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COMMITTEE ON THE PEACEFUL USES
OF OUTER SPACE

REPORT OF THE UNITED NATIONS EXPERT ON SPACE APPLICATIONS TO THE SCIENTIFIC AND TECHNICAL SUBCOMMITTEE

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INTRODUCTION

1. At its twenty-ninth session, held in New York from 25 February to 5 March 1992, the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space reviewed the activities of the United Nations Programme on Space Applications (hereafter referred to as "the Programme"). The Subcommittee noted that the activities of the Programme for 1991 had been carried out satisfactorily and that the activities scheduled for 1992 had been endorsed by the General Assembly in its resolution 46/45 of 9 December 1991. The Subcommittee recommended to the Committee, for its approval, the activities scheduled for 1993 under the regular budget and took note of other activities of the Programme, all of which are to be implemented as part of the space-applications-related recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE 82), as proposed by the Expert on Space Applications in his annual report (A/AC.105/497 and Corr.1) submitted to the Scientific and Technical Subcommittee at its 1992 session.

I. MANDATE OF THE PROGRAMME

2. The United Nations Programme on Space Applications operates within the scope of its expanded mandate as contained in General Assembly resolution 37/90 of 10 December 1982, taking into account the recommendations of UNISPACE 82, with special emphasis on the following activities: (a) provision of assistance in the development of indigenous capability at the local level; (b) provision of long-term fellowships for in-depth training; (c) provision of technical advisory services to Member States and regional institutions upon request; (d) organization of a series of regional and international training courses, seminars, workshops, conferences and technical expert meetings for the benefit of specialists, educators, managers and decision-makers in order to enhance their technical capabilities as well as to keep them abreast of ongoing developments in the discipline; (e) acquisition and dissemination of space-related information; and (f) promotion of greater cooperation between developed and developing countries, as well as among developing countries. Presented below is a summary of the activities carried out in 1992, including those scheduled for implementation in 1993 and those proposed for 1994.

3. In its resolution 44/46 of 8 December 1989, the General Assembly, in endorsing the recommendation of the Committee on the Peaceful Uses of Outer Space regarding the participation of the United Nations in International Space Year (ISY), also directed that "the training and educational capabilities of the United Nations Programme on Space Applications should be utilized to bring about a meaningful role for the United Nations". The efforts of the Programme in this regard are identified in section V of the present report, as well as in document A/AC.105/445/Add.9.

A. Development of indigenous capability

4. The efforts of the Programme in assisting the developing countries to develop indigenous capability in space science and technology have focused principally on the development and enhancement of knowledge and skills in the discipline through the establishment and operation of Centres for Space Science and Technology Education at the regional level. In this connection, the General Assembly, at its forty-fifth session, in its resolution 45/72 of 11 December 1990, endorsed the recommendation of the Committee on the Peaceful Uses of Outer Space that:

> "... the United Nations should lead, with the active support of its specialized agencies and other international organizations, an international effort to establish regional centres for space science and technology education in existing national/regional educational institutions in the developing countries." (A/AC.105/456, annex II, para. 4 (n))

5. A progress report (A/AC.105/498) on the establishment of these Centres was prepared in early 1992. Given the global realities and concerns of our time, the initial emphasis of the planned Centres for Space Science and Technology Education shall concentrate on in-depth education, research and applications programmes in satellite meteorology and remote sensing as these relate to environmental monitoring and natural resources management. The Centres shall be viable educational, teaching and research institutions that are capable of high attainments particularly in the development and transmission of knowledge in the developing countries.

6. The Centres shall also focus on developing various capacities necessary to undertake, at the local level, the different aspects of Agenda 21 programme. One such requirement of Agenda 21 is its call for all countries to undertake:

> "... a comprehensive national inventory of their land resources in order to establish a land information system in which land resources will be classified according to their most appropriate uses and environmentally fragile or disaster-prone areas will be identified for special protection measure." (A/CONF.151/26 (vol. I), annex II, chap. 7, para. 7.29)

For this and other purposes,

> "All countries, particularly developing countries, alone or in regional or subregional groupings, should be given access to modern techniques of land-resource management, such as geographical information systems, satellite photography/imagery and other remote-sensing technologies." (ibid., para. 7.33)

7. The activities at each Centre shall be in two major phases. Phase 1 will strive to develop and enhance the knowledge and skills of participants in both the physical sciences and analytical disciplines, tested through laboratory

exercises and fieldwork over a nine-month period as laid out in the curriculum of the Centre's education programme. Phase 2 shall concentrate on ensuring that the participants make use of the skills and knowledge gained in phase 1 in their pilot projects, which are to be carried out over a one-year period in their respective countries. The activities and opportunities provided in these two phases should adequately equip these educators and research-and-applications scientists (a) to introduce relevant aspects of space science and technology into existing education curricula in their respective countries, and (b) to contribute significantly to their nations' development programmes. Each of the Centres for Space Science and Technology Education should also (a) contribute to sustainable development of natural resources (air/water/land) and (b) provide a crucial supplementary input for biodiversity conservation and other related environmental programmes.

8. A step-by-step implementation of the Centre's programme in education, research and applications (see A/AC.105/534, paras. 46-56), with emphasis on Earth observation systems for sustainable development as laid out in the two phases described above, should have a multiplying effect, fuelled through national motivation and commitment and international cooperation, and would result in:

(a) A capacity that would enable each country to enhance its scientific and technical knowledge and experience particularly in those application areas (air/land/water) that have the potential for a greater impact on each country's economic and social development, including preservation of its environment;

(b) A capacity to utilize data from Earth observation systems for weather prediction and monitoring of hurricanes and other natural phenomena so that they could undertake appropriate disaster management and mitigation programmes;

(c) A capacity that would strengthen institutions of higher learning and national and regional institutions and subsequently enable each country to support research-and-development efforts in its national institutions, especially those dealing with the understanding and application of environmental information systems;

(d) A capacity to develop an environmental and atmospheric sciences curricula that can easily be taught and demonstrated at the high school and university levels in each country and to effectively prepare the educators to teach classes in these disciplines on their return to their institutions;

(e) A capacity to participate in regional and international environmental programmes such as the International Geosphere-Biosphere Programme and Mission to Planet Earth and to contribute to the understanding and support of international actions on such issues as global warming and climate change, ozone layer depletion, global deforestation, land degradation and management of the coastal marine environment.

