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ON THE EXPLORATION AND PEACEFUL USES OF OUTER SPACE

PROMOTION OF INTERNATIONAL COOPERATION

Background paper 12

The full list of the background papers:

1. Earth and its environment in space
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5. Space communications and applications
6. Basic space science and microgravity research and their benefits
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PREFACE

The General Assembly, in its resolution 52/56, agreed that the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) should be convened at the United Nations Office at Vienna from 19 to 30 July 1999 as a special session of the Committee on the Peaceful Uses of Outer Space, open to all States Members of the United Nations.

The primary objectives of UNISPACE III will be:

(a) To promote effective means of using space technology to assist in the solution of problems of regional or global significance;

(b) To strengthen the capabilities of Member States, in particular developing countries, to use the applications of space research for economic and cultural development.

Other objectives of UNISPACE III will be as follows:

(a) To provide developing countries with opportunities to define their needs for space applications for development purposes;

(b) To consider ways of expediting the use of space applications by Member States to promote sustainable development;

(c) To address the various issues related to education, training and technical assistance in space science and technology;

(d) To provide a valuable forum for a critical evaluation of space activities and to increase awareness among the general public regarding the benefits of space technology; and

(e) To strengthen international cooperation in the development and use of space technology and applications.

As one of the preparatory activities for UNISPACE III, the Office for Outer Space Affairs has prepared a number of background papers to provide Member States participating in the Conference, as well as in the regional preparatory meetings, with information on the latest status and trends in the use of space-related technologies. Those papers have been prepared by the Office for Outer Space Affairs on the basis of input provided by international organizations, space agencies and experts from all over the world. A set of 12 complementary background papers have been published and should be read collectively.

Member States, international organizations and space industries planning to attend UNISPACE III should consider the contents of the present paper, particularly in deciding on the composition of their delegation and in formulating contributions to the work of the conference.

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I. SUMMARY

1. Since the launch of the first artificial Earth satellite (Sputnik 1) in 1957, an event which ushered in the space age, space activities until recently have been usually characterized as competition between the United States and the

former Union of Soviet Socialist Republics. The cold war and geopolitical considerations of the time fuelled the development of their space programmes, and much of the space technology and the applications to which they gave rise are still in use today.

2. Despite the role of competition, a great deal of international cooperation did in fact emerge in the 40 years since the exploration and use of outer space began. Cooperation has occurred between many States on a bilateral basis; several major regional cooperative programmes have been developed; and a number of global cooperative activities have resulted in the creation and operation of global satellite organizations.

3. The fading away of cold war tensions during the last decade has dramatically cleared the way for States to engage in even greater international cooperation in space activities. That significant political development, along with the rapidly changing world economic landscape, has provided the context and impetus for closer cooperation between States challenged by a new sense of urgency about long-neglected global problems.

4. With space less frequently thought of in strategic terms and more often regarded today for its potential contributions to development, established and emerging space technologies are being successfully used to alleviate common regional and global problems. Nevertheless, the full potential of space technology for economic and social development is yet to be realized, especially in some developing countries. Increased social and economic development using space technologies could be accomplished with an enhanced level of international cooperation. To facilitate the needed and desired improvements in international cooperation, many developing countries should consider how Governments can establish the enabling infrastructure to take advantage of the opportunities for cooperation and development that already exist.

5. International cooperation has also been intensified as those involved in space activities recognize both the advantages of working together to identify common goals and the need to optimize existing resources, financial and otherwise. With budgets for space programmes in some spacefaring countries shrinking and a general skepticism among the general public about the relevance of a number of space activities, never before in the history of the space age has it been more critical to stimulate and encourage international cooperation.

6. There are several arguments, besides the need simply to rationalize resources, why the benefits of space technology are better achieved through international cooperation. For developing countries, enhanced capabilities in using space technology might lead to accelerated economic, social and cultural growth, as space-based services and technologies help them to leapfrog stages in development. Many national space activities, such as satellite communications and broadcasting, require international coordination in order to function successfully. Furthermore, in view of the increasing number of complex and interwoven regional crises, international cooperation can lead to greater transparency in space activities and enable the establishment of new programmes for confidence-building measures. Space activities offer many possibilities for finding solutions to a variety of problems, especially those confronting developing countries.

