabilities that are already supplied by the global systems through the provision of additional regional coverage. As providers of GNSS services, those six global and regional system providers have formed a Providers' Forum² in order to conduct discussions of mutual interest focused on improving coordinated service provision to benefit humankind. The Providers' Forum provides ways and means of promoting communication among system providers on key technical issues and operational concepts such as protection of the GNSS spectrum, and orbital debris and orbit de-confliction.

5. The present report reflects the wide range of activities carried out in 2011 by the Office for Outer Space Affairs, consistent with its role as the executive secretariat for ICG. Detailed information on the activities can be found on the ICG website (www.icgsecretariat.org).

II. Activities of the International Committee on Global Navigation Satellite Systems carried out in 2011

6. To support the work of ICG and its programme on GNSS applications, the Office for Outer Space Affairs 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, as well as deploying instruments for the International Space Weather Initiative. All these activities bring together a large number of experts, including those from developing countries, to discuss and act on GNSS-related issues that are also highly relevant to ICG.

7. The Office for Outer Space Affairs is also leading the development by ICG of an in-depth GNSS education curriculum for inclusion in the training programmes at the regional centres for space science and technology education, affiliated to the United Nations,³ which also serve as information centres⁴ for ICG. The regional centres for Africa are located in Morocco and Nigeria; for Asia and the Pacific there is one in India; and for Latin America and the Caribbean there are centres in Brazil and Mexico.

8. Pursuant to the elements of the ICG workplan, the Office for Outer Space Affairs concentrated on: (a) promoting the use of GNSS technologies as tools for scientific applications, including space weather effects on GNSS; and (b) regional workshops on applications of GNSS and the International Space Weather Initiative.

² See A/AC.105/901.

³ More information on the centres is available at www.unoosa.org.

⁴ See A/AC.105/928.

A. Promoting the use of global navigation satellite system technologies as tools for scientific applications, including space weather effects on global navigation satellite systems

Ten years of achievement of the United Nations on global navigation satellite systems

9. The Office for Outer Space Affairs hosted the International Meeting on the Applications of Global Navigation Satellite Systems at the Vienna International Centre, Austria, from 12 to 16 December 2011. The meeting brought together experts from around the world to discuss possibilities for making GNSS accessible as an enabling space technology utilized worldwide and to look at what could be best achieved through a new approach in the next 5 to 10 years.

10. Sessions during the meeting involved discussions on a wide variety of applications of GNSS and conclusions were reached on the benefits of multi-GNSS availability and the development of GNSS applications, taking into account space weather. In addition, the format of the GNSS education curriculum for teaching GNSS applications as part of the proven standard model education curricula of the regional centres was finalized. The establishment of an international centre on GNSS science, applications and education in an existing national educational and research institution was recommended.

11. The meeting also marked 10 years of achievement by the United Nations in the area of GNSS, with the Office for Outer Space Affairs taking an active role as the executive secretariat of ICG and co-organizer of the meeting. ICG is a multilateral forum that provides an opportunity for discussing and resolving spectrum compatibility and interoperability issues, seeking ways to enhance performance of GNSS services. In the future, ICG will provide a significant opportunity for reaching out to developing countries to discuss and interact on technical issues involved in space-based positioning, navigation and timing.

Regional centres for space science and technology education, affiliated to the United Nations, and information centres for the International Committee on Global Navigation Satellite Systems

12. Within the framework of the ICG Working Group on Information Dissemination and Capacity-Building, led by the Office for Outer Space Affairs, negotiations with the regional centres are ongoing in order to utilize them as “hubs” for training and information dissemination on the global applications of GNSS. By using the existing infrastructure of the regional centres, ICG (and, more specifically, GNSS service providers) could save significant amounts of time and financial resources by using the centres for information dissemination. The centres could then expand their range of training programmes and services and thus open up new opportunities to connect to other GNSS providers (or future providers).

13. The ICG executive secretariat and GNSS providers identified two areas for enhanced cooperation with regard to the further development of information centres for ICG: the technical level, which would include various GNSS technologies; and the cooperative level, with industry leaders and linkages (seminars, training and supporting materials) with current and future system and augmentation system

providers, as well as communication and outreach to the wider community through the ICG information portal, mailing lists, brochures and newsletters.

Regional reference frames and systems

14. At the regional level (Africa, Latin America and the Caribbean, West Asia, Europe, and Asia and the Pacific), applications of GNSS technologies, particularly GPS, are increasingly being used in geo-information applications, services and products. With the increased use and application of GNSS and the requirement to relate GPS 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 Reference Frame Sub-Commission 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.