9. The different stages of development to date regarding the establishment of these Centres are described in document A/AC.105/534. That document provides detailed information on the evolution of the project, its immediate and long-term objectives, the user community it will serve, the programme of each Centre, the needed personnel, equipment, facilities and budget, input from different sponsors (host Government/institution, other participating Governments in the region, sponsors/donors and funding organizations), operation and management of the Centres (executing agency, the Centre, the Governing Board, the Advisory Board) and strategy for implementation of the Centre's activities.

B. Long-term fellowship programmes for in-depth training

10. The Programme received 19 long-term fellowship offers for the 1991/92 period from the Governments of Austria (2), Brazil (10) and China (2), as well as from the European Space Agency (ESA) (5); all of these fellowships have been renewed for the 1992/93 period. The status of the 1992/93 awards and the recipients' countries are set out in annex II to the present report. The fellowship awards cover monthly stipends for room and board, books, local travel and health benefits. Details of the offers are presented below.

11. The two fellowships offered by the Government of Austria are for in-depth training in microwave technology, each for a period of one year from 1 October 1992 to 30 September 1993. These fellowships are tenable at the Technical University Graz, Graz, Austria.

12. The 10 long-term fellowships offered by the Government of Brazil are for research and applications in remote-sensing technology and are tenable at the Instituto Nacional de Pesquisas Espaciais (INPE), Sao José dos Campos, State of São Paulo, Brazil. The sixth set of participants in this fellowship series, selected from the Latin America and the Caribbean (ECLAC) region, completed their nine months of training at INPE on 14 November 1992. The next set of participants will be selected from among candidates from the English- and Portuguese-speaking countries of the Caribbean and Economic Commission for Africa (ECA) regions and will undergo their training at INPE from 5 April to 15 November 1993.

13. The two fellowships offered by the Government of China, each for a period of one year, are for research and training in geodesy, photogrammetry and remote sensing. These fellowships are tenable at Wuhai Technical University of Surveying and Mapping, Wuhai, China.

14. ESA's five fellowships are each for a period of one year and are for research and study at the ESA institutions and in the disciplines described below:

(a) Space antennas and propagation: European Space Research and Technology Centre, Noordwijk, the Netherlands;

(b) Communications systems: European Space Research and Technology Centre, Noordwijk, the Netherlands;

(c) Remote sensing information systems: European Space Research Institute, Frascati, Italy;

(d) Satellite meteorology: European Space Operations Centre, Darmstadt, Germany;

(e) Remote sensing instrumentation: European Space Research and Technology Centre, Noordwijk, the Netherlands.

C. Technical advisory services

Use of data from Maspalomas Station

15. As a follow-up activity to the United Nations/United Nations Development Programme (UNDP)/ESA Meeting of Experts on Remote Sensing and Satellite Meteorology Applications to Marine Resources and Coastal Management (Gran Canaria, Spain, 1989) (see A/AC.105/436), the European Space Agency and the United Nations Space Application Programme jointly conducted a survey on the need for remote sensing data particularly in those countries of Africa within the coverage area of ESA's two ground-receiving stations in Maspalomas, Grand Canaria, Spain, and Fucino, Italy. At the conclusion of the survey, and as part of ESA's contributions to the United Nations ISY activities (see para. 64 below), the United Nations and ESA jointly selected a number of projects that could benefit from the data that are either available in ESA's archives or being acquired by the two ground-receiving stations.

16. The aim of the United Nations/ESA assistance is to make available historical, current and future data acquired by different satellites so that they may be used to support development programmes in different application projects, particularly irrigation, roads, water resources, land use, forestry and agriculture in the countries involved. Currently, the beneficiaries of this programme are Guinea, Morocco, Nigeria and Tunisia. ESA is providing remote sensing data in hard copy prints, films and computer compatible tapes to the scientists in those countries.

17. At the conclusion of these ongoing projects, plans are in progress to bring the scientists concerned to Frascati, Italy, so that they may present the results of their work as well as undergo necessary training in the use of ERS-1 data in relevant application projects in their countries.

Cotopaxi Station, Ecuador

18. As a follow-up activity to the Workshop on Space Technology for Resource Development and Environmental Management, held at Quito, Ecuador, in March 1992 (see A/AC.105/525), the United Nations is working very closely, on request, with the Government of Ecuador, towards the following goals:

To promote cooperation between the Government of Ecuador and all the countries that are within the coverage area of the Cotopaxi Ground Station. Such cooperation, with its financial implications, can be achieved through appropriate consultations with the Governments of those countries. The end result of those consultations should witness an agreement with all those countries and ensure a continuous operation of the Cotopaxi Station and the acquisition and delivery of data to those countries.

19. In this connection, the Government of Ecuador has requested the United Nations to organize a technical assistance programme which should carry out the following activities:

(a) Conduct a short-term mission to analyse the current situation and determine the most appropriate procedure for studying the alternatives;

(b) Conduct a survey of countries using the antenna to determine if the Cotopaxi Station is a project beneficial to the region;

(c) Analyse the cooperation and support that those countries could offer;

(d) Define the technical and economic assistance that could be provided from the United Nations and other sources in order to find the best solutions to this situation.

20. At present, the United Nations is working with all parties associated with the Cotopaxi Station to achieve the goals described in paragraph 19 (a) to (d) above.

Seminars in Nigeria and the Islamic Republic of Iran

21. In 1992, the United Nations cooperated with the Governments of Nigeria (12 November) and the Islamic Republic of Iran (8-13 December) in organizing the following activities in observance of International Space Year:

Nigeria. A National Seminar on Space Science and Technology to mark ISY 1992 was held at the Senate Chambers, National Assembly Complex, Tafawa Balewa Square, Lagos. The specific objectives of the seminar were (a) to identify the benefits that Nigeria could derive from a judicious utilization of satellite-acquired data of the Earth, particularly in its social and economic development programmes, (b) to critically review the past and ongoing efforts of Nigeria in this discipline, (c) to provide adequate information on the relevance and importance of this discipline to social and economic development, to policy/decision makers, (d) to review successful remote-sensing programmes in other countries and (e) to offer appropriate suggestions and ideas that would enable Nigeria to march forward in this discipline.

