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**Committee on the Peaceful
Uses of Outer Space**

Report on the Thirteenth United Nations International Training Course on Remote Sensing Education for Educators

(Stockholm and Kiruna, Sweden, 5 May-13 June 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), in particular through its Vienna Declaration on Space and Human Development,¹ recommended that activities of the United Nations Programme on Space Applications should promote collaborative participation among Member States at the regional and international levels, emphasizing the development of knowledge and skills in developing countries.

2. 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 2003.² Subsequently, the General Assembly, in its resolution 57/116 of 11 December 2002, endorsed the United Nations Programme on Space Applications for 2003.

3. Pursuant to General Assembly resolution 57/116 and in accordance with the recommendation of UNISPACE III, the Thirteenth United Nations International Training Course on Remote Sensing Education for Educators was held at Stockholm and Kiruna, Sweden, from 5 May to 13 June 2003. The training course was organized by the United Nations Programme on Space Applications, in cooperation with the Government of Sweden, as part of the 2003 activities of the Office for Outer Space Affairs. As was the case for the 12 previous courses in the series, the course in 2003 was conducted specifically for the benefit of educators from developing countries with the objective of enabling them to introduce remote sensing courses in their respective academic institutions. It was co-sponsored by the Swedish International Development Cooperation Agency (Sida) on behalf of the Government of Sweden and was hosted by the Department of Physical Geography and Quaternary Geology of Stockholm University in Stockholm and by Metria Satellit AB (formerly SSC Satellitbild) in Kiruna.

4. The present report describes the organization of the training course, its technical contents, the results of the course evaluation and proposed follow-up action. It has been prepared for consideration by the Committee on the Peaceful Uses of Outer Space at its forty-seventh session and by its Scientific and Technical Subcommittee at its forty-first session, in 2004. Participants have reported on the knowledge acquired and on the work conducted during the course to the appropriate authorities of the Government, universities and research institutions in their respective countries.

B. Organization and programme

5. Application forms and information brochures on the training course were sent out in November 2002 by the Office for Outer Space Affairs to the permanent missions to the United Nations (Vienna) of 53 developing countries. Copies were also sent to the local offices of the United Nations Development Programme in those countries for transmission to the relevant national authorities. The same materials were distributed simultaneously to relevant Swedish embassies and to previous course participants for circulation in their academic institutions. A total of

183 completed applications from 43 developing countries were subsequently received and processed jointly by the Office for Outer Space Affairs and Stockholm University.

6. Twenty-seven candidates, including 15 women, were selected as participants from the following 25 countries: Argentina, Bangladesh, Bhutan, Brazil, Cambodia, Colombia, Ethiopia, Ghana, Guatemala, Haiti, Honduras, Jamaica, Kenya, Malawi, Mongolia, Namibia, Nepal, Peru, South Africa, Sri Lanka, Thailand, Uganda, United Republic of Tanzania, Viet Nam and Zimbabwe. Funds for the international travel of 13 participants were provided from the fellowship budget of the United Nations Programme on Space Applications. Support for the international travel of the remaining 14 participants, as well as the cost of room and board, course materials and inland transport for all 27 participants, was provided by the Government of Sweden. The European Space Agency (ESA) funded the participation of one course instructor.

7. Course instructors and speakers came from several institutions, including ESA, the Ministry of Foreign Affairs of Sweden, Sida, Stockholm University, the Swedish National Space Board, the Swedish Royal Institute of Technology, Uppsala University, L and L Monitor AB, Metria Satellus AB and the Office for Outer Space Affairs.

II. Summary of the contents of the course

8. Except for minor modifications to reflect technological advances and feedback received during annual course evaluations, the core content and structure of the course have not changed significantly over the years. The course is modular in format and consists of a series of lectures and office and field exercises. A more detailed summary of the contents of the course can be found in the report on the fifth course in the series (A/AC.105/617).

9. The first technical module of the course, which lasted four days, dealt with the fundamental principles of remote sensing. The principal topics covered were electromagnetic radiation, the reflective properties of various types of materials on the surface of the Earth and elementary optics; electronic imaging; georeferencing of objects in the field, on maps and on satellite imagery; Earth resources and environmental satellites and remote sensing for land degradation studies. A special presentation on gender awareness was also delivered during that part of the course.

10. The next 10 days were subsequently devoted to image interpretation, digital image processing and analysis and geographic information systems (GIS). That part of the programme also included presentations on the introduction to visual interpretation and in-service training in developing countries and on applications of remote sensing.

11. To reinforce understanding of the principles of image interpretation, participants were divided into groups on a regional basis; each group studied a case where visual interpretation of satellite images played a key role.

12. Other aspects of the technical module covered digital analysis (theory); computer image enhancement (theory); GIS theory; and digital image processing

techniques, including computer-aided analysis, GIS applications, CD-ROM data capture and global navigation satellite systems (GNSS).

13. During the next part of the course which was held in Skinnskatteberg in southern Sweden, participants were also introduced, over a period of five days, to the principles of radar image formation and the use of such images in various development and research applications. There were also lectures on and practical training in GIS. In addition, the participants were introduced to the use of appropriate procedures for the field verification of interpretation of remotely sensed data using Landsat TM images of the Skinnskatteberg area.

14. The next part of the course was held in Kiruna, at the facilities of Metria Satellus AB. Six days were reserved for visual interpretation of satellite images and the use of satellite imagery in project planning exercises and presentation of results, as well as for digital classification of satellite images and comparison of results of visual and digital interpretation. Wherever possible, those exercises were carried out on images selected by the participants of areas of their countries with which they were familiar. Lectures were also given on archiving, catalogue updating and standard production of images; selecting satellite products; value-added production, radiometric and geometric corrections and digital elevation model production; and future Earth resource satellites.