7. Global issues such as the protection of the environment, humanitarian relief assistance and efforts to combat illicit drug-crop production are just some of the important areas in which space technology could play a leading role. In fact, a number of mechanisms are already in place to promote greater international cooperation. Other activities may require the creation of such mechanisms, provided there exists the political will and strong, visionary leadership. There are also obstacles that could prevent greater cooperation, for example, conflicting national interests or security considerations.

8. As the new millennium approaches, there is a unique window of opportunity for the global community to construct a practical, well-defined framework for international cooperation in space activities that could result in greater benefits for all of humanity for decades to come.

II. HISTORY OF INTERNATIONAL COOPERATION IN SPACE ACTIVITIES

9. In the early days of space activities, international cooperation faced the challenges brought about by cold war tensions, which raised the fear among many States that space would become the next battleground. Yet international cooperation slowly emerged, beginning with bilateral cooperative programmes for space science and exploration. One of the earliest efforts was the International Geophysical Year (July 1957 to December 1958), comprising a comprehensive series of global geophysical activities, including rocket and satellite research that eventually led, in part, to the development of the United States space programme.

10. By the 1960s in western Europe, two new international cooperative programmes were established, the European Organization for the Development and Construction of Space Vehicle Launchers (ELDO) and the European Space Research Organization (ESRO), to facilitate cooperative launcher and payload development in western Europe. In 1975, ELDO and ESRO were consolidated into the European Space Agency (ESA).

11. To facilitate global realization of satellite communications, in 1964 a group of 16 States established the interim International Telecommunications Satellite Organization (INTELSAT), which currently has more than 125 members and its communication infrastructure is used daily by more than 150 countries for international communications via satellite. Numerous other international cooperative ventures followed, including the Arab Satellite Communications Organization (ARABSAT), the European Telecommunications Satellite Organization (EUTELSAT), the International Mobile Satellite Organization (Inmarsat) and the International Organization of Space Communications (INTERSPUTNIK).

12. States thus began to realize the benefits of space technology very early in the space age as a direct result of expanding international cooperation. The former Soviet Union established its Council on International Cooperation in the Study and Utilization of Outer Space (INTERCOSMOS) as a vehicle to facilitate the flow of space applications benefits to States wishing to cooperate in its space programmes. The rapid growth in cooperative programmes created a need for effective international rules for the use of outer space.

13. In 1967, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies (General Assembly resolution 2222 (XXI), annex), also known as the Outer Space Treaty, a landmark in the development of principles regarding outer space activities, entered into force. In addition to affirming that outer space is the province of all of humankind and should be used for peaceful purposes, it called upon States to “be guided by the principle of cooperation ... with due regard to the corresponding interests of all other States Parties to the Treaty” (article IX).

14. The legal agreements and principles adopted by the United Nations in the following 30 years continued to emphasize the desire of States to engage in international cooperation in such activities as the rescue of astronauts, direct television broadcasting and remote sensing of Earth. Those efforts culminated in 1996 in the adoption of the Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries (General Assembly resolution 51/122, annex).

15. The World Weather Watch programme, established by the World Meteorological Organization (WMO) in April 1963, is one example of the early cooperative efforts of the United Nations system in areas of global significance.

16. In 1968, the first United Nations Conference on the Exploration and Peaceful Uses of Outer Space was held. The participants in the Conference reviewed the progress made in space science, technology and applications, and called for increased international cooperation. As a result, the United Nations Programme on Space Applications was created to assist developing countries in using space technology for development.

17. Fourteen years later, the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE 82) was held to conduct an updated review of progress in space activities. In the end,

UNISPACE 82 sought to promote international cooperation to assist developing countries in the use of space technology for development. Consequently, it strengthened the United Nations Programme on Space Applications and reoriented its activities to focus on the promotion of indigenous capabilities in those countries.

18. In 1992, the Secretary-General issued a report entitled “International cooperation in space activities for enhancing security in the post-cold war era” (A/48/221). In paragraph 2 of that report, the Secretary-General urged the international community to “seize the opportunity to ensure that space technology is effectively used to promote security in all its forms—political, military, economic and environmental—for the benefit of all countries.”

