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**Committee on the Peaceful
Uses of Outer Space****Report on the Fourteenth United Nations/Sweden
International Training Course on Remote Sensing
Education for Educators****(Stockholm and Kiruna, Sweden, 3 May-11 June 2004)**

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I. Introduction

A. Background and objective

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-sixth session, in 2003, the Committee on the Peaceful Uses of Outer Space endorsed the programme of workshops, training courses, symposiums and conferences planned for 2004.² Subsequently, the General Assembly, in its resolution 58/89 of 9 December 2003, endorsed the United Nations Programme on Space Applications for 2004.

3. Pursuant to General Assembly resolution 58/89 and in accordance with the recommendation of UNISPACE III, the Fourteenth United Nations/Sweden International Training Course on Remote Sensing Education for Educators was held in Stockholm and Kiruna, Sweden, from 3 May to 11 June 2004. The training course was organized by the Office for Outer Space Affairs of the Secretariat in cooperation with the Government of Sweden as part of activities carried out in 2004 within the framework of the United Nations Programme on Space Applications. As was the case for the 13 previous courses in the series, the course in 2004 was conducted 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 Satellus 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 actions. It has been prepared for consideration by the Committee on the Peaceful Uses of Outer Space at its forty-eighth session and by its Scientific and Technical Subcommittee at its forty-second session, in 2005. Each participant reported on the knowledge acquired and on the work completed during the course to the appropriate authorities of the Government of and university or research institution in his or her country.

B. Organization and programme

5. Application forms and information brochures on the training course were sent out in November 2003 by the Office for Outer Space Affairs to the permanent missions to the United Nations (Vienna) of 51 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 209 completed applications from 41 developing countries were subsequently received and processed jointly by the Office for Outer Space Affairs and Stockholm University.

6. Twenty-seven candidates, including 12 women, were selected as participants from the following 27 countries: Argentina, Bangladesh, Bhutan, Brazil, Cambodia, Chile, Colombia, Costa Rica, Ethiopia, Guatemala, Honduras, Kenya, Malawi, Mongolia, Mozambique, Nepal, Nigeria, Pakistan, Senegal, Sri Lanka, Swaziland, United Republic of Tanzania, Thailand, Trinidad and Tobago, Uganda, Uruguay and Viet Nam. 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 course content

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 laboratory 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 second module, which took place over the following 10 days, was devoted to image interpretation, digital image processing and analysis and geographic information systems (GIS). The module included presentations on visual interpretation, the introduction of in-service training in developing countries and 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 cases in which visual interpretation of satellite images had played a key role.

12. Other aspects of the second 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 third module, which was held in Skinnskatteberg, 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 thematic mapper images of the Skinnskatteberg area.

14. The fourth module was held in Kiruna, at the facilities of Metria Satellus AB. Six days were reserved for the visual interpretation of satellite images and the use of satellite imagery in project-planning exercises and the presentation of results, as well as for the digital classification of satellite images and the 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 of the production facilities of Metria Satellus AB.

16. The fifth and final module 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 whose members were selected on a regional basis and, on the last day of module five, each group presented a sample remote sensing curriculum project, which, in addition to educational content, included such components as the necessary teaching staff, equipment and budget.

17. The participants also received sets of teaching materials that included books, teacher's notes, slides and images, as well as four compact discs (CDs) with satellite data and GIS and image-processing software. In addition, the participants were given copies of a document, entitled "Remote Sensing and the Geographic Information System: education curriculum" (ST/SPACE/18), which had been 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 education curricula for nine-month postgraduate programmes in remote sensing and GIS and was intended to assist participants in introducing remote sensing courses in their respective academic institutions.

III. Course evaluation

18. On the final 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.

19. During the formal presentation and discussions, the participants emphasized that the training programme had been well organized and that the course had achieved its major goal. They made suggestions for improvements to future courses. The main suggestions and recommendations made were as follows: (a) more time should be allocated for gender-awareness lectures; (b) more time should be devoted to practical exercises on radar data processing and GIS topics; and (c) some teaching materials and imagery should be sent to participants in advance to allow them to prepare for the practical exercises held in Sweden.