15. While in Kiruna, technical visits were arranged for the participants to a number of sites of interest, including the ESA/Salmijärvi and Esrange satellite receiving stations. Lectures were supplemented by a tour at the production facilities of Metria Satellus AB.

16. The final part of the course concerned the development of remote sensing curricula and was held over a period of three days in Stockholm at the Department of Physical Geography and Quaternary Geology of Stockholm University. The participants worked in small groups set up on a regional basis and on the last day of that part of the course each group presented a sample remote sensing curricula project, which, in addition to educational content, included such components as necessary teaching staff and equipment and the required budget. The participants also received sets of teaching material that included books, teacher's notes, slides and images, as well as a compact disc (CD) with satellite data and GIS and image-processing software.

III. Course evaluation

17. On the last day of the course, during a half-day evaluation session, participants made a formal presentation of the course evaluation to representatives of the Office for Outer Space Affairs, Sida, Stockholm University and several course lecturers. Discussions following the formal presentation by a representative of the course participants allowed additional inputs to be made by all participants.

18. During the formal presentation and discussions, participants emphasized that the training programme was well organized and that the course had achieved its major goal. They also made some suggestions, which they believed would improve the programme of the course in the future. The main suggestions and recommendations made were as follows: (a) more time should be allocated for

practical exercises on radar data processing; (b) more time should be devoted in the future to digital image processing and GIS subjects; and (c) during practical exercises at the personal computer laboratory, the course should be divided into two groups, one for advanced users and one for beginners, to make better use of time.

19. In order to evaluate the general organization of the training programme, a questionnaire prepared by Sida was distributed to participants during the final part of the course. The opinions of the participants (based on replies to the questionnaire submitted by 24 participants) could be summarized as follows: (a) 67 per cent of participants thought the course was the right length; (b) 17 per cent found the schedule too heavy, while 75 per cent thought the daily schedule was just right; (c) 75 per cent found that the theoretical training corresponded to their professional needs to a large or very large extent and 55 per cent said the same about the practical training; (d) 100 per cent found the overall level of the programme to be adequate from their professional point of view; (e) 50 per cent found that there were subjects not adequately covered in the programme, most of them indicating that those subjects were microwave remote sensing, digital techniques and GIS; (f) 96 per cent found the methods of instruction to be good or very good; and (g) 59 per cent found the content of the programme relevant to their professional environment to a large or very large extent, and 58 per cent thought that they would have an opportunity to apply the newly acquired knowledge and experience in their current employment to a large or very large extent.

20. The feedback received from the exercise would be taken into account in the development of the course programme for 2004, as was the case with recommendations made by participants in 2002, which had led to a half-day extension devoted to computer-based practical exercises in Skinnskatteberg in 2003, as well as to a larger amount of teaching materials, data and software made available on CDs prepared by Stockholm University and given to the participants at the end of the course.

21. At the conclusion of the discussions, the participants expressed their appreciation to the Government of Sweden, Sida, Stockholm University and the United Nations for providing them with an opportunity to participate in the training programme.

IV. Follow-up action

22. The report on the survey of local impact of the United Nations/Sweden international training course series on remote sensing education for educators (1990-2000) (ST/SPACE/9) contained examples of follow-up action that could be taken in order to increase the success of the programme in the future and to enhance the local impact of the United Nations/Sweden training course series.

23. Pursuant to that report, the Office for Outer Space Affairs and Stockholm University developed and submitted to Sida in June 2003 a proposal on a follow-up evaluation exercise, the primary goals of which were to evaluate the local impact of the series of the training courses held from 1990 to 2003, find out the major reasons for their high or low rates of success in implementing the knowledge received in Sweden and to identify the nature and scope of possible support, in order to ensure that ongoing efforts had established firm roots within the educational communities

in developing countries. Such an evaluation would also enable the content and format of the current course to be reviewed, with a view to implementing any changes that might be deemed necessary.

24. The proposal included two joint United Nations/Stockholm University/Sida evaluation missions (one to the region of the Economic and Social Commission for Asia and the Pacific, and another to the region of the Economic Commission for Latin America and the Caribbean) in 2004 to academic institutions that had benefited from the participation of their staff in the training courses. The missions would be followed by regional evaluation workshops in the period 2004-2005 allowing an upgrade of the participants' knowledge of current remote sensing techniques and teaching methods.

25. As suggested in the above-mentioned report (ST/SPACE/9), the Office for Outer Space Affairs continued the practice of selecting qualified former participants in the course for participation in other activities organized by the United Nations Programme on Space Applications. In 2003, four former participants benefited from participation in the United Nations/International Astronautical Federation Workshop on Education and Capacity Building in Space Technology for the Benefit of Developing Countries with emphasis on remote sensing applications, and in the fifty-fourth International Astronautical Congress, both of which were held in Bremen, Germany, at the end of September 2003.

26. Stockholm University was also working on the adjustment of the course programme to meet the increasing demand for more computer-based education, as well as on the preparation of CDs with data and software that could be used by former participants for teaching and research purposes. In addition, the participants were provided with the education curriculum for remote sensing and the geographic information system (ST/SPACE/18), prepared by the Office for Outer Space Affairs for the regional centres for space science and technology education, affiliated to the United Nations. The document contained well-developed education curricula for nine-month postgraduate programmes in remote sensing and GIS, which could prove extremely useful to participants subsequently to introducing remote sensing courses in their respective academic institutions.

27. Stockholm University and the Office for Outer Space Affairs also continued the practice of selecting well-qualified representatives of universities in developing countries on a repeat basis, in order to develop a "critical mass" of knowledgeable educators in those institutions.

Notes

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.

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