19. Many States have continued to move in that direction and have been actively engaged in international cooperation, albeit for a variety of reasons. Their motivations can be broadly characterized as political, scientific and technical and economic.

A. Political considerations

20. For many spacefaring States, cooperating for political reasons may serve several purposes. Joint activities such as the historic Apollo-Soyuz mission sometimes take on symbolic meanings. At other times, important foreign policy goals are at stake, such as strengthening relationships between long-standing and new international partners. Space partnerships can be used as an incentive to achieve certain results or to influence behaviour.

21. Several space activities require international coordination in order to function successfully. For example, satellite communications would be an unruly and disorganized activity if States did not recognize the need for common standards and practices. The International Telecommunication Union (ITU) plays a central role in cooperation. Avoiding duplicative or redundant satellites for studying global climate change requires sharing information and collected data and enhancing the compatibility and complementarity of existing and future remote sensing systems, as well as continuity in the acquisition of data. The Committee on Earth Observation Satellites (CEOS), which is currently working on a number of those issues, is an example of such collaboration.

22. International cooperation has also increased transparency in space and other activities, thereby contributing to worldwide peace and security. While transparency is not a substitute for broader cooperation, it does promote confidence-building in the international community. Space techniques have already demonstrated their potential to assist in verifying conformity with a number of international protocols, such as the Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water, signed at Moscow on 5 August 1963, also known as the Partial Nuclear Test Ban Treaty, and the Interim Agreement between the United States of America and the Union of Soviet Socialist Republics on Certain Measures with Respect to the Limitation of Strategic Offensive Arms of 1972.

B. Scientific and technical aims

23. Coordination for scientific and technical purposes allows for sharing of both expertise and the costs of developing that expertise. Data analysis and international publication of research results enhance the scientific return of a research project. Moreover, as space activities become more multidisciplinary, the favourable political climate allows more scientists from around the globe, in various fields, to participate in space-related activities that might have been previously unavailable to them, especially through the announcement of such opportunities by entities such as the National Aeronautics and Space Administration (NASA) of the United States.

24. Additionally, decision makers around the world need objective scientific knowledge on which to base their actions; thus, the credibility of the information depends on international participation in the scientific process. An international data and information system to collect and distribute the data generated from global, regional and national satellites and *in situ* observations may be needed in order to ensure the most thorough scientific analysis of the data.

C. Economic motivations

25. The increased role of the private sector and the release of formerly classified technologies into the private sector have both led to the transformation of many space activities to more commercial adaptations over the past decade and has generated a variety of economic benefits. Commercialization has allowed an increasing number of countries to take advantage of such space-based technologies as satellite communications and remote sensing for national economic and social development. Diffusion of space technologies into the commercial market place has allowed more countries to reap the benefits of those technologies and has produced a variety of spin-off benefits from them.

26. A number of States have also realized that pooling financial and human resources among international partners reduces the overall cost of a given programme and increases the number of programmes that a State can undertake, as exemplified by the 14-member European Space Agency (ESA) and the International Space Station programme, which is being led by the United States. For a non-spacefaring State multinational coverage through the sharing of satellites for satellite meteorology costs no more than national coverage, since only a few satellites are required to provide global coverage. Thus, a participating country gains access to most of the benefits, such as data and information, technology and know-how. Similarly, Earth system science and global change research require a global effort and continued international participation, because no single agency or nation can afford the comprehensive systems needed to understand all the components of Earth system science. Such phenomena transcend international borders and have to be studied collectively on a global scale, as is being done through CEOS and the International Geosphere-Biosphere Programme (IGBP).

27. The participation of developing countries in space activities also makes it possible for their scientists and industry to work on space projects, thereby enabling them to add diversity to their economies and bring in much-needed expertise. However, it is important to note that developing countries, such as Brazil, China and India, which have established basic educational resources and training centres to create and sustain the cadres needed to exploit space technologies have enjoyed substantial benefits. Conversely, countries that have focused their efforts on only acquiring space data or space technology while neglecting the need for indigenous training facilities or educational or research organizations to establish and maintain the necessary technical cadres have gained very few benefits.