Islamic Republic of Iran. A National Seminar on Remote Sensing of Environment and Space Applications was held at the Centre for International

and Political Studies, Ministry of Foreign Affairs, Tehran. The Seminar focused on (a) the importance of satellite remote sensing and space applications for research and development, environmental management, and its role in the corresponding planning, management and execution of different social and economic development programmes, particularly in the Islamic Republic of Iran, (b) a review of different national remote-sensing programmes in other countries, (c) environmental applications of remote sensing, including geographic information systems, (d) space applications programmes, with emphasis on the next generation of resource assessment satellites, (e) historical perspective, current status and future potential of remote sensing and (f) data collection platforms. The Seminar was briefed on the status of space activities of the Islamic Republic of Iran, including the status of satellite communications in the country.

Regional conference in Chile

22. The Programme is providing technical advisory support to the Government of Chile in its organization of the Second Space Conference of the Americas, to be held at Santiago from 26 to 30 April 1993, and in its preparation for a preliminary intergovernmental meeting also to be held at Santiago from 25 to 29 January 1993. The latter would deliberate on the objectives, specific agenda and the procedure for the Conference.

D. United Nations training courses/workshops/seminars/conferences/symposium

1. Activities carried out in 1992

23. In 1992, the United Nations conducted three training courses, four workshops and an international conference under the auspices of the Programme. A summary of each of these activities is presented below.

Quito, Ecuador: United Nations Workshop on Space Technology for Resource Development and Environmental Management

24. The United Nations Workshop on Space Technology for Resource Development and Environmental Management was organized in cooperation with the Governments of Ecuador and Japan for the benefit of participants from the ECLAC region. The Workshop was hosted by the Centro de Levantamientos Integrados de Recursos Naturales por Sensores Remotos (CLIRSEN) and was held at Quito from 9 to 13 March 1992. The Workshop was fully funded by the Government of Japan. Sixty experts from 21 Member States and three international organizations participated in the Workshop; 44 of these participants represented 18 developing countries from the ECLAC region. In addition, 38 individuals from 15 national institutions in Ecuador attended as observers and benefited from the presentations and discussions.

25. The objectives of the Workshop were (a) to expose the managers of natural resources programmes as well as the planners of national development and

environment protection to the possibilities of utilizing data from current and future Earth observation systems that could assist them in their decision-making process; (b) to familiarize participants with the functions of the newly established CLIRSEN-Cotopaxi satellite receiving station; and (c) to provide a forum to discuss and formulate possible regional cooperation programmes that would enable the utilization of the capabilities of the station by the 22 countries that are within its coverage. The goals of the Workshop were met through a number of technical presentations and working group discussions. The presentations addressed the issues related to the acquisition, processing, analysis and archiving of satellite data and included examples of the type of results that could be derived from specific applications. The Workshop noted that for countries in the ECLAC region to make rational use of their natural resources and to conduct their economic and social development projects in a sustainable manner, it would be necessary for them to monitor their territories continuously. Noting that Earth observation satellites could provide the most cost-effective means of monitoring vast territories and that for that purpose it was necessary that the operation of the Cotopaxi satellite receiving station be ensured, the Workshop concluded that cooperative funding and operation of the station in an adequate regional or subregional framework was a desirable goal that should be pursued.

26. The funds provided by the Government of Japan were used to defray the cost of international air travel and per diem of 32 participants from 17 countries of the ECLAC region. The participants in the Workshop were remote sensing experts and high-level decision makers from the ministries of natural resources, economic planning or research institutions from the following countries and organizations: Argentina, Barbados, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Jamaica, Japan, Mexico, Panama, Paraguay, Peru, Suriname, United States of America, Venezuela, the Food and Agriculture Organization of the United Nations (FAO), ESA and the United Nations. The Government of Ecuador, through CLIRSEN, provided conference facilities and local transportation for all participants in the Workshop. A detailed report of the Workshop is contained in document A/AC.105/525.

Stockholm/Kiruna, Sweden: Second United Nations Training Course on Remote Sensing Education for Educators

27. The Second United Nations Training Course on Remote Sensing Education for Educators was organized in cooperation with the Government of Sweden, represented by the Swedish Agency for International Technical and Economic Cooperation (BITS); it was hosted by Stockholm University and the Swedish Space Corporation (SSC) for the benefit of developing countries. The Course was held in Stockholm and Kiruna from 11 May to 12 June 1992. Twenty-seven educators from universities and colleges from 23 countries of Africa, South-East Asia and Latin America participated in the Course.

28. The main objective of the Course was to develop the practical knowledge and skills of these educators in remote sensing technology; it also aimed at equipping them with the ability to introduce elements of the technology, as

appropriate, in the academic curricula of their respective universities and institutions. The programme of the Course was also designed to provide participants with a basic understanding of the development and use of remote sensing technology in natural resource management and environmental assessment.

29. The programme was designed jointly by the United Nations Office for Outer Space Affairs, the University of Stockholm and SSC. The United Nations was responsible for the overall external organizational arrangements, and the Government of Sweden, through Stockholm University, SSC and BITS, coordinated local arrangements and provided professional services of instructors, technical equipment, materials, course facilities and local transportation. Funds allocated by the United Nations were used to defray the costs of international air travel for five participants. The Government of Sweden provided room and board, local transportation and pocket money for all the participants as well as international air travel for 22 of the participants. The report on the training course is contained in document A/AC.105/526.

Boulder, Colorado, United States of America: United Nations/United States International Conference on Satellite Remote Sensing for Resource Management, Environmental Assessment and Global Change Studies: Needs and Applications of Developing Countries

30. A United Nations/United States International Conference on Satellite Remote Sensing for Resource Management, Environmental Assessment and Global Change Studies: Needs and Applications of Developing Countries was organized in cooperation with the Government of the United States (represented by the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), the United States Geological Survey (USGS), and the Consortium for International Earth Science Information Network (CIESIN)) and was held at Boulder, Colorado, from 17 to 20 August 1992.

31. The objectives of the Conference were to examine the issues facing developing countries in their efforts to contribute to the development and utilization of remote sensing technology and to address the role of satellite remote sensing in resource management, environmental assessment and global change studies. The Conference also discussed existing data sources, their accessibility and availability, the needs of developing countries and the role of remote sensing in meeting those needs.

