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Committee on the Peaceful Uses of Outer Space

Activities carried out in 2008 in the framework of the workplan of the International Committee on Global Navigation Satellite Systems

Report of the Secretariat

I. Introduction

1. In its resolution 54/68 of 6 December 1999, the General Assembly endorsed the resolution entitled “The Space Millennium: Vienna Declaration on Space and Human Development”,¹ which had been adopted by the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), held in Vienna from 19 to 30 July 1999. The strategy contained in the Vienna Declaration included key actions for using space applications in the area of human security, development and welfare. One such action was to improve the efficiency and security of transport, search and rescue, geodesy and other activities by promoting the enhancement of, universal access to and compatibility of space-based navigation and positioning systems.

2. In the plan of action contained in the review of the implementation of the recommendations of UNISPACE III (A/59/174), endorsed by the General Assembly in its resolution 59/2 of 20 October 2004, findings were presented and specific actions were proposed in areas important to the well-being and future of all nations. Those actions included maximizing the benefits of the use and applications of global navigation satellite systems (GNSS) in support of sustainable development.

3. In its resolution 61/111 of 14 December 2006, the General Assembly noted with appreciation that the International Committee on Global Navigation Satellite Systems (ICG) had been established on a voluntary basis as an informal body to promote cooperation, as appropriate, on matters of mutual interest related to civil

¹ *Report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 19-30 July 1999* (United Nations publication, Sales No. E.00.I.3), chap. I, resolution 1.



satellite-based positioning, navigation, timing and value-added services, as well as the compatibility and interoperability of GNSS, while increasing their use to support sustainable development, particularly in developing countries.

4. At its fifty-first session, in 2008, the Committee on the Peaceful Uses of Outer Space noted that, pursuant to General Assembly resolution 62/217 of 22 December 2007, the Scientific and Technical Subcommittee had considered recent developments in GNSS as a new and regular agenda item and had reviewed issues related to ICG, the latest developments in the field of GNSS and new GNSS applications.² The Committee also noted that the establishment of ICG had been a concrete result of the implementation of the recommendations of UNISPACE III.

Background

5. In 2006, the Office for Outer Space Affairs of the Secretariat co-organized two activities focusing on building capacity so that GNSS could be used more widely to support sustainable development:

(a) The United Nations/Zambia/European Space Agency Regional Workshop on the Applications of Global Navigation Satellite System Technologies for Sub-Saharan Africa, held in Lusaka from 26 to 30 June 2006 (see A/AC.105/876);

(b) The United Nations/China/European Space Agency Training Course on the Use and Applications of Global Navigation Satellite Systems, held in Beijing from 4 to 8 December 2006 (see A/AC.105/883).

6. In 2007, the Office for Outer Space Affairs conducted a special session on GNSS and climate change at the International Workshop on Climate Change and Adaptation in Africa: the Role of Space Technologies, held in Algiers from 22 to 24 October 2007. The Workshop was co-organized by the African Regional Centre for Space Science and Technology Education – in French Language and the Algerian Space Agency (ASAL).

7. The Office for Outer Space Affairs also organized the first Meeting of the International Committee on Global Navigation Satellite Systems, which was held in Vienna on 1 and 2 November 2006 (A/AC.105/879). At that meeting, ICG adopted the terms of reference and workplan that had been developed at international meetings held since 2002 and which incorporated the proposals made by the open-ended ad hoc working group of ICG, which had met in Vienna in March, June and October 2006. The workplan included compatibility and interoperability of GNSS, enhancement of performance of GNSS services, information dissemination, interaction with national and regional authorities and relevant international organizations and coordination.

8. The Second Meeting of the International Committee on Global Navigation Satellite Systems was held in Bangalore, India, on 6 and 7 September 2007 and was hosted by the Indian Space Research Organization (ISRO). A major outcome of the Second Meeting was the establishment of the Providers Forum, which was intended to enhance compatibility and interoperability among current and future system providers and to serve as a mechanism for continuing discussion on important issues

² *Official Records of the General Assembly, Sixty-third Session, Supplement No. 20 (A/63/20)*, paras. 132-141.

addressed by ICG and requiring focused input from system providers. The members of the Providers Forum included China, India, Japan, the Russian Federation and the United States of America, as well as the European Community.

