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Report on the United Nations/International Astronautical Federation Workshop on Education and Capacity-Building in Space Technology for the Benefit of Developing Countries, with an Emphasis on Remote Sensing

(Bremen, Germany, 25-27 September 2003)

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I. Introduction

A. Background and objectives

1. The Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), and the Vienna Declaration on Space and Human Development that emanated from it, recommended that activities of the United Nations Programme on Space Applications promote collaborative participation among Member States at both the regional and international levels, emphasizing the development of knowledge and skills in developing countries.[1] At its forty-fifth session, in 2002, the Committee on the Peaceful Uses of Outer Space endorsed the programme of workshops, training courses, symposiums and conferences planned for 2003 under the United Nations Programme on Space Applications.[2] Subsequently, the General Assembly, in its resolution 57/116 of 11 December 2002, endorsed the activities of the Programme for 2003.

2. The present report contains a summary of the discussions at the United Nations/International Astronautical Federation Workshop on Education and Capacity-Building in Space Technology for the Benefit of Developing Countries, with an Emphasis on Remote Sensing. Organized by the Office for Outer Space Affairs as part of the 2003 activities of the United Nations Programme on Space Applications, the Workshop was co-sponsored by the International Astronautical Federation (IAF), the European Space Agency (ESA) and the Government of Germany. It was the thirteenth workshop in the series and was held in Bremen, Germany, in conjunction with the fifty-fourth Congress of IAF, also held in Bremen. Organizational and programme support was provided locally by the University of Bremen.

3. Space technology and its applications have been widely recognized as a major instrument for enhancing human ability to understand the environment and manage natural resources. Data from existing and future Earth observation satellites can be used to address issues of social and economic importance in such areas as land use management, the management of renewable and non-renewable resources, disaster management and mitigation, global health and agricultural and fishery management. Remote sensing is an essential tool to support efforts to achieve sustainable development and capacity-building in developing countries in general.

4. The deliberations of the 12 previous United Nations/IAF workshops, held from 1991 to 2002, have demonstrated that, while the potential benefits of remote sensing technology are generally recognized in developing countries, experience has shown that the successful implementation and use of that technology is subject to the resolution of some major issues, including the continuous development of human resources.

5. The objective of the present Workshop was to address those and related issues and to discuss how capacity-building in remote sensing applications and remote sensing education could help benefit developing countries. The Workshop provided a forum for discussion between space experts, policy makers and decision makers and representatives of the academic community and private industry. Participants were encouraged to share their experience and to examine opportunities for better cooperation.

6. The present report includes the background and objectives of the Workshop, as well as a summary of the discussions, observations and conclusions of the participants. It has been prepared for submission to the Committee on the Peaceful Uses of Outer Space at its forty-seventh session and to its Scientific and Technical Subcommittee at its forty-first session, both in 2004. Participants will report to the appropriate authorities in their own countries.

B. Programme

7. The programme of the Workshop focused on capacity-building in space technology through education, research and application, with an emphasis on remote sensing. It included two plenary meetings (the opening and closing sessions) and six presentation meetings held in two parallel sessions. The first session was entitled "Capacity-building in space technology through research and application" and included 26 presentations, while the second was on "Capacity-building in space technology through education" and included 21 presentations.

8. Two keynote addresses were given during the opening plenary session by U. R. Rao (India) and K. Doetsch (Canada) on "Capacity-building towards achieving food and environmental security using remote sensing" and "Education and training for achieving economic security by bridging the digital divide", respectively. Opening statements were made by representatives of the University of Bremen, ESA, IAF and the Office for Outer Space Affairs. Closing remarks were made by representatives of IAF, including its President, as well as representatives of the German Aerospace Center (DLR), the International Institute of Space Law (IISL), the International Academy of Astronautics (IAA), the Committee on Earth Observation Satellites (CEOS) and the Office for Outer Space Affairs.

9. The presentations made during the Workshop included case studies of the use of space technologies in natural resource management, disaster management, management of water resources, environmental protection and food security. Educational initiatives and the role of education and capacity-building in space technology in developing countries were also presented at the Workshop. The directors of three regional centres for space science and technology education, affiliated with the United Nations (two from Africa and one from Latin America and the Caribbean), also participated and informed participants of the latest status of and challenges faced by the regional centres.

10. Each of the six presentation meetings was followed by comprehensive discussion with the objective of developing conclusions and recommendations. The results of those discussions were summarized and presented by each chairperson at the closing plenary session, at which a final discussion was held and the conclusions and recommendations resulting from the Workshop were formulated.