32. Forty-one foreign professionals attended the Conference as speakers, from 22 countries and 3 international organizations. The Conference was also attended by 155 participants. The Government of the United States defrayed the cost of international air travel as well as daily subsistence allowance for room and board for 23 participants and provided the conference facilities. A detailed report on the Conference is contained in document A/AC.105/527.

Potsdam and Berlin, Germany: Fourth United Nations International Training Course on Remote Sensing Applications to Geological Sciences

33. The Fourth United Nations International Training Course on Remote Sensing Applications to Geological Sciences, organized in cooperation with the Government of Germany through the Carl Duisberg Gesellschaft e.V. Berlin, was hosted by the GeoResearch Centre, Potsdam, and the Free University of Berlin from 28 September to 16 October 1992. The main objective of the Course was to provide education and practical training to participants from developing and Eastern European countries on the applications of airborne and satellite remote sensing techniques to geological sciences. The programme of the Course covered (a) the fundamentals of remote sensing (analogue-optical and digital image processing, classification procedures, geostatistics, analysis of geological units, lineament analysis, field checking), (b) interpretation and development of geological models (remote sensing for economic geology, documentation of results) and (c) geological fieldwork in two areas of the Central European Hercynides in the eastern part of Germany.

34. The 17 participants in the Course were from 14 countries. The United Nations provided international air travel to 12 of the participants. The Government of Germany, through the Carl Duisberg Gesellschaft e.V., provided room and board and local transportation for all participants for the duration of the Course and international travel for five participants from Eastern European countries as well as all necessary facilities. Lecturers at the Course included specialists from Germany, Italy, the Netherlands, Poland and the Russian Federation. The report on the Course is contained in document A/AC.105/528.

Nairobi, Kenya: United Nations/ESA Regional Training Course on the Use of Remote Sensing Systems in Hydrological and Agrometeorological Applications

35. A United Nations/ESA Regional Training Course on the Use of Remote Sensing Systems in Hydrological and Agrometeorological Applications, organized in cooperation with the Regional Centre for Services in Surveying, Mapping and Remote Sensing (RCSSMRS), Nairobi, was hosted by RCSSMRS from 12 to 30 October 1992. The main objective of the Course was to provide education and practical training to participants from countries of Africa and the Middle East on the applications of remote sensing in the visible, infrared and microwave regions of the electromagnetic spectrum, with emphasis on hydrological and agrometeorological applications. The programme of the Course covered (a) the fundamentals of remote sensing (analogue and digital image processing), (b) characteristics of current and future satellite systems, (c) imaging radar theory, (d) image processing hardware and software analysis, (e) introduction to geographical information systems, (f) fieldwork and (g) practical exercises.

36. The Course was attended by 17 participants of the Economic Commission for Africa (ECA) and Economic and Social Commission for Western Asia (ESCWA)

regions. Lectures and practical exercises were conducted by experts from the Canada Centre for Remote Sensing; the University of Dundee, Scotland; SCOT CONSEIL, France; ESA; FAO; RCSSMRS; and the Office for Outer Space Affairs of the United Nations. Funds allocated by the United Nations and ESA were used to defray the costs of international air travel and per diem of the foreign participants. RCSSMRS provided the conference facilities, computer facilities and needed supplies for the practical exercises. A detailed report on the Course is contained in document A/AC.105/529.

San José, Costa Rica, and Santa Fe de Bogotá, Colombia: Basic Space Science Workshop

37. The Second United Nations/European Space Agency/The Planetary Society Workshop on Basic Space Science was organized in cooperation with the Governments of Costa Rica and Colombia. The Workshop was hosted by the University of Costa Rica, San José, and the International Centre for Physics (CIF) and the University of the Andes, Santa Fe de Bogotá, and held respectively at San José from 2 to 7 November, and at Santa Fe de Bogotá from 9 to 13 November 1992.

38. The Workshop was organized with the knowledge that the scientific, economic and social progress of any country are strongly interrelated, and from the recognition that basic space science, including physical and mathematical sciences, play an exceedingly important role in providing solutions to problems of development in general, and that the pursuit of basic space science is crucial to the future economic prosperity of all citizens of the world. Thus, the Workshop was organized for the purpose of (a) creating and improving the awareness of scientists about current and future scientific and technical aspects of basic space science, (b) enhancing national capabilities to develop programmes and to undertake research activities in basic space science, (c) enhancing scientific cooperation among developing countries, including the exchange of scientific information, (d) fostering international collaboration, (e) establishing centres of excellence in the region and (f) exploring avenues of education, training and research on basic space science subjects. The scientific programme of the Workshop focused on the importance of basic space science for developing countries and international cooperation in the field. Workshop sessions included topics related to the origin of the solar system, the sun, the terrestrial planets, the outer planets, space missions in astronomy, cosmology and neutrino astrophysics.

39. The Workshop was attended by 122 scientists from 19 countries and 3 international organizations. Participating experts funded by their respective Governments/institutions were from Canada, Germany, Sweden, the United States, Venezuela and ESA. Funds allocated by the United Nations and the European Space Agency were used to defray the cost of international air travel and a daily subsistence allowance for 19 participants from 14 countries. The Planetary Society sponsored the participation of nine speakers from the United States. The Governments of Costa Rica and Colombia provided conference facilities and local transportation for all participants,

and each funded the travel and per diem of three experts from the ECLAC region in addition to the participation of their own experts at the Workshop. A detailed report on the Workshop is contained in document A/AC.105/530. The proceedings of the Workshop will be published in the International Journal of Cosmic Physics.

Seoul, Korea: United Nations Workshop on Space Communications for Development

40. The United Nations Workshop on Space Communications for Development was organized in cooperation with and hosted by the Government of the Republic of Korea at Seoul from 24 to 28 November 1992. The main objective of the Workshop was to provide participants with information on the current state and future trends of satellite communication technology and the contribution of this technology to economic and social development in the Economic and Social Commission for Asia and the Pacific (ESCAP) region. It also provided an opportunity for managers and specialists in the field to exchange information on their activities in satellite communication and to discuss possibilities for increasing regional and international cooperation. The programme of the Workshop covered presentations on current trends and prospects of satellite communications service demands, architectures for future satellite networks, including mobile and global personal satellite services, advanced communication technologies, including domestic and regional satellite communications systems and their application to health care, rural education and broadcasting, disaster management, etc., low-cost Earth terminals, power-efficient access techniques and intelligent on-board resource control.