9. The Third Meeting of the International Committee on Global Navigation Satellite Systems is to be held in Pasadena, United States, from 8 to 12 December 2008. The Russian Federation has offered to act as host to the Fourth Meeting of the International Committee on Global Navigation Satellite Systems, to be held in 2009.

II. Activities of the International Committee on Global Navigation Satellite Systems carried out in 2008

10. All the ICG activities for 2008 were to be implemented as part of the workplan approved at the first meeting of ICG, in 2006 (A/AC.105/879, annex I).

11. In 2008, the activities of ICG concentrated on (a) providing support for education and training in satellite navigation and location-based services for purposes of building capacity in developing countries through the regional centres for space science and technology education affiliated with the United Nations; and (b) organizing workshops and special sessions on the use of GNSS technologies as tools for scientific applications.

A. Training for capacity-building in developing countries

12. Efforts to build capacity in space science and technology are considered a major focus of the Office for Outer Space Affairs and are of specific interest to ICG. Such efforts should aim to provide support to the regional centres for space science and technology education affiliated with the United Nations, which would also act as ICG information centres; to foster a more structured approach to information exchange in order to fulfil the mutual expectations of a network linking ICG and the regional centres; and to connect the institutions involved or interested in GNSS applications with GNSS system providers. The regional centres for Africa are located in Morocco and Nigeria; for Latin America and the Caribbean, in Brazil and Mexico; and for Asia and the Pacific, in India.

13. An international training course on satellite navigation and location-based services was organized jointly by the Office for Outer Space Affairs and the Regional Centre for Space Science and Technology Education in Asia and the Pacific. The aim of the training course was to initiate the development of a GNSS curriculum similar to the curricula developed for the regional centres for space science and technology education for courses on remote sensing and geographic information systems; space and atmospheric science; satellite communications; and satellite meteorology and global climate. Participants were familiarized with relevant technologies to help them to gain an in-depth understanding of how those technologies could be used in an operational scenario. The course was hosted by the Space Applications Centre of ISRO, in Ahmedabad, India, from 18 June to 18 July 2008, and was co-sponsored by the Government of the United States.

14. The speakers and instructors at the technical sessions of the training course came from the Airports Authority of India, ISRO, the Istituto Superiore Mario

Boella (Italy), Osmania University (India), the Politecnico di Torino (Italy), the Russian Institute of Space Device Engineering and Survey of India.

15. The training course was modular in format and consisted of a series of lectures and practical exercises. The modules dealt with basic concepts of satellite navigation and applications of satellite navigation with special emphasis on location-based services. The practical exercises dealt with different types of GNSS receivers, both in stand-alone mode and integrated with communications systems, and included computer-based exercises using Matrix Laboratory (MatLab) programme simulation. The training course report is available at the ICG information portal (<http://www.icgsecretariat.org>).

16. Funds provided by the Government of the United States, through ICG, and by the Government of India were used to defray the costs of air travel, daily subsistence allowance and accommodation for 12 participants from developing countries.

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

17. At its forty-first session, in 2004, the Scientific and Technical Subcommittee agreed that, as society became increasingly dependent on space-based systems, it was 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 radio communications, GNSS signals and long-range radar.

18. Since 2004, worldwide ground-based instrument arrays for exploring atmospheric phenomena related to space weather and climate change have been established. Within the framework of ICG, global positioning system (GPS) applications in low-cost worldwide ground-based instrument arrays have been considered.

19. In view of critical new observations made concerning the Earth's atmosphere and global climate, notably from the Constellation Observing System for Meteorology, Ionosphere and Climate (COSMIC), Detection of Electromagnetic Emissions Transmitted from Earthquake Regions (DEMETER), Challenging Minisatellite Payload (CHAMP), Thermosphere Ionosphere Mesosphere Energetics and Dynamics (TIMED), Republic of China Satellite (ROCSAT) and Defense Meteorological Satellite Program (DMSP) satellites, GPS ground-based receivers, airglow instruments and radars, all of which helped to provide clues to the complex plasma variations and electrodynamics of the F-region ionosphere during storms, the Office for Outer Space Affairs organized a session on ionospheric storms and their space weather effects. The session was held on 23 May 2008, in conjunction with the twelfth International Symposium on Equatorial Aeronomy, held in Heraklion, Greece, from 18 to 24 May 2008,³ and received support from the Government of the United States. The session addressed all aspects of the response of the mid- and low-latitude ionosphere to magnetic storms and the space weather

³ For more information on the Symposium, see the website (<http://isea12.physics.uoc.gr/>).

effects of such storms, including in situ and ground-based observations as well as modelling and theoretical studies, particularly using GPS.