D. Future prospects for international cooperation

28. International cooperation should assist and result in the strengthening of ongoing efforts in developing countries to apply space technology, and therefore will continue to play a large role in the twenty-first century as more uses are established for space technology to address manifold problems and to ensure a better quality of life. However, there are still many countries that do not fully utilize or are not in a position to utilize the existing potential of space technology. The know-how of a developing country can be enhanced through education programmes and technical assistance, enabling it to participate in space activities and obtain hands-on experience in projects that can then be developed and adapted to their specific needs. The centres for space science and technology education being established at the regional level by the United Nations offer such opportunities.

29. For example, small, multimission satellites and other similar projects offer opportunities to developing countries for acquiring greater knowledge of current technology and for skill development, which in turn may lead to a gradual build-up of indigenous capabilities, thereby creating a “space-literate” cadre within a country. Participation in such programmes could result in the following: development of a national space programme, if so desired; new opportunities for acquiring advanced technical and management expertise through international cooperation; opportunities to train a wide range of engineers and scientists; development of local industries; opportunities to carry out low-cost scientific and technological experiments in space; and opportunities to develop low-cost projects to satisfy local needs.

30. Similarly, the use of space technology for assisting small island States or rural areas on issues pertinent to development and safety will continue to provide a rationale for greater international cooperation, in addition to the need for basic socio-economic development. For example, satellite communications are cheaper, more reliable and easier to implement than building a traditional terrestrial cable network in rural or remote areas, territories scattered across wide distances, or places likely to be affected by natural disasters. Linking such areas, at a fraction of the cost and time, with satellites and ground stations would foster economic, social and cultural development, which could lead to less migration to urban areas, fewer overcrowded cities and reduced environmental degradation and crime.

31. Most countries can use satellites not only for point-to-point broadcasts, but also for mass communication by direct broadcast television, particularly for reaching inaccessible regions. National programmes on literacy, education, family planning and productivity are essential components of development, and satellites can play a small, but critical, role in the implementation of such programmes. Given the fact that 55 per cent of school-age children today, most of them in the developing countries of Africa, Asia and Latin America, are not in school, satellite television can assist in providing relatively prompt relief from such a situation.

32. The provision of health-care services to non-urban and isolated areas can be greatly assisted through telehealth and telemedicine systems, or distance communication in medical care. Terrestrial-based telemedicine systems have been used to a limited extent worldwide, but those networks cannot reach many areas. Satellite systems seem to offer a viable alternative solution that would enable medical consultations to take place over great distances, health professionals to update their knowledge and skills with the latest medical information and wide-reaching public health campaigns to be conducted.

33. In addition to development concerns, protecting the environment is another reason why international cooperation in space-related activities will continue to be important. For instance, the results of research on the stratospheric ozone layer by the United Nations Environmental Programme and WMO helped to provide the scientific guidance for formulating the Montreal Protocol on Substances that Deplete the Ozone Layer, adopted on 16 September 1987.

34. Human activities in the last decade have also created many new transnational problems in which space activities could play a useful role. High-resolution satellite sensors can be deployed to monitor refugee movements, and to assist in planning humanitarian relief operations or in locating landmines or illegal stockpiles of weapons.

35. Space studies in life science and medicine have important potential benefits for all countries. Ongoing studies of human and animal physiology under the microgravity conditions of space flight within the Mir space station will lead to a number of important advances in medical knowledge, and continued international cooperation would certainly facilitate further findings that would benefit humankind.

36. Space technology offers many exciting potential uses and benefits, as shown by the above examples, and it is tempting for countries to see the applications of space technology as a panacea for many of their ills. However, it must be emphasized that space technology is but one tool that can be used in an overall national development plan. States will still have to provide the trained personnel, resources and facilities required to ensure that development is sustainable.

III. EXISTING MECHANISMS FOR COOPERATION IN SPACE ACTIVITIES

37. There has always been a variety of bilateral and multilateral cooperative initiatives in space activities involving spacefaring and non-spacefaring States, as well as developed and developing countries. Examples of regional and global programmes are presented below.

A. Satellite communications

38. Communication satellites were among the first space technologies to stimulate international cooperation, going back to the early 1960s with the Telstar, Sycom and EarlyBird programmes. Today, international programmes exist that enable real-time worldwide communications to occur at a fraction of the cost charged just 25 years ago. Organizations such as Inmarsat and INTELSAT, at the global level, and ARABSAT and EUTELSAT, at the regional level, have undertaken some of the current cooperative programmes that make possible real-time communications whether on land, in the air or at sea. The most dramatic and economically successful application of space technology, the communication satellite, has been the greatest boon to national, regional and global economic and social development.