15. Within the framework of the workplan of ICG, the Office for Outer Space Affairs co-organized the seventh annual Africa-Array workshop in Johannesburg, South Africa, from 17 to 21 November 2011. The School of Geosciences of Witwatersrand University hosted the workshop. The workshop was co-sponsored by the United States through ICG.

16. The workshop brought together students, post-doctoral fellows and faculty engaged in Africa-Array-related research. Participants in the workshop addressed the following topics: (a) structure and tectonics of the African plate; (b) African geodesy, hydrology and space weather; and (c) seismic hazards. A three-day training course on using the GAMIT and GLOBK⁵ software for processing GPS data followed the workshop. The training course included lectures and tutoring in static processing of both continuous and survey mode measurements; defining global, regional and local reference frames; temporal and spatial filtering of time series; combining solutions to estimate post-seismic and long-term crustal deformation; handling step-displacements resulting from earthquakes; and instrument changes.

17. A total of 80 scientists in the field of GNSS and space weather from 17 African countries were invited to attend the workshop and training course. Funds provided by the United States through ICG were used to defray the costs of air travel for 24 participants.

International Space Weather Initiative: space weather effects on GNSS

18. The International Space Weather Initiative contributes to the observation of space weather phenomena through the deployment of ground-based worldwide instrument arrays, such as GPS receivers, magnetometers, solar telescopes,

⁵ GAMIT and GLOBK are part of a suite of programs developed by MIT for analysing GPS measurements. More information is available from www.gpsg.mit.edu/~simon/gtgk/.

very-low-frequency monitors, solar particle detectors and the sharing of recorded data among researchers around the world.

19. Ionospheric modelling using GPS data is the focus of extensive efforts within the GPS provider and user communities. The range error caused by ionospheric delay in GPS signals is currently the largest component that affects the accuracy of positioning and navigation determination using single-frequency GPS measurements. Ionospheric modelling is an effective approach for correcting the ionospheric range error and improving GPS positioning accuracy. The abundance of GPS measurements from worldwide GPS reference networks, which provide uninterrupted 24-hour operational services to record dual-frequency GPS measurements, provides an ideal data source for ionospheric modelling research. Currently, more than 1,000 instruments are operational in 97 countries as part of the deployment of instrument arrays.

20. Within the scope of its activities, ICG supported the school on space weather, held at the African Regional Centre for Space Science and Technology — in French language, in Rabat, from 5 to 16 December 2011. The objectives of the school were to familiarize African scientists with the solar processes influencing the terrestrial environment and to teach them how to use data obtained within the network of instruments in Africa. Funds provided by the United States through ICG were used to defray the costs of air travel for 11 participants from 6 African countries.

B. Regional workshop on global navigation satellite system applications and International Space Weather Initiative

21. Pursuant to General Assembly resolution 65/97 and as part of the United Nations Programme on Space Applications, the Office for Outer Space Affairs held the United Nations/United Arab Emirates/United States of America Workshop on Applications of Global Navigation Satellite Systems⁶ in Dubai from 16 to 20 January 2011. The Workshop was hosted by the Emirates Institution for Advanced Science and Technology on behalf of the Government of the United Arab Emirates and was co-sponsored by the United States through ICG.

22. Participants in the Workshop addressed recent developments in current and planned global and regional navigation satellite systems. Various sessions featured discussions about perspectives and critical issues regarding the increasing number of applications for satellite navigation. At the same time, it was highlighted that capacity-building should be seen as a process initiated through projects and sustained beyond the project implementation period. A detailed programme of the workshop and its proceedings are available on the website of the Office for Outer Space Affairs (www.unoosa.org).

23. The United Nations/Nigeria Workshop on the International Space Weather Initiative, held in Abuja from 17 to 21 October 2011, was co-organized by the Office for Outer Space Affairs as part of the United Nations Programme on Space Applications. The Workshop was co-sponsored by the National Aeronautics and Space Administration (NASA), the Japan Aerospace Exploration Agency, the Space Environment Research Center of Kyushu University, Japan, and ICG. The Workshop

⁶ See A/AC.105/988.

programme focused on the fact that the variability of the Sun had adverse impacts on the Earth. As society becomes increasingly dependent on space-based systems, it is vital to understand how space weather, caused by solar variability, can affect, among other things, space systems and human space flight, electric power transmission, high-frequency radio communications, GNSS signals and long-range radar, as well as the well-being of passengers in high-altitude aircraft. The Workshop comprised in-depth presentations of results emanating from 15 space weather instrument arrays. It was also announced that three new instrument arrays were under construction by Argentina, Germany and Israel. Detailed information on the Workshop is available from www.iswinigeria.org.ng.