20. ICG provided financial support for selected participants from Brazil, Peru and Viet Nam to attend the session and to present papers, which focused on the total electron content (TEC) results of GPS observations in Latin America and the Caribbean and in South-East Asia.

21. In the first of those papers, the large TEC fluctuations near the equatorial ionization anomaly (EIA) in the equatorial spread F-region of the ionosphere were described as an example of using observations from the GPS network over Brazil. To explain the large TEC fluctuations near the EIA region, a three-dimensional simulation of the spread F bubble, including the dynamics parallel and perpendicular to the magnetic field, was demonstrated. In the second paper, TEC over South America was examined using GPS data from the low-latitude ionospheric sensor network (LISN). The case was made that, with the fully operational LISN consisting of 50 GPS dual-frequency receivers, 5 digital ionosondes and 5 magnetometers, the studies of TEC variation in EIA and the assimilation models would improve. The third paper described studies of the influence of the atmosphere on single-point positioning by GPS in Viet Nam.

22. In view of the use made of GNSS equipment in Africa for various disciplines, such as geodesy, geophysics, space weather and meteorology, and in an attempt to coordinate those activities and to provide a forum for exchanges among scientists and organizers of networks of instruments, with a focus on GPS-based instruments, the Office and the University of Witwatersrand, in Johannesburg, South Africa, jointly organized a session on coordinating GPS and geoscientific instrumentation in Africa. The session was held on 19 June 2008 as an integral part of a meeting of key groups involved in the following projects: the African Geodetic Reference Frame (AFREF), AfricaArray, the International Heliophysical Year and the African Monsoon Multidisciplinary Analysis GPS project (AMMA-GPS). The meeting, held in Johannesburg from 17 to 20 June 2008, was attended by 23 participants. The contribution provided by ICG enabled 10 participants from Africa to attend.

23. The meeting participants identified the following six action areas: (a) an inventory of stations was to be created in order to determine where current stations were situated, what had been installed at each station and what potential existed at each station for co-location of multiple sensors; (b) pilot stations were to be identified to test possible collaboration between AFREF, AfricaArray, the International Heliophysical Year and AMMA-GPS; (c) the different groups were to provide detailed guidelines to supplement those of the International GNSS Service (IGS) for the installation of GNSS equipment and data specifications; (d) it was necessary to determine what capacity-building efforts could be developed in the programme and what partnerships and collaborative efforts were already in place; (e) practicalities of the importation of instrumentation were to be investigated by the Economic Commission for Africa, in Ethiopia, which would also approach vendors to obtain a special pricing scheme for AFREF; and (f) a joint policy statement was to be prepared by the participating networks with the aim of clarifying what was to be achieved through collaborative efforts and working towards a common vision.

24. The United Nations/Colombia/United States of America Workshop on Applications of Global Navigation Satellite Systems was organized jointly with the

Government of Colombia and with support from the Government of the United States within the framework of the United Nations Programme on Space Applications. The Workshop, held in Medellin, Colombia, from 23 to 27 June 2008, brought together 100 participants from 18 countries. The Workshop addressed the use of GNSS in agriculture and environmental management, in tele-health and landscape epidemiology and in civil aviation and inland waterway and marine transportation. The Workshop also provided participants with an overview of available education and training in GNSS and their applications (A/AC.105/920).

25. Through ICG and its Providers Forum, the Office for Outer Space Affairs organized a one-day ICG expert meeting on global navigation satellite systems and services on 15 July 2008 to introduce the scope and work of ICG to the international community. The meeting was organized as an associated event of the thirty-seventh Scientific Assembly of the Committee on Space Research (COSPAR), held in Montreal, Canada, from 13 to 20 July 2008.

26. The focus of the ICG expert meeting was on identifying the needs of users and manufacturers of equipment with respect to the compatibility and interoperability of global systems, regional systems and space-based augmentations providing or planning to provide GNSS services. The meeting served the international community by conveying information on the objectives of the Providers Forum, the ongoing efforts of ICG working groups and the benefits of interaction between GNSS providers and users.

27. Introductory and welcoming statements were made by the president of COSPAR, by the outgoing chair of ICG (India), by the incoming chair of ICG (United States) and by a representative of the Office for Outer Space Affairs.

