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Committee on the Peaceful Uses of Outer Space

Report on the United Nations/Zambia/European Space Agency Regional Workshop on the Applications of Global Navigation Satellite System Technologies for Sub-Saharan Africa

(Lusaka, 26-30 June 2006)

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I. Introduction

A. Background and objectives

1. The Plan of Action proposed by the Committee on the Peaceful Uses of Outer Space in its review of the implementation of the recommendations of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (A/59/174) and endorsed by the General Assembly in its resolution 59/2 of 20 October 2004, presented findings and proposed specific actions in areas that are important for strengthening and further developing the well-being and future of all nations. These actions include, among others, maximizing the benefits of the use and applications of global navigation satellite systems to support sustainable development, improving medical and public health services through the use of space technologies, developing a comprehensive, worldwide environmental monitoring strategy and improving the management of the Earth's natural resources.

2. Since 2001, the Office for Outer Space Affairs of the Secretariat has organized a series of regional workshops and international meetings to promote the use of Global Navigation Satellite Systems (GNSS). Those workshops and meetings presented the status of existing GNSS and their augmentations, as well as examples of GNSS applications that supported sustainable development. Information on those regional workshops and international meetings, including programme and background materials, are available at the website of the Office (www.unoosa.org/oosa/en/SAP/gnss/index.html).

3. The participants of the United Nations/United States of America International Meeting on the Use and Applications of Global Navigation Satellite Systems, held in Vienna from 13 to 17 December 2004, summarized the follow-up projects and initiatives that had been implemented since December 2003 and made a number of observations and recommendations in the areas of enhancing awareness and applications of GNSS technologies to increase their use to support sustainable development, in particular in developing countries.

4. At its forty-eighth session, in 2005, the Committee on the Peaceful Uses of Outer Space endorsed the programme of workshops, training courses, symposiums and conferences scheduled for 2006.¹ Subsequently, the General Assembly, in its resolution 60/99 of 8 December 2005, endorsed the United Nations Programme on Space Applications for 2006.

5. Pursuant to General Assembly resolution 60/99, the United Nations/Zambia/European Space Agency Regional Workshop on the Applications of Global Navigation Satellite System Technologies for Sub-Saharan Africa was held in Lusaka from 26 to 30 June 2006. Organized by the Office for Outer Space Affairs and the Ministry of Health of Zambia, the Workshop was co-sponsored by the European Space Agency (ESA) and hosted by the Ministry of Health on behalf of the Government of Zambia.

6. The Workshop built upon the work carried out by the Office for Outer Space Affairs in the framework of the United Nations Programme on Space Applications,

¹ *Official Records of the General Assembly, Sixtieth Session, Supplement No. 20* and corrigendum (A/60/20 and Corr.1), para. 94.

and addressed, inter alia, such space technology applications as remote sensing, precision agriculture and environmental management, telehealth and landscape epidemiology, with the aim of considering projects that could bring benefits to countries in sub-Saharan Africa.

7. The main objective of the Workshop was to present examples of GNSS applications that supported sustainable development. The specific objectives were (a) to increase awareness among managers and policy and decision makers about the potential benefits of applying GNSS technology to the areas of agriculture and environmental management, telehealth and landscape epidemiology, as well as civil aviation and land transportation; (b) to strengthen regional information and data-exchange networks on the use of GNSS technology; and (c) to develop regional or national pilot projects, or both, using this technology in the above areas for improving social development and economic growth.

8. The present report was prepared for submission to the Committee on the Peaceful Uses of Outer Space at its fiftieth session and to the Committee's Scientific and Technical Subcommittee at its forty-fourth session, both in 2007.

B. Programme

9. The opening ceremony of the Workshop included addresses by the Vice-President of Zambia on behalf of the Government of Zambia, the Minister of Health and Permanent Secretary of the Ministry of Health of Zambia and representatives of ESA and the Office for Outer Space Affairs.

10. The Workshop consisted of eight technical sessions, each focusing on specific issues. Presentations by invited speakers described current and future global space-based navigation and positioning systems and their applications and the status of ongoing international initiatives and experiences on GNSS implementation and uses. The Workshop addressed the use of GNSS in agriculture and environmental management, in telehealth and landscape epidemiology, and in civil aviation and land transportation. The Workshop also provided participants with an overview of available education and training in GNSS and its applications. In addition, participants from countries in the region presented information on their national institutions' activities related to GNSS applications and case studies. A total of 42 presentations were delivered by invited speakers from both developing and industrialized countries. Two working group sessions enabled further deliberation on issues concerning regional cooperative mechanisms and resources for implementing projects.

C. Attendance

11. A total of 85 participants from Australia, Burundi, Cameroon, Ethiopia, Germany, Ghana, Italy, Kenya, Madagascar, Malawi, Nigeria, Russian Federation, Senegal, South Africa, Swaziland, United Republic of Tanzania, Uganda, United States of America, Zambia and Zimbabwe attended the Workshop. The Office for Outer Space Affairs and ESA were also represented.