39. The above-mentioned regional and global organizations serve, *inter alia*, the telecommunications, information, cultural and educational needs of people in many parts of the world. They ensure, at the international and national levels, public, fixed and mobile telecommunications, such as telephony, telex, telefacsimile, data, videotext, television and radio transmission services. They also offer specialized telecommunications services such as radio navigation and meteorological services and remote sensing for Earth resources. In addition, they provide mobile satellite communications worldwide for commercial and distress and safety applications at sea, in the air and on land.

40. Besides service providers, there are also policy-making and cooperative bodies such as ITU, an international organization within which Governments and the private sector coordinate the establishment and operation of telecommunication networks and services. An ITU goal is to foster and facilitate the global development of telecommunications for the universal benefit of humankind, through the rule of law, mutual consent and cooperative action. ITU also facilitates the development of telecommunications in developing countries by providing technical assistance in telecommunication policies, the choice and transfer of technologies, financing of investment projects, mobilization of resources, the installation and maintenance of networks, the management of human resources and research and development.

B. Earth observation

41. There are a number of formal and informal international cooperative bodies dealing with issues related to observing the Earth system. Among the research-oriented activities are IGBP, the Mission to Planet Earth (MTPE) and the World Climate Research Programme, each established to accumulate information on different facets of the Earth environment, such as the atmosphere, hydrosphere, biosphere and land surface. There are also systems designed for global observation using both remote and ground-based measurements. They include the Global Climate Observing System (GCOS), the Global Ocean Observing System (GOOS) and the Global Terrestrial Observing System (GTOS).

42. In addition to the above-mentioned programmes, there are organizations that coordinate operational and research satellite programmes and missions. One such body is CEOS, whose primary objectives are to optimize the benefits of space-borne observation systems through cooperation in mission planning and in the development of compatible data products, formats, services, applications and policies. CEOS serves as a focal point for the international coordination of space-related Earth observation activities, for the exchange of policy and technical information with a view to encouraging complementarity and compatibility among space-borne Earth observation systems that are currently in service or are to be deployed.

43. Remote sensing technologies and data delivered by various Earth observing systems through analytical and integrative technologies such as Geographic Information Systems (GIS) are being applied to a wide range of activities, including environmental monitoring (for example, land-cover mapping, forest planning, deforestation monitoring, desertification mapping and monitoring of cultural sites), monitoring of natural resources, pest and disease control, drought and flood management, earthquake and landslide studies, ensuring food productivity and preventing land degradation.

44. Through international agreements, much of the data collected by meteorological satellites are made available to interested parties under the aegis of WMO without cost. Some of the programmes undertaken support the distribution of image data to other users, such as universities and research institutes for research and education purposes; as well as commercial organizations, which use the systems either as end-users (for example, airlines) or as service providers (for example, television stations and commercial weather-forecasting firms).

45. Still other cooperative mechanisms, such as the WMO World Weather Watch programme, support the coordination of global scientific activity for prompt and accurate weather information and other services for public, private and commercial use. Such mechanisms facilitate international cooperation in establishing a network of stations for making meteorological, hydrological and other observations, and in promoting the rapid exchange of meteorological information, the standardization of meteorological observations and the uniform publication of observations and statistics. They are intended to offer up-to-the-minute worldwide weather information, and the collection and preservation of climate data will assist Governments in preparing national development plans and determining their policies in response to global climate change.

C. Disaster prediction, warning and mitigation

46. The frequency and effect of natural disasters led the General Assembly to proclaim, in its reso-lution 44/236, the International Decade for Natural Disaster Reduction (IDNDR), beginning on 1 January 1990, with the objective of reducing, through concerted international action, especially in developing countries, the impact of natural disasters. Governments have been called upon to enact a number of measures, including: the formulation of national disaster-mitigation plans; the establishment of multisectoral national committees to stimulate and coordinate activities designed to address the aims of IDNDR; mobilization of support in the public and private sectors; increasing public awareness of the need for risk reduction; relief and short-term recovery activities and the enhancement of preparedness; closer attention to the impact of natural disasters on health care; improving the system for ensuring the early availability of emergency supplies.