41. The Workshop was attended by 86 participants from governmental institutions of 25 Member States and 9 international organizations and private companies. Funds allocated by the United Nations and the Government of the Republic of Korea were used to defray the costs of international air travel and per diem of 18 foreign participants. The Government of Korea provided the conference facilities. A detailed report on the Workshop is contained in document A/AC.105/531.

2. Activities scheduled for implementation in 1993

42. The following training courses, workshops, symposium and conferences are scheduled for 1993:

(a) A United Nations/European Space Agency Training Course for African Francophone Countries on Applications of ERS-1 for Natural Resources, Renewable Energy and the Environment will be held at the European Space Research Institute (ESRIN), Frascati, Italy, from 19 to 30 April 1993 in cooperation with the Government of Italy. The Course is being co-organized by the Programme on Space Applications of the United Nations Office for Outer Space Affairs and the Division for Science, Technology, Energy, Environment and Natural Sources of the United Nations Department of Economic and Social Development and will be financed by the United Nations Trust Fund for New and Renewable Resources of Energy. The money in this fund is provided by the

Government of Italy. The programme of the Course will provide an overview of the principles of remote sensing in the visible and infrared portions of the electromagnetic spectrum as well as education and practical training on various aspects of passive and active microwave remote sensing. Participants will also cover the theory and applications of data obtained from Earth observation sensor systems, such as the ERS-1 satellite, for monitoring the environment, agriculture and natural resources.

(b) The Third United Nations/Sweden Training Course on Remote Sensing Education for Educators will be held from 3 May to 4 June 1993 at Stockholm and Kiruna, Sweden, in cooperation with the Government of Sweden. The Course will be hosted on behalf of the Government by the Swedish Agency for International Technical and Economic Cooperation (BITS), the Swedish Space Corporation Satellitbild, and the University of Stockholm. The main objective of the Course is to develop practical knowledge and skills of university educators from the developing countries in remote sensing technology. The programme of the Course will also provide participants with a basic understanding of the development and use of remote sensing technology in natural resource management and environmental assessment; it will also aim at equipping them with the ability to serve as a focal point in their own countries and to introduce elements of the technology, as appropriate, into the education curricula in their respective universities and educational institutions.

(c) A United Nations Workshop on Space Communications for Development for the benefit of Member States of the Mediterranean and Adjacent Areas will be held from 10 to 12 May 1993 at Athens, Greece, in cooperation with the Government of Greece. The Workshop will focus on the status and projected directions of the technology, with particular emphasis on such issues as rural communications for health-care delivery; search/rescue missions and disaster relief; overview of satellite broadcasting systems; and development of national satellite broadcasting systems. The Workshop will also familiarize the participants with international satellite network applications for regional and national economic development and address possibilities of regional cooperation.

(d) A United Nations Regional Conference on Space Science and Technology for the benefit of countries of the ESCAP region will be held at Bandung, Indonesia, from 17 to 21 May 1993 in cooperation with the Government of Indonesia. The Conference will review the state of the art of space science and technolcgy and, in line with Agenda 21, will examine those space-related activities that can support sustainable development in the ESCAP region. The Conference will identify and delineate cooperation programmes for the countries of the region, promote cooperation among scientists and provide a forum for communication among young scientists in the region.

(e) A United Nations/Office of the United Nations Disaster Relief Coordinator (UNDRO)/ESA Workshop on Applications of Space Technology to Combat Natural Disasters, for the benefit of Member States in the ECLAC region, will be held in September 1993 in cooperation with the Government of Mexico. The

objective of the Workshop is to expose the participants to various aspects of current and future techniques and systems associated with remote sensing, satellite meteorology, satellite communications and satellite positioning systems that could be useful in forecasting, monitoring and mitigating the effect of natural disasters. The Workshop will also address the development of databases and the use of Geographic Information Systems (GIS) to monitor disaster-related activities. The Workshop will be one of the Programme's contributions to the International Decade for Natural Disaster Reduction.

(f) A United Nations Regional Conference on Africa's Environmental and Natural Resources Information and Management Needs is to be organized in October 1993. The Conference is intended to bring together country representatives at the highest managerial and national adviser levels. The participants will evaluate and develop plans that would focus on relevant aspects of space science and technology, with emphasis on environmental and resource information systems which can be directed towards the solution of Africa's resource management problems, including the safeguarding of its environment and its social and economic development. The Conference will also review the recommendations of the United Nations Conference on Environment and Development (UNCED) held in Rio in June 1992 and its Agenda 21, including the initiatives to implement those elements of Agenda 21 that are relevant to Africa. The European Space Agency is co-sponsoring the Conference.

(g) The Fifth United Nations Training Course on Remote Sensing Applications to Geological Sciences is to be organized in cooperation with the Government of Germany, through the Carl Duisberg Gesellschaft e.V. Berlin, and will be organized in the ESCAP region in October 1993. This training course will provide education and practical training to participants from the developing countries on the applications of airborne and satellite remote sensing techniques to geological sciences. The course will also demonstrate to the participants how to develop and apply techniques for extracting information and for merging disparate data sets that can be used for evaluating geological formations and their selected occurrences. The European Space Agency is co-sponsoring the training course.

(h) A United Nations/International Astronautical Federation (IAF)/ESA Symposium on Organizing Space Activities in Developing Countries: Resources and Mechanisms, to be organized in cooperation with the Government of Austria, will be held at Graz, Austria, from 18 to 22 October 1993. The objective of the Symposium will be to identify, through specific case-study presentations, the types of mechanisms and resources that can be brought together to initiate space activities in developing countries. The case-study presentations will primarily be examples of successful (a) space research activities; (b) development programmes or enterprises; and (c) applications programmes/projects in user agencies that have been established in developing countries. Towards this end, the Symposium will benefit from the results of the United Nations/IAF/Committee on Space Research (COSPAR)/American Institute of Aeronautics and Astronautics (AIAA) Symposium that was held in Washington in 1992 (see paras. 51-53 below).