20. 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 20 participants) could be summarized as follows: (a) 75 per cent of participants thought the course had been the right length; (b) 45 per cent had found the schedule too heavy, while 55 per cent thought that the daily schedule had been just right; (c) 70 per cent found that the theoretical training had corresponded to their professional needs to a large or very large extent and 60 per cent said the same about the practical training; (d) 85 per cent found the overall level of the programme to be adequate from their professional point of view; (e) 75 per cent found that certain topics, such as microwave remote sensing, digital techniques and GIS, had not been adequately covered in the programme; (f) 80 per cent had found the methods of instruction good or very good; and (g) 65 per cent had found the content of the programme relevant to their professional environment to a large or very large extent; and 60 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.

21. The feedback received from the exercise would be taken into account by the co-organizers of the course in the development of future course programmes, as had been the case with recommendations made by participants in 2001 and 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 being made available on CDs prepared by Stockholm University and given to the participants at the end of the course.

22. 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 actions

23. In 2003, Sida approved a proposal, jointly developed by the Office for Outer Space Affairs and Stockholm University, for a follow-up evaluation exercise, the primary goals of which were to evaluate the local impact of the series of training courses held from 1990 to 2003, identify the major reasons for high or low rates of success on the part of the participants in making effective use of the knowledge received in Sweden, and determine the nature and scope of support that could be

provided in order to ensure that participants from developing countries succeeded in transferring the knowledge gained to their educational communities.

24. The exercise comprised two joint United Nations/Stockholm University evaluation missions (one to the Asian and Pacific region and the other to the Latin American and Caribbean region) to a number of academic institutions whose staff had participated in training courses held between 1992 and 2003, to be followed by two regional evaluation workshops, scheduled for 2004 and 2005.

25. The mission to the Asian and Pacific region covered Nepal, Sri Lanka and Thailand and was carried out in February 2004. Representatives of the Office for Outer Space Affairs and Stockholm University visited nine universities and organizations in those countries and met with 25 former participants of the courses, as well as with members of the administration of their respective academic institutions. During the mission to the Latin American and Caribbean region in March 2004, representatives of the Office for Outer Space Affairs and Stockholm University visited nine universities and organizations in Brazil, Colombia and Costa Rica, and met with 13 former participants and with members of the administration of their respective academic institutions. During the missions, education curricula designed by and ongoing research projects carried out by former participants were reviewed. In addition, facilities and laboratories used for remote sensing education at the respective academic institutions were visited and evaluated. The results of the missions were used for the preparation of the regional evaluation workshops.

26. The first evaluation workshop, entitled “United Nations/Space and Upper Atmosphere Research Commission Regional Seminar on Monitoring and Protection of the Natural Environment: Educational Needs and Experience Gained from United Nations/Sweden Training Courses on Remote Sensing Education for Educators”, was held in Islamabad from 30 August to 4 September 2004 for the benefit of former participants in the United Nations/Sweden courses from the Asian and Pacific region. The second evaluation workshop will be held in São José dos Campos, Brazil, at the Brazilian campus of the Regional Centre for Space Science and Technology Education in Latin America and the Caribbean, affiliated to the United Nations, from 21 to 25 February 2005, for the benefit of the former participants in the course from the Latin American and Caribbean region.

27. The objectives of the evaluation workshops are:

(a) To evaluate the impact of the courses in terms of course objectives met and identify the factors that favour or frustrate the attainment of those objectives;

(b) To review the current course content and format based on the experience and needs of former participants in order to improve the course for future participants;

(c) To assess what support, if any, is required to promote the success of projects developed by the former participants and what technical assistance might be required by their institutions;

(d) To upgrade the participants’ knowledge of current remote sensing techniques and advanced teaching methods;

(e) To provide former participants with an opportunity to meet and exchange experiences with fellow participants from their region.

28. The outcome of the evaluation exercise will be used by the co-sponsors of the course series to improve the course for future participants and to determine the nature and scope of possible support to ensure that participants from developing countries succeed in transferring the knowledge gained to their educational communities.

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-eighth Session, Supplement No. 20 (A/58/20)*, para. 75.