47. A target of IDNDR is that by the year 2000, all countries should have achieved sustainable development and have established:

(a) Comprehensive national assessments of risks from natural hazards;

(b) Mitigation plans (and the necessary legal framework) at national and local levels involving long-term prevention, preparedness and community awareness;

(c) Ready access to global, regional, national and local warning systems to ensure broad dissemination of warnings.

48. In disaster situations, satellite systems such as the International Search and Rescue Satellite System (COSPAS-SARSAT) have provided basic information which, combined with other data, facilitates coordination and enables decisions and subsequent action to be taken. COSPAS-SARSAT began as an initiative of Canada, France, Russian Federation and United States and has expanded to include the participation of 31 States. Several existing meteorological and navigation satellites have on-board receivers tuned to pick up signals emitted from transmitters that are activated in distress situations. The beacons can be located within a very short time and with very precise coordinates, thereby greatly aiding in search and rescue operations following land, air or sea accidents. Between September 1982 and December 1996, the programme has assisted in the rescue of over 7,300 persons who would otherwise have been lost in aircraft and boating accidents in remote areas, where only the reach of the satellite could discover the distress signals of threatened people.

D. Global positioning and navigation systems

49. Various organizations and consortia are working to develop a civil and internationally controlled Global Navigation Satellite System (GNSS) to meet the requirements of all user categories, in particular civil aviation, through the implementation of a system overlay or augmentation that would eventually replace the two currently existing navigation systems—the United States Global Positioning System (GPS) and the Global Orbiting Navigation Satellite System (GLONASS) of the Russian Federation. The two systems are under military control and available on a limited basis to civilian users, but there are questions about their future integrity, availability, control and life expectancy.

50. Ongoing discussions at the International Civil Aviation Organization and the International Maritime Organization have centred around the design and operation of a future international GNSS for air and sea users that could be compatible with existing infrastructures and devices.

51. Europe has been pursuing a two-pronged strategy of augmenting current GPS and GLONASS (GNSS-1) operations and establishing in parallel an independent civil replacement (GNSS-2) that would provide maximum safety, efficiency and cost-effectiveness.

52. The European contribution to GNSS-1 is based on the use of navigation payloads on geostationary satellites and is referred to as the European geostationary navigation overlay service (EGNOS). The EGNOS system will meet civil aviation primary navigation requirements for all phases of flight, from en route to non-precision approach, down to precision landing.

53. GNSS-2 is expected to be under civilian control, tailored to the long-term needs of civil user communities and designed for improved navigation performance while still retaining GPS/GLONASS backward compatibility.

54. Meanwhile, commercial uses of GPS and other location and navigation devices continue to grow. Automotive navigation is a burgeoning market, with several automobile firms having recently introduced satellite navigation systems in their cars. Commercial marine and aviation enterprises are using GPS to supplement or replace other means of navigation, and GPS systems for personal marine applications have been on the market for years.

E. Basic space science*

55. The Office for Outer Space Affairs developed the basic space science workshop programme for 1990-2000 to help bridge the gap in space science knowledge between developed and developing countries.

56. The seven annual workshops held so far in different regions around the world have concentrated on the needs of developing countries in space science, the specific theme and focus of the workshops being defined by the host country in the light of the interests of the region concerned.

57. The workshops have helped to build indigenous infrastructures and to create a global community of participants in basic space science in developing countries, leading to specific space science projects involving the participation of developing countries. The projects include the donation by Japan of an astronomical telescope to Sri Lanka, the operation of an astronomical observatory in Honduras, the development of an Inter-African Astronomical Observatory and Science Park in Namibia and the upgrading of the Kottamia Observatory in Egypt.

58. Future efforts in basic space science on board the International Space Station (ISS) will provide extraordinary physical and environmental circumstances not available on Earth. One of the most important factors will be the reduced levels of gravity, or microgravity, in space. The microgravity environment would allow high-value materials such as precision latex microspheres, electronic materials, various kinds of pharmaceutical products, optical fibres

*For a complete discussion of basic space science, see background paper 6.

and highly specialized alloys to be produced in their purest forms, leading to improvements in the efficiency of the production process as well as in the quality of goods produced on Earth.