12. Funds provided by the United Nations, ESA and the Government of Zambia were used to cover the travel and living expenses of 15 participants, of whom six (40 per cent) were female participants from developing countries. The valuable contribution provided by the International Cartographic Association secured the presence of one of the international speakers.

II. Summary of presentations

13. The presentation sessions enabled participants to learn about the value of GNSS for a variety of applications and also stimulated discussion on the current status of the use and applications of GNSS technologies for the benefit of African countries. The presentations made at the Workshop are available at the website of the Office (<http://www.unoosa.org/oosa/en/SAP/gnss/index.html>).

14. The first presentation session provided an overview of the GNSS technologies currently being used in agriculture and the management of natural resources, telemedicine and landscape epidemiology, and transportation. Participants learned how the information derived from GNSS is integrated into other technologies such as geographic information systems (GIS), automated controls and sensing equipment for measuring, for example, crop yield or soil salinity. Participants also learned how telehealth technologies could help with diagnosis and treatment in difficult cases in isolated hospitals in remote rural areas, as well as provide learning opportunities for health workers. Participants were also given an overview of current and future developments and growth in GNSS-based application areas, including upgrades to the Global Positioning System (GPS) and infrastructure-based augmentations.

15. The second presentation session focused on policies and strategies for promoting sustainable development. There was a presentation on the work of the Office for Outer Space Affairs in the field of GNSS. Participants were informed about ongoing long-term projects on the establishment or further development of regional reference frameworks, emphasizing the African Geodetic Reference Framework project that aimed at a GNSS-compatible and homogeneous geodetic infrastructure for Africa. Participants were also provided with an overview of the European Geostationary Navigation Overlay Service (EGNOS), which includes the operational EGNOS extension for Africa that aims at demonstrating methods for safer aviation in the region. A concept named Alert Interface via EGNOS (ALIVE) for disaster prevention and mitigation was reviewed. It concerned the provision of early warning messages to citizens or government and local authorities in the event of a major disaster. Presentations were made on GPS of the United States and the Global Navigation Satellite System (GLONASS) of the Russian Federation; these provided status updates on GPS and GLONASS and their modernization programmes.

16. The third presentation session covered international initiatives on GNSS implementation and uses. Participants learned about the European Position Determination System (EUPOS), which is an international initiative aimed at the development of “full-scale accuracy” integrated differential GNSS (DGNSS) infrastructure in Central and Eastern Europe. Participants were also given an overview of the implementation of the Galileo European satellite-based navigation

programme initiatives in Piedmont and Turin, Italy. In addition, participants from Madagascar and Zambia provided information on their national GNSS-related activities and GNSS education programmes. The final presentation of the session was on GNSS application development, during which participants learned how a navigation system could be used for ecological monitoring and emergency city transport management. The benefits of the combined use of GPS and GLONASS were also presented.

17. The fourth presentation session dealt with GNSS implementation and uses in agriculture and environmental management. The first presentation focused on the use of remote sensing and GNSS in precision agriculture. The integrated use of GNSS, GIS and different satellite imagery to create spatial information was described. They can be used as “supporting guides” for adjusting inputs such as fertilizer and pesticide, as well as seeding rates in precision agriculture and for site-specific crop management. The widespread use and applications of GNSS in agricultural development in the United Republic of Tanzania were described. It was emphasized that the agricultural sector could benefit from the use of GNSS, a modern and interdisciplinary approach, to advance precision agriculture. Presentations were made by Australia, Kenya, Malawi and Nigeria. These provided further examples of the use of GNSS technology to implement regional infrastructure and land use planning for agricultural areas, as well as mapping and modelling of land degradation. In addition, GNSS implementation and uses in agriculture and environment in rural Africa were outlined by the United States.

18. The fifth presentation session was on GNSS implementation and uses in telehealth and landscape epidemiology. The South African experience in telemedicine was presented. A national telemedicine programme with the main objective of reducing differences in health care between urban and remote rural areas was described, as well as ongoing projects in clinical telemedicine and tele-education. It was noted that the aim of these projects was to improve patient access to specialists inside and outside a province, as well as to improve health professionals’ access to continuing education. The Telemedicine and Advanced Technology Research Center of the United States presented its work on grid technologies for biomedicine, which was involved with landscape epidemiology. A grid refers to the concept of sharing resources such as software and data of medical interest. It was also reported that, despite advances in modern medicine, diseases such as malaria and dengue fever still afflicted millions of people each year. Many such diseases were spread through infected mosquitoes and could cause widespread epidemics. Participants learned how advances in satellite remote sensing, global positioning and GIS made it easier to integrate ecological, environmental and other data for developing models that could be used in disease surveillance.