(i) A United Nations Workshop on the Use of Space Techniques for Monitoring and Control of the Desert Environment is scheduled to be held in November 1993 for the benefit of Member States in the ESCWA region. Topics to be covered by the Workshop will include, inter alia, pollution problems in the desert environment, occurrence and control of desertification, reclamation of deserts and trafficability (sand displacement) in the sand environment.

(j) A United Nations Workshop on Basic Space Science is to be organized for the benefit of countries in Africa. The objective of the Workshop is to strengthen basic space science in Africa by addressing the ways and mechanisms through which the following goals could be accomplished:

(i) Enhancement of national capabilities to develop programmes and to undertake research activities in basic space science;

(ii) Enhancement of scientific cooperation among developing countries, including exchange of scientific information;

(iii) Exploration of avenues for education, training and research on space science subjects for the benefit of African countries.

3. Activities proposed for implementation in 1994

43. The following training courses, workshops and conferences are proposed for 1994:

(a) A United Nations International Workshop on Spin-off Benefits of Space Technology;

(b) Fourth United Nations/Sweden International Training Course on Remote Sensing Education for Educators;

(c) A United Nations International Training Course on Communications Technology for Development;

(d) A United Nations International Workshop on Remote Sensing Information Systems;

(e) A United Nations Microwave Remote Sensing Training Course for the benefit of ESCAP and ESCWA member States;

(f) A United Nations/UNDRO Regional Workshop on Space Technology to Combat Natural Disasters for the benefit of Member States in the ECA region;

(g) A United Nations Regional Training Course on Remote Sensing Applications to Geological Sciences for the benefit of ECLAC member States;

(h) A United Nations Workshop on Basic Space Science in Development Programmes for the benefit of ESCAP and ESCWA member States;

(i) A United Nations International Workshop on the Development and Design of Small Experimental Payloads;

(j) A United Nations/IAF Symposium on Space Technology in Developing Countries.

E. Information systems

44. The first edition of the directory on "Education, Training, Research and Fellowship Opportunities in Space Science and Technology and its Applications" (A/AC.105/432) was published in 1989; its addendum 2 was issued in 1992 as document A/AC.105/522.

45. The directory on "Information Systems on Space Science and Technology" (A/AC.105/397/Rev.1) was published in 1988; it has been reissued in 1992 as document A/AC.105/517.

46. The fourth publication of selected papers on remote sensing and satellite communications from the activities of the Programme that were conducted in 1992 has been issued as document A/AC.105/532.

F. Promotion of greater cooperation in space science and technology

47. The Programme jointly organizes a number of activities with international professional bodies in order to provide necessary forums for interaction and exchange of ideas among educators and research-and-applications scientists within the global community. In this connection, the Programme organized the activities described below in 1992.

United Nations/International Society for Photogrammetry and Remote Sensing Workshop

48. The United Nations/International Society for Photogrammetry and Remote Sensing (ISPRS) Workshop on Remote Sensing Data Analysis Methods and Applications was organized during the XVIIth ISPRS Congress for the benefit of scientists from developing countries and was held from 6 to 7 August 1992 in Washington. The Workshop was so arranged that the participants could attend the overall Congress, which was a major international forum covering all areas of remote sensing technology and applications.

49. The Workshop provided a forum for scientists concerned with algorithms, software development, software systems and hardware employed in the reduction and analysis of data and their applications. It fostered communication between developers and users of remote sensing; these were individuals with a wide range of expertise in the production and use of software packages for photogrammetry, image processing and remote sensing applications.

50. Participating experts funded by their respective Governments/institutions were from Australia, Brazil, Canada, Finland, France, Germany, Japan, the Netherlands, Switzerland, Taiwan Province of China and the United Kingdom of Great Britain and Northern Ireland. Funds allocated by the United Nations were used to defray the cost of international air travel and daily subsistence allowance for participants and speakers from Brazil, Nigeria, the United Republic of Tanzania and the United Kingdom.

United Nations/IAF/COSPAR/AIAA Symposium

51. The Programme co-sponsored a United Nations/IAF/COSPAR/AIAA Symposium on Space Technology in the Developing Countries - Making it Happen; it was held from 28 to 30 August 1992 during the World Space Congress in Washington.

52. The Symposium was attended by 127 participants from 39 countries, representing all regions of the world; 56 of the participants were from 30 developing countries. The participants in the Symposium were internationally renowned scientists in the fields of remote sensing and satellite communications or high-level decision makers in the institutions that are users of the technology in their respective countries. Through the financial support provided by the co-sponsors, 36 participants from developing countries were also able to participate in the technical sessions of the World Space Congress from 31 August to 4 September.

53. The Symposium focused on the central themes of (a) sustainable development of natural resources and (b) modernization through communications; these two topics were identified by the Workshop on Space Technologies for Development organized and co-sponsored by the United Nations, IAF and the Government of Canada and held at Montreal, Canada, in October 1991. The participants at the Washington Symposium reviewed and discussed effective ways in which applications and user agencies, research and governmental institutions and industry could initiate cooperative ventures to establish fully operational programmes or enterprises. The Symposium encouraged and provided ample opportunities for formal and informal discussions between participants from developing countries and their counterparts from the industrialized countries and representatives from the industry. It also provided ample opportunities for the exploration of joint-venture possibilities between institutions in developing countries and various industries and institutions in the industrialized countries.

II. VOLUNTARY CONTRIBUTIONS

54. The successful implementation of the 1992 activities of the Programme benefited from a variety of support and voluntary contributions from Member States and their institutions as well as from regional and international governmental and non-governmental organizations. Such support included voluntary contributions, both in money and in kind, and the sponsorship of technical and scientific presentations by several experts, as detailed below:

(a) A number of Member States (Austria, Brazil, Canada, Colombia, Costa Rica, Ecuador, France, Germany, Greece, Japan, Pakistan, the Republic of Korea, Spain, Sweden and the United States provided support for the activities of the Programme in 1992 in various ways, including the following:

(i) Defrayal of the local expenses of candidates from developing countries in the long-term fellowship programmes (see paras. 10-14 above, and annex II to the present report);

(ii) Voluntary cash contributions received in 1992 from the Governments of Austria (US$ 20,000), China ($30,000), Greece ($7,000) and Pakistan ($15,000);