F. Space environment and space debris

59. The issue of space debris has been gaining prominence in recent years as States have acknowledged the potential danger to missions and crew of unchecked growth in the amount of accumulated objects in outer space. Such concerns led to the inclusion of an item on space debris in the agenda of the Committee on the Peaceful Uses of Outer Space and its subsidiary bodies and to the establishment of the Inter-Agency Space Debris Coordination Committee (IADC). IADC, comprising experts from the major space agencies, has since been examining the problem at annual meetings and has contributed to a technical study prepared by the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space.

G. Non-governmental organizations

60. Several international non-governmental organizations, such as the Committee on Space Research of the International Council of Scientific Unions, the International Academy of Astronautics, the International Astronautical Federation, the International Astronomical Union and the International Society for Photogrammetry and Remote Sensing, regularly hold congresses, workshops, seminars and other technical forums. Their activities and programmes allow their membership, comprising individual scientists, engineers and policy makers as well as institutions and organizations, and other interested parties to examine or promote further understanding of different space-related issues, particularly through the exchange of information. Their findings are normally brought to the attention of the Committee on the Peaceful Uses of Outer Space at its annual meeting.

H. United Nations

61. The Committee on the Peaceful Uses of Outer Space, established in 1959 in the hope of forestalling an arms race in space, has played a significant role in shaping international law and policy relating to the development and use of space technology.

62. Its Scientific and Technical Subcommittee studies and reports on space science and technology issues such as space debris, information networks and the safe use of nuclear power sources in outer space. The Subcommittee also devises scientific, technical and capacity-building programmes to be undertaken under the auspices of the United Nations, particularly to assist developing countries in using space technology for sustainable development purposes.

63. Its Legal Subcommittee examines legal and political problems arising from the exploration and use of outer space and has set in place the basic legal and regulatory framework for governing space activities, as elaborated in the five international treaties and five sets of principles adopted by the General Assembly and several Member States.

64. The specialized agencies of the United Nations have also played key roles in the development and coordination of space-related activities, such as ITU, which has addressed the need for new radio regulatory structures, and WMO, which has established its World Weather Watch programme to integrate worldwide weather information gathered by satellites.

I. International Space Station

65. ISS, a major multinational scientific and engineering project which will provide unprecedented opportunities for science, technology and commercial investigation, illustrates many of the motivations and benefits of international partnerships.

66. In 1984 the United States proposed the development of an international space station; a project in which it offered to play a leadership role. International participation would reduce the total costs to the United States and expand the research capabilities of the proposed space station. By the second quarter of 1985, Canada, Japan and ESA had each signed a bilateral memorandum of understanding with the United States, leading to their participation in the project.

67. The end of the cold war and the subsequent changes in the international security environment also raised new possibilities for the utilization of space technology to promote international peace, security and stability. In December 1993, the United States and its international partners formally invited the Russian Federation to participate in the redesigned space station. In January 1998, all the participating States signed agreements establishing the framework for cooperation among the partners on the design, development, operation and utilization of the space station.

68. The United States Space Shuttle has undertaken many cooperative flights with Russian cosmonauts and has performed docking missions with the Russian Mir space station. Such cooperation, together with the manning of Mir by international crews, has yielded valuable experience as a prelude to the actual construction of ISS, providing early opportunities for extended scientific research, and developing and demonstrating joint mission procedures. Each of the participating States are also preparing different components of the giant ISS programme, requiring intensive coordination on design specifications and construction timetables and agreement on mission goals.

J. Bilateral cooperation

69. Bilateral agreements and projects have been the primary elements of international cooperation, between spacefaring States, between spacefaring States and developing countries and, increasingly, among developing countries.

70. Since its beginning, the United States civil space programme has carried out several bilateral projects with dozens of countries. One of the earliest was the launch of the Ariel 1 satellite in partnership with the United Kingdom of Great Britain and Northern Ireland. Several subsequent programmes, such as the development of the Landsat series of satellites and the Space Shuttle furthered the concept of expanding and encouraging international cooperation in United States space activities.