11. Twenty-nine presentations were made by representatives of the African Regional Centre for Space Science and Technology Education—in English Language, the African Regional Centre for Space Science and Technology—in French Language, the Asian Institute of Technology (AIT), the Canadian Space Agency, CEOS, the Earth Observation Applications Department and the Education Office of ESA, the European Aeronautic Defence and Space Company (EADS) Astrium of Germany, the General Organization of Remote Sensing of the Syrian

Arab Republic, the German Remote Sensing Data Centre, the Hashemite University of Jordan, the Indian Institute of Technology Kanpur, the Indian Space Research Organization, the Instituto Nacional de Pesquisas Espaciais of Brazil, the National Aerospace Agency of Azerbaijan, the National Council for Science and Technology of Kenya, the National Oceanic and Atmospheric Administration of the United States, the Regional Centre for Space Science and Technology Education for Latin America and the Caribbean, the Remote Sensing and Communication Centre, Gujarat, India, the Romanian Space Agency, the Russian Academy of Sciences, the Space Generation Advisory Council, Stockholm University, Surrey Satellite Technology Ltd. (United Kingdom of Great Britain and Northern Ireland), the Universidad Tecnológica Centroamericana, the Universiti Teknologi Malaysia, the Vikram Sarabhai Space Centre (India) and the Office for Outer Space Affairs. In addition, 18 participants, mainly from developing countries, made presentations on the status of space technology applications in their respective countries.

12. The programme of the Workshop was developed jointly by the Office for Outer Space Affairs and the Workshop's programme committee, which included highly regarded and experienced representatives of a number of national space agencies, international organizations and academic institutions, with a substantial contribution from the Workshop's honorary committee, which consisted of prominent members of IAF, DLR, the International Space University (ISU) and the Office for Outer Space Affairs. The input received from both committees, as well as direct participation of members of the committees in the Workshop, ensured that the aims of the Workshop were achieved.

13. The detailed programme of the Workshop and its proceedings, along with a list of participants, have been made available on the web site of the Office for Outer Space Affairs (www.oosa.unvienna.org/SAP/act2003/iaf/index.html).

C. Attendance

14. The United Nations, on behalf of the co-sponsors, invited developing countries to nominate candidates for participation in the Workshop. Participants were required to have a university degree or well-established professional working experience in a field related to the overall theme of the Workshop and were also selected on the basis of their working experience in programmes, projects or enterprises that were already using space technology applications or that could potentially benefit from using space technology. The participation of specialists at a decision-making level from both national and international entities was specifically encouraged.

15. The Office for Outer Space Affairs received over 120 applications for participation from more than 50 developing countries.

16. Funds allocated by the United Nations, the United Nations Educational, Scientific and Cultural Organization (UNESCO), ESA, IAF and the Government of Germany for the organization of the Workshop were used to cover the international air travel and per diem expenses of 23 speakers and participants from developing countries and countries with economies in transition. An additional 12 participants were provided partial funding to cover either air travel or per diem expenses or the cost of registration to participate in the 54th International Astronautical Congress, held immediately after the Workshop. These 35 participants funded in full or in part

came from 29 countries. The co-sponsors covered the cost of Congress registration fees for 30 participants from developing countries.

17. The Workshop was attended by 85 participants from the following 37 countries: Algeria, Angola, Azerbaijan, Brazil, Bulgaria, Canada, Colombia, Egypt, Ecuador, Germany, Guatemala, Honduras, India, Jamaica, Japan, Jordan, Kenya, Lesotho, Malaysia, Mexico, Morocco, Namibia, Nepal, Nigeria, Pakistan, Romania, Russian Federation, South Africa, Sri Lanka, Sweden, Syrian Arab Republic, Thailand, Turkey, Uganda, United Kingdom, United Republic of Tanzania and United States. The following regional and international organizations were also represented at the Workshop: ESA, IAA, IAF, IISL, ISU, UNESCO and the Office for Outer Space Affairs.

II. Observations and conclusions

18. Participants reiterated that space infrastructure, used in conjunction with ground-based systems, including appropriate education systems, was essential to providing food and environmental security, effective management of water resources and natural disaster mitigation in order to achieve sustainable development.

19. Participants also agreed that major efforts were required to build awareness among decision makers and policy makers in developing countries of the benefits of space technology for sustainable development.

20. The participants noted that it was necessary to match space capabilities with priority issues or problems identified and to develop plans of action to use space applications in order to meet targets and thus help alleviate poverty. The plans of action should include short- and mid-term activities in research and development that were realistic, limited in time and would have the potential to demonstrate a possible mechanism for the introduction of space applications that would become operational in a sustainable manner.

21. It was emphasized that capacity-building could not be achieved in a short period of time. In particular, capacity-building through education should be conducted in developing countries with a long-term perspective. Participants identified a number of issues and problems that limited education in, and the penetration and application of, space technology in developing countries and discussed possible solutions and action to be taken. In some cases, appropriate lead agencies and partners were identified and possible methodologies suggested.