(iii) Co-sponsorship of the activities of the Programme and, in particular, defrayal of the costs of participants' international air travel, local organization and facilities, room and/or board and local transportation (see paras. 26, 29, 32, 34 and 41);

(iv) Sponsorship (travel and per diem) of experts from Member States to provide technical presentations and to contribute to the deliberations at these activities (see paras. 26, 32, 34, 36, 39 and 41);

(v) Funding of experts (Canada and Spain) to participate in the Evaluation Mission to Latin America to provide an accurate and informative report that could assist in the selection of the host country/institution(s) for the Centre for Science and Technology in that region;

(b) The European Space Agency defrayed the local expenses of candidates from developing countries in its long-term fellowship programmes (see paras. 10 and 14 above and annex II). ESA also made a voluntary financial contribution of $50,000 in support of the United Nations workshop and training course held in Kenya (paras. 35-36), Colombia and Costa Rica (paras. 37-39);

(c) COSPAR, IAF and the AIAA contributed amounts of $1,000, $20,000 and $25,000 respectively to defray the costs of air travel and daily subsistence allowance for individuals from developing countries that participated in the United Nations/IAF/COSPAR/AIAA Symposium (see paras. 51-53). In addition, AIAA provided the secretariat services for the Symposium;

(d) ESA, the Food and Agriculture Organization of the United Nations (FAO), the International Maritime Satellite Organization (INMARSAT), the International Telecommunication Union (ITU), the Planetary Society and RCSSMRS sponsored the participation of their experts (travel and per diem) in the activities described in paragraphs 24, 35, 37 and 40.

III. FINANCIAL PROVISIONS AND ADMINISTRATION OF 1993 ACTIVITIES

55. The 1993 activities of the Programme presented in the present report will be implemented in the following manner:

(a) Financial provisions. Under the United Nations regular budget, an amount of $345,900 was approved by the General Assembly at its forty-sixth session for implementing the activities of the Programme for the 1992-1993 biennium. Because this budgetary allocation is insufficient to carry out the mandated and expanded activities of the Programme, it has become necessary to solicit additional funds, in the form of voluntary contributions, in support of these activities. These contributions will be used to supplement the regular budget of the Programme.

(b) Administration by, and contributions and participation of staff. The Office for Outer Space Affairs, and in particular the Expert on Space Applications and his staff, will carry out the activities described in the present report. In this connection, travel would be undertaken as appropriate by the Expert and his staff within the provisions of the biennium travel budget of the Office for Outer Space Affairs as approved by the General Assembly at its forty-sixth session and as may be necessary from voluntary contributions.

(c) Consultations, instructors/speakers and technical materials. Up to 15 specialists in space science and technology and its applications would be required to serve as instructors, speakers and consultants during the implementation of the 1993 activities of the Programme. Expenses incurred in respect of the travel and per diem of these specialists and for necessary technical materials would be met partly from the regular budget and partly from voluntary contributions received from Member States and international organizations.

IV. EVALUATION OF THE IMPACT OF SOME OF THE ACTIVITIES OF THE UNITED NATIONS PROGRAMME ON SPACE APPLICATIONS FOR 1989

56. It takes about two to three years for a candidate who has participated in the activities of the Programme to establish needed facilities and support at the local level before he or she could make meaningful use of the knowledge gained through the Programme. Thus, a survey of those who participated in the activities of the Programme in 1989 was carried out in 1992. The evaluation of the effectiveness of the Programme activities presented in the present report is based on information received as feedback from these participants; the results of this evaluation are contained in the paragraphs that follow.

57. In 1989, the activities of the Programme included one workshop on oceanographic/marine space information systems, held at Karachi, Pakistan; two meetings of experts on remote sensing and satellite meteorology applications to marine resources and coastal management, and on the development of remote

sensing skills and knowledge, held at Canary Islands, Spain, and Dundee, United Kingdom, respectively; and four training courses held at Potsdam, Germany, Rome, Moscow and Canberra. These training courses were devoted to remote sensing applications to (a) geological sciences, (b) land resources, (c) agriculture management and (d) hydrological and agrometeorological applications, respectively.

58. On 10 March 1992, a questionnaire was sent to the 156 individuals who participated in the above-mentioned activities of the Programme in 1989. The statistical evaluation of the responses received is given below.

59. A total of 110 participants, out of the 156 who participated in these activities, responded to the questionnaire. The professional activities of several of the 110 participants have been in more than one area. Five of the respondents continued working in communications, 21 in meteorology, 81 in remote sensing, 39 in mapping, 26 in agriculture, 18 in forestry, 28 in hydrology, 22 in geology, 5 in mineralogy, 22 in fisheries and 62 in environmental sciences. Their post-meeting overall activities are summarized as follows:

	Number of participants
Research and development	83
Planning	23
Operational activities	42
Education	41

60. The table below gives the number of participants who expressed the view that their participation in the activities of the Programme had enabled them to initiate, establish, run or direct the following groups, facilities or activities in their different professional fields in their own countries:

	Initiate	Establish	Run
	(number of participants)		
Study group	18	14	16
Coordination of user group	11	10	14
National committee	7	11	14
National programme	13	10	18
Regional/international cooperation	13	5	13
Data receiving station	16	3	9
Data analysis centre	11	8	12
Training facility	19	13	17

V. INTERNATIONAL SPACE YEAR 1992: PARTICIPATION OF THE UNITED NATIONS

61. In compliance with General Assembly resolution 44/46 of 8 December 1989, the Programme designed a number of activities to mark the participation of the United Nations in the International Space Year. These activities have been described in the ISY Guidebook as well as in document A/AC.105/445 and Add.1-8.

62. The implementation of these activities began in 1991. Most of these activities, such as the United Nations/United States training course on remote sensing (1991), the United Nations/China Workshop on Combating Natural Disasters (1991), the United Nations/United States Conference on Earth Observation Systems in Resource Management, and Global Change Studies (1992), Workshops with ISPRS, IAF and during the World Space Congress (1992), the Essay Contest on "My Vision of Outer Space" (1992), the Universarium and Observation of Space Subjects (1992), the United Nations/Ecuador/Japan Workshop on Space Technology for Resource Development and Environmental Management (1992), and the United Nations/Sweden Training Course on Remote Sensing Education for Educators (1992) have been completed; in each case, an appropriate report has been issued (see A/AC.105/445/Add.9).