19. The sixth presentation session was on GNSS implementation and uses in civil aviation and land transportation. GNSS was highlighted as a system which, once implemented, would improve airline communications, navigation, surveillance and traffic management safety, reduce delays and costs, and lead to more efficient use of airspace. In addition to the GNSS-derived position, the use of high-resolution imagery and GIS in airport infrastructure management was demonstrated. It was recognized that many existing and new technologies could benefit from the incorporation of GNSS capabilities. A further presentation focused on the

applications of GNSS technologies in the transport sector. The participants were shown examples of current initiatives for improving Zimbabwe's transport infrastructure using GNSS. It was emphasized that it was important to spread satellite navigation know-how through institutes and research centres by giving the appropriate education to both experienced and inexperienced engineers.

20. The seventh presentation session was on education and training in the use and applications of GNSS technologies. The four presentations updated participants on education and training in global navigation and related applications, and research on and development of GNSS applications. Social and economic development in the countries of the region could be enhanced by the improvement of university educators' and scientists' skills and knowledge through rigorous theory, research, field exercises and pilot projects in GNSS technologies.

21. Finally, the session on case studies gave participants an additional opportunity to share their experiences in the use and applications of GNSS. Presentations were made on GNSS meteorology applications, satellite information applications in disaster management and emergency response in Malawi, the uses and applications of GNSS in environmental and resource management in the Niger Delta, GPS applications for GIS purposes in Swaziland, applications of GNSS and remote sensing for environmental sustainability, and GNSS applications for mineral exploration in Zambia.

III. Conclusions and recommendations

22. Two discussion sessions were held as part of the Workshop for the purpose of identifying follow-up projects and activities aimed at enhancing regional cooperation in the conduct of projects and activities of common interest and exchanging information and experiences. The sessions were designed to give participants an opportunity to share and understand the issues and concerns relating to the use and applications of GNSS, and to work together to define a framework for a mechanism of regional cooperation.

23. In recognition of the various ongoing projects and programmes of relevance to the region, the Workshop agreed on actions to further strengthen a reference system for Africa through the African Geodetic Reference Frame project, with the commitment of African nations and the support of international partners.

24. It was therefore recommended that demonstration projects be initiated by EUPOS on "full-scale accuracy" DGNSS infrastructure in order to enhance cooperation with ongoing projects and programmes and with a view to developing a partnership with these projects and programmes for the benefit of the countries in sub-Saharan Africa.

25. Participants identified the following four projects that would systematize best practices (knowledge- and information-sharing), enabling GNSS technologies to be transferred between countries throughout the region.

Project 1. Needs assessment for preparation of effective cooperation and networking

26. The objective of the needs assessment project is to assess the needs and readiness for cooperation and networking of countries in the sub-Saharan African region by assessing national policies, logistical structure, resources (human and financial), technological capabilities and infrastructure related to the applications of GNSS and to identify common interests in and actions to be taken for cooperation and networking in the area of GNSS applications.

27. The assessment will be used as the initial step in understanding each country's needs for preparation of effective cooperation and networking in the area of GNSS application projects and activities. After completion of the needs assessment, an implementation plan could be established.

28. Participants whose countries did not have an integrated implementation plan or policy were (a) invited to carry out this assessment for their own countries, (b) encouraged to create their own teams within their respective countries and implement the study using their own national resources, (c) encouraged to use e-mail to share information and exchange experiences during the assessment phase, (d) requested to provide their respective URL addresses to the Office for Outer Space Affairs to enable information to be exchanged among the national team leaders, team partners and the Office for Outer Space Affairs, together with the names and full contact addresses of the national contact points.

Project 2. Mapping and data access

29. The mapping and data access project is aimed at applying remote sensing, GIS and satellite-based GPS in various fields such as forest-area estimation and mapping, forest-fire monitoring and assessment, flood-mapping and -damage assessment, land use and land cover classification and mapping, geology, hydrology, meteorology and infectious-disease mapping.

30. The participants will jointly conduct this project in various applications and determine together the scope, schedule, end product and financial resources of the project. The Office for Outer Space Affairs will maintain quarterly communication with all team leaders on the status of the project.

Project 3. Capacity-building in GNSS education and training

31. The objective of the GNSS education and training capacity-building project is to raise awareness among managers and policy and decision makers of the potential benefits of GNSS applications in terms of national economic growth and social development, and to provide continuous training to experts, educators and end-users on the use and applications of GNSS technologies.

32. The Workshop recommended that participants work with the Office for Outer Space Affairs to draw up a plan and a list of point(s) of contact for establishing an e-library that would contain training materials, proposals, a calendar of GNSS-related training courses and Web linkages to other e-libraries and information resources. Additionally, the Office should consider the use of the Regional Centres for Space Science and Technology Education, affiliated to the United Nations, to promote GNSS use and applications.

Project 4. Telehealth

33. A few nations in the region have initiated planning for a communications-satellite-based telehealth programme. However, several nations have the capacity to provide telehealth services using a landscape epidemiology approach employing GNSS technologies. Therefore, the telehealth project includes both approaches and has the common goal of improving public health via space technologies.

34. Since the telehealth application was new to the majority of the GNSS Workshop participants and requires collaboration across two fields, “tele” and “medicine”, participants were encouraged to contact their national health departments or agencies and request the nomination of representatives, with a view to project teams being led jointly by one expert in space technology and one medical expert.