22. The main obstacles to the use of space technology identified by participants could be classified according to the following categories:

(a) Insufficient capacity to use space technology at the local level, where the direct benefits of the technology could be realized;

(b) Insufficient awareness among decision makers and policy makers in developing countries of the benefits of space technology in capacity-building;

(c) Lack of appropriate, accurate and timely data and limited availability of equipment and facilities, which prevented the application of space technologies.

23. During the discussion sessions and plenary meetings, participants formulated the observations, conclusions and recommendations below. Although their observations and conclusions focused on remote sensing applications, analogies could be drawn for other space technologies.

A. Enhancing capacity to apply remote sensing technology at the local level

24. An environment supportive of the use of space technology in sustainable development should be ensured by:

(a) Capitalizing on the capacity of the United Nations system to coordinate activities and to collect and distribute information related to space applications for sustainable development, including preparation for the five-year review of UNISPACE III and associated activities of appropriate action teams;

(b) Supporting and encouraging space-related training and educational activities of the United Nations and other international and national organizations, including those provided through the regional centres for space science and technology education, affiliated with the United Nations;

(c) Organizing a workshop on capacity-building in space technology in 2005.

25. The infrastructure developed by UNESCO for distributing information and initiating education and training development programmes should be fully utilized in order to improve education and capacity-building in space technology.

26. Participants stressed that the activities resulting from UNISPACE III, the World Summit on Sustainable Development, held in Johannesburg, South Africa, from 26 August to 4 September 2002, and initiatives of CEOS that related to the development of a worldwide capacity for applying space technology for the benefit of society should be identified, coordinated and, where possible, integrated.

27. A comprehensive set of human resource development principles, which was crucial for effective capacity-building in space technology, should be considered and include the following components: education; research and development; pilot projects; user involvement; review; leadership; participation of industry; participation of the academic community; human resource development; and international cooperation.

28. Creative modes of training using practical applications as training projects were recognized as effective. The benefit of training should be further enhanced by conducting follow-up pilot projects. There was a need for a pool of experts, facilities and funding to be available for training and other outreach purposes. To improve the transfer of space technology between different countries and regions, glossaries of space technology terms should be developed in local languages. Post-training support from national Governments was essential to ensure that the benefits of training were maximized.

29. Space technology curricula should be developed to bring together users and suppliers at the decision-making and implementation levels, while incorporating key stakeholders in the development phase. Aspects of space technology should be incorporated into existing school curricula in order to attract students to

space-related careers. Educational materials must be credible and reflect phenomena that were familiar to participants and related to their areas of interest, while also presenting both the limitations and the advantages of the technology. Existing resources should be utilized in the development of educational materials.

B. Improving the awareness of decision makers

30. Participants stressed the need to create awareness at the decision-making level. The transfer of remote sensing technology to stakeholders for implementation was dependent on decision makers, who were often unaware of the benefits of remote sensing.

31. An environment supportive of general awareness among decision makers, leaders of industry, development and funding agencies and the general public that the benefits of space technology were crucial to achieving sustainable development should be established in developing countries. It could be achieved through outreach programmes that gained:

(a) General support from national Governments and the private sector;

(b) Specific support of pilot projects to raise awareness and to demonstrate the economic benefit of using space technology at the local level;

(c) Funding for activities that included the use of remote sensing information in development planning and projects.

32. Cost-benefit analysis should be used to demonstrate to decision makers the economic benefits of using remote sensing technology and to obtain their support. Performance measures that defined the success of space application efforts and that encouraged support from outside the space community should be developed. Independent evaluators and assessors from funding agencies should be sought to measure the benefits of remote sensing applications in achieving sustainable development in order to develop user demand for space-derived information.

C. Improving access to data and information and increasing the availability of equipment and facilities

33. Participants considered that it was necessary to develop a demand for space-derived information from organizations with a mandate to achieve sustainable development, including the various government departments responsible for resource development, agriculture, development of capacity, foreign aid and safeguarding the environment.

34. Space-related information should be made more accessible by:

(a) Cataloguing the available sources of space-derived information;

(b) Coordinating the distribution of materials, including educational and teaching materials, as appropriate;

(c) Identifying users who needed access to space-derived information;

(d) Developing mechanisms for sharing that information.

35. An information- and data-sharing network that could be provided by the regional centres for space science and technology education, affiliated with the United Nations, should be considered as a suitable mechanism for providing better access to space-related information and satellite data.

36. Although the benefits of remote sensing have long been realized in developing countries, capacity-building in those regions had been hindered by the limited availability of facilities and funding. The United Nations, CEOS and other international and national organizations should be supported in their efforts to encourage international partnerships, especially the transboundary sharing of space infrastructure and information.

37. In addition to the technical conclusions, participants also recommended that the United Nations/IAF series of workshops be used as an important instrument in implementing the recommendations of UNISPACE III.

Notes

[1] See *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, and chap. II, para. 409 (d) (i).

[2] *Official Records of the General Assembly, Fifty-seventh Session, Supplement No. 20* (A/57/20), para. 56.