63. Other activities scheduled for 1993 include the United Nations/Greece Seminar on Space Communication Technology for Development (May 1993), the United Nations/Indonesia Regional Conference for Sustainable Development (May 1993) and the United Nations Regional Conference on Meeting Africa's Environmental and Natural Resources Information and Management Needs (October 1993).

64. Activities that will continue beyond ISY include the establishment and operation of the Centres for Space Science and Technology Education, the United Nations/European Space Agency assistance to make available historical, current and future satellite data to support project execution in four African countries and the booklet on "Space Science and Technology for Development and Environment". Efforts are still in progress to implement the global telecast and video programmes. The activity titled "Bridging the Information Gap" will commence in the immediate future.

65. As a result of inadequate financial support, a number of planned activities could not be implemented; these include the lecture series and the exhibition entitled "The Home Planet".

66. The status of all of these activities is described in document A/AC.105/445/Add.9.

67. The United Nations will participate in future activities of the Space Agency Forum (SAF), the successor to the Space Agency Forum for International Space Year (SAFISY).

Annex I

SPACE APPLICATIONS PROGRAMME - 1993
(Planned Schedule of Courses/Workshops/Conferences)

Activities	Date/Place	Objective	Status
1. United Nations/ESA Training Course for African Francophone Countries on the Monitoring, using ERS-1 Satellite, of Natural Resources, Renewable Energy and Environment	19-30 April 1993 ESRIN/ Frascati (Italy)	to define and quantify the needs and requirements needed to facilitate remedial action and to strengthen national capacities in the management of environmental problems	- 24 participants to be funded by UN Trust Fund for New and Renewable Sources of Energy - Course being organized jointly by ESA and UN (STEENRD and OOSA)
2. Third UN/Sweden Training Course on Remote Sensing Education for Educators	3 May-4 June 1993 Stockholm/ Kiruna (Sweden)	to develop knowledge and skills of university educators in remote sensing technology	- 24 international participants being funded by Sweden and UN (OOSA)
3. United Nations/ Greece Workshop on Space Communications for Development	10-12 May 1993 Athens (Greece)	to provide ah opportunity for exchange of information on technical and operational issues associated with various international/regional satellite systems and services	- A minimum of 20 participants - Funding to be provided by Greece and UN (OOSA)
4. United Nations/ Indonesia Regional Conference on Space Technology for Sustainable Development (ESCAP region)	17-21 May 1993 Jakarta (Indonesia)	review state of the art of space science and technology and related applications for sustainable development, and address mechanisms for promoting regional cooperation in the discipline	- Scope of Conference already defined. - Papers being invited
5. UN/ESA Regional Workshop on Space Technology to Combat Natural Disasters	September 1993 Mexico	to consider ways in which Latin America and the Caribbean countries can use space techniques and to address the development of databases and the use of GIS techniques to monitor disaster-related activities and problems	- Funding being provided by Mexico, ESA and UN (OOSA). Consultations in progress with UNDRO

Activities	Date/Place	Objective	Status
6. United Nations Regional Conference on Africa's Environmental and Natural Resources Information and Management Needs	October 1993 (Consultations in progress with host country)	to assess social and economic impact and implications of current and future developments in Earth Observation Systems for Africa, to assess environmental and natural resources information needs and to initiate plans for meeting them	- Scope of Conference already defined. Programme under preparation - Consultations in progress with host country. ESA will co-sponsor Conference - Funding being solicited from potential co-sponsors
7. United Nations/ Germany Regional Training Course on Remote Sensing Applications to Geological Sciences	October 1993 ESCAP (consultation in progress with host country)	to provide education and practical training on the applications of airborne and satellite remote sensing techniques to geological sciences	- 24 participants to be funded by Germany, ESA and UN (OOSA)
8. UN/IAF/ESA Symposium on Organizing Space Activities in Developing Countries	18-22 October 1993 Graz (Austria)	to identify the types of mechanisms and resources that can be brought together to initiate space activities in developing countries	- Participants from developing countries to be funded by UN, ESA, IAF and Austria
9. United Nations Workshop on the Use of Space Techniques for Monitoring and Control of Desert Environment	November 1993 ESCWA	to address the use of space technology in pollution of the desert environment, sand storms generation, dissipation and consequences, reclamation of deserts	- Consultations in progress with ESCWA and Member States of the region
10. United Nations Workshop on Basic Space Science	November 1993 (Africa)	to strengthen basic space science in African countries	- Consultations in progress with potential host countries

Annex II

LONG-RANGE FELLOWSHIPS OFFERED BY AUSTRIA, BRAZIL, CHINA AND THE EUROPEAN SPACE AGENCY WITHIN THE FRAMEWORK OF THE UNITED NATIONS PROGRAMME ON SPACE APPLICATIONS BEGINNING IN 1992-1993 a/

Period	Country/ organizations	Subject	Financial support by host country/ organization	Offered	Selected	Applied	User countries (one or more candidates selected)
1992-1993	Austria	Telecommunications (microwave technology)	Subsistence allowance; installation grant;local transportation	2		5	In progress
1992	Brazil	Research and applications in remote sensing	Subsistence allowance; medical and accident insurance	10	9	20	Argentina Chile Ecuador Mexico Panama Peru Cuba (2) Brazil
1992-1993	China	Geodesy, photogrammetry and remote sensing	Subsistence allowance; medical insurance	2	2	4	Lao People's Dem. Rep (2)
1992-1993	European Space Agency	Satellite meteorology	Subsistence allowance	1		21	In progress
1992-1993	European Space Agency	Space antennas and propagation	Subsistence allowance	1		18	In progress
1992-1993	European Space Agency	Remote Sensing information	Subsistence allowance	1	1	4	Philippines
1992-1993	European Space Agency	Communications Systems	Subsistence allowance	1	1	14	Colombia
1992-1993	European Space Agency	Remote sensing instrumentation	Subsistence allowance	1		12	In progress
TOTALS				19b/	13b/	98b/	

a/ These fellowship awards were made on the basis of: (1) the background and qualifications of nominated candidates; (2) the evaluation and recommendations of the United Nations; and (3) the analysis and final decision of the Government/organization/institution awarding the fellowship.

b/ These figures refer to the fellowship programmes processed as of 16 December 1992.