28. The programme of the meeting included three sessions, at which 14 presentations were made by (a) the co-chairs of each working group on the actions under way to accomplish the workplan of ICG, with a focus on activities carried out since the Second Meeting of ICG; (b) all system and augmentation system providers, on the technical characteristics of their systems and services provided to GNSS users; and (c) leaders from industry, academia and organizations representing users or producers, who provided information on their application sector with an emphasis on satellite systems compatibility and interoperability from their perspectives. A discussion session provided an opportunity for providers and users/producers to discuss issues concerning the importance of compatibility and interoperability among satellite systems. The discussion session was facilitated by the co-chairs of the working group on compatibility and interoperability. The presentations made at the meeting are available at the ICG information portal.

29. A panel discussion on the global influences of GNSS, held in Savannah, United States, on 18 September 2008, was organized jointly by the Office for Outer Space Affairs and the United States Department of State. The panel discussion was organized in conjunction with the twenty-first International Technical Meeting of the Satellite Division of the Institute of Navigation, held from 16 to 19 September 2008.

30. The panel discussion included a briefing on the work of ICG as background for the panel's focus on the use of GNSS to support capacity-building and sustainable development, particularly in developing countries. The panel also aimed to examine opportunities for functional partnerships and cooperation, as well as the possible need for new frameworks for cooperation that could be established through

voluntary action by Governments, international organizations, non-governmental organizations and other relevant stakeholders in the use of GNSS technologies.

31. The Government of the United States, through ICG, sponsored the participation of two researchers in the panel discussion: one from Brazil and one from Nigeria. A presentation entitled “Brazil: GNSS use and influence in brief” provided examples of the growing use of GNSS in Brazil, including the Amazonian surveillance system. A presentation entitled “GNSS: impacts, prospects and challenges in Africa” addressed GNSS applications in Nigeria, including rice plantation management, desertification control and studies related to climate change, as well as the GPS Africa project, aimed at increasing the number of real-time dual-frequency GPS stations worldwide for the study of ionospheric variability. Information on the Meeting is available at the ICG information portal.

III. Technical advisory services

32. In 2008, the Office for Outer Space Affairs participated in and contributed to the following major international meetings on GNSS:

(a) Munich Satellite Navigation Summit 2008 – Towards a GNSS System of Systems, held in Munich from 19 to 21 February 2008;

(b) International Satellite Navigation Forum 2008, held in Moscow on 7 and 8 April 2008;

(c) International Symposium on GPS/GNSS 2008, held in Tokyo from 11 to 14 November 2008;

(d) International Symposium on GNSS, Space-based and Ground-based Augmentation Systems and Applications, held in Berlin from 11 to 14 November 2008;

(e) Fifth Plenary Session of the Group on Earth Observations, held in Bucharest on 19 and 20 November 2008.

33. The Office for Outer Space Affairs also managed the content and maintained the server of the ICG information portal that was launched in 2006.

34. An ICG brochure and poster were designed and published by the Office for Outer Space Affairs in January 2008 and were made available on the ICG information portal.

IV. Voluntary contributions

35. The successful implementation of ICG activities in 2008 benefited from the support and voluntary contributions (in cash and in kind) of the following ICG members:

(a) The Government of the United States provided \$ 440,000 to support capacity-building and technical advisory services and also arranged for experts to make technical presentations and participate in deliberations at activities covered in the present report. The funds allocated were used as well to defray the cost of air

travel and daily subsistence allowance for 28 participants from developing countries and 2 staff members of the Office for Outer Space Affairs;

(b) The Government of the Russian Federation provided sponsorship for experts to participate in and contribute to the training course on satellite navigation and location-based services and the United Nations/Colombia/United States of America workshop on GNSS applications. Sponsorship was also provided for one staff member of the Office for Outer Space Affairs to participate in the International Satellite Navigation Forum 2008;

(c) The Government of India, through the Regional Centre for Space Science and Technology Education in Asia and the Pacific, defrayed the cost of local organization and facilities, accommodation and meals for participants and lecturers at the training course in Ahmedabad;

(d) The European Community provided sponsorship for experts to participate in and contribute to the United Nations/Colombia/United States of America workshop on GNSS applications. Sponsorship was also provided for one staff member of the Office for Outer Space Affairs to participate in the Fifth Plenary Session of the Group on Earth Observations.