24. The outcome of the Workshop is contained in the Abuja International Space Weather Initiative resolution, adopted by the participants. The resolution calls for the establishment of an international centre for space weather science and education. The Space Environment Research Center of Kyushu University has offered to host such a centre, which will begin the institutionalization of the International Space Weather Initiative. Regional centres of this nature will be hosted by the Centre for Basic Space Science at the University of Nigeria (for Africa) and by the Faculty of Science of Helwan University, Cairo (for West Asia).

III. Technical advisory services

25. With regard to present developments in and activities by ICG, in 2011 the Office for Outer Space Affairs, as the executive secretariat of ICG and its Providers' Forum, participated in and contributed to several major international and regional meetings on GNSS. The meetings offered the opportunity to exchange technological information with a diverse range of participants, including representatives of air, space, marine, land navigation, position determination and space weather sectors. Those meetings, which provided an opportunity to promote the achievements of the United Nations on GNSS and the integration of GNSS into national infrastructures, particularly in developing countries, were as follows:

(a) Munich Satellite Navigation Summit 2011, held in Munich, Germany, from 13 to 15 March 2011. The Summit included plenary discussions and presentations providing updates on the main activities in worldwide satellite navigation systems. Emphasizing a future trend in satellite navigation, the Summit focused on GNSS aspects, GNSS receivers, special applications and interrelations with other technology domains. Synergies and differences between life sciences and GNSS were discussed, including bird tracking and the prevention of bird strikes, as well as environmental monitoring;

(b) The 15th meeting of the Asia and the Pacific Economic Cooperation (APEC) GNSS Implementation Team (GIT/15), held in Brisbane, Australia, from 13 to 17 June 2011. APEC is a forum for facilitating economic growth and cooperation in the region of Asia and the Pacific. The APEC GIT/15 meeting focused on intermodal GNSS transportation applications. GIT/15 is a subgroup of the Intermodal Experts Group of the APEC Transportation Working Group;

(c) The 24th Institute of Navigation GNSS Conference, held in Portland, United States, from 20 to 23 September 2010. The Institute of Navigation is the

world's premier professional society dedicated to the advancement of the art and science of positioning, navigation and timing;

(d) The International Symposium on Global Navigation Satellite Systems, Space-based and Ground-based Augmentation Systems and Applications, held in Berlin on 10 and 11 October 2011. Since 2008, ICG, the Berlin Senate Department for Urban Development and the EUPOS Steering Committee have organized an annual symposium on GNSS in order to increase awareness among policy- and decision makers of the potential and performance of EUPOS and similar regional reference systems and frames and to establish a broad framework for regional and international cooperation;

(e) The International Global Navigation Satellite Systems (IGNSS) Society International Symposium on GPS/GNSS, held in Sydney, Australia, from 15 to 17 November 2011. The IGNSS Society is an association incorporated in Queensland, Australia, that encourages research and development in GNSS disciplines and the development of end-user GNSS applications. It was hosted by the University of New South Wales.

26. The Office for Outer Space Affairs organized the preparatory meetings for the sixth meeting of ICG and its Providers' Forum, co-chaired by Japan and the United States, in Vienna on 14 February 2011 and 7 June 2011. The meetings were held on the margins of the forty-eighth session of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space and the fifty-fourth session of the Committee. At the meetings, issues related to open service signal specifications and service standards, and spectrum protection were also discussed.

27. In addition, the Office for Outer Space Affairs organized an interim meeting of ICG Working Group A on Compatibility and Interoperability in Vienna from 8 to 10 June 2011. The Working Group discussed organizational models and procedures for multilateral coordination of GNSS compatibility for the benefit of the Providers' Forum and the status of individual system provider efforts to develop templates for GNSS performance standards.

28. The Office continued managing the content and server of the ICG website to reflect recent developments and activities by ICG and the Providers' Forum.

IV. Voluntary contributions

29. The activities of ICG in 2011 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 \$100,000 to support capacity-building and technical advisory services and also arranged for experts to make technical presentations and participate in discussions during activities described in the present report. The funds allocated were used to defray the costs of air travel and daily subsistence of 37 participants from developing countries and two staff members of the Office for Outer Space Affairs, and the services of an associate expert;

(b) The Government of China, the Government of Italy, the Government of Japan, the Government of the Russian Federation, the Government of the

United Arab Emirates, the European Union and the European Space Agency provided sponsorship for experts to make technical presentations and participate in deliberations at activities carried out in the framework of the ICG workplan. The Government of Japan and the European Union provided sponsorship for one staff member of the Office for Outer Space Affairs to participate in the sixth annual meeting of ICG and the Munich Satellite Navigation Summit respectively.