71. Today, the United States continues its varied programme of bilateral agreements in space activities with numerous countries, as exemplified by the use of its rockets to launch foreign satellites, the development and training of foreign astronauts, coordination of broadcasting rights and standards and integration of foreign hardware and instruments into its own projects, in addition to ongoing Earth observation programmes and Space Shuttle missions, which have carried payloads and astronauts from Australia, Canada, France, Germany, India, Italy, Japan, Mexico, Netherlands, Russian Federation, Saudi Arabia and United Kingdom.

72. The projects carried out by the United States in conjunction with the Russian Federation and previously with the Union of Soviet Socialist Republics have been important from a global perspective. As the two leading space powers, the handshake during the Apollo-Soyuz link-up in 1975 gave the world a first glimpse at the real possibility of cooperation in the peaceful uses of outer space by all States. Political developments during the 1980s and early 1990s made possible the widening of participation by one State in the space programmes of the other, as recently demonstrated by the inclusion of United States astronauts in the crew of the Mir space station, and the invitation to the Russian Federation to join the ISS project.

73. The Russian Federation tradition of bilateral cooperation may be best exemplified by its recent manned space flights, where in addition to United States astronauts, nationals of Afghanistan, Austria, Bulgaria, Canada, France, Germany, Japan, Kazakhstan, Syrian Arab Republic and United Kingdom have worked on board the Mir space station. Russian cooperation with numerous countries have also spanned areas as diverse as launching foreign

satellites, establishing a global navigation satellite system and the exploration and use of outer space, in particular the study of Mars and microgravity and radiation experiments, as well as its own geophysical research and telecommunication satellite projects.

74. France, Germany and Japan are spacefaring States that have concluded several bilateral agreements with different States in disciplines such as Earth observation, including the use of balloons as platforms for taking various scientific measurements, telecommunications, satellite launches, space science, acquisition and exchange of scientific data and exploration of the universe.

75. Brazil, China and India, three of the leading spacefaring developing countries, have all entered into bilateral arrangements with developed and developing countries alike throughout the years. Recently, Brazil has signed an accord with Argentina providing for the use by Argentina of the Alcantara facility in Brazil for the development and launch of space payloads; with France to pursue cooperative space ventures, including the design and construction of a joint scientific satellite and a rocket ground-test facility in Brazil; and with the Russian Federation, to replace its previous agreement with the former Soviet Union in satellite launching and space research.

76. Similarly, China has current agreements with countries such as Thailand, on satellite communications; with Canada, on receiving and using RADARSAT images as well as telecommunications issues; with France, on space research and satellite construction for remote sensing and space science missions; with Brazil, for the development of the China-Brazil Earth Resources Satellite; and with Australia and Sweden, for satellite launch contracts.

77. India built up its space programme through joint programmes with established spacefaring States, including France, the United States and the former Soviet Union. Today, it has agreements with countries such as Canada, Hungary, Norway and the United Kingdom, covering areas such as satellite Earth observation, space physics, astronomy and solar-terrestrial physics, satellite communications, space research and space exploration.

78. As a regional intergovernmental organization, ESA has also entered into several bilateral agreements with both spacefaring and non-spacefaring States covering different space activities. Recently, ESA has concluded agreements with the Czech Republic to cooperate in space science, Earth observation, research and applications, satellite communications, microgravity research and ground segment engineering and utilization. ESA has launched satellites for the Republic of Korea and Malaysia; it has reached an agreement with the Government of Portugal on activities in space science, remote sensing, telecommunications and microgravity research; and it has agreed to cooperate with Japan in telecommunications, manned spaceflight and the ISS project.

79. Today, virtually all countries engaging in space-related activities are involved in some form of bilateral, regional and international cooperation.

IV. CONSTRAINTS TO BETTER COOPERATION

A. Sustainability of transferred technologies

80. Current and future international cooperation in space activities faces a variety of obstacles. A major one is the application of control regimes that could restrict the export of certain kinds of technology and materials. As with many other instances of technology transfer and cooperative projects, another issue is that the recipient of the technology should have the capability to sustain or maintain the technology after the donor has left. Education and training is of paramount importance in ensuring not only that the user community knows how to use a given technology, but also in enhancing understanding, for example, of the inventive process, so that the recipient community will eventually be able to contribute to further refinements of the technology or have the capability to create new ones.

B. Inadequate information

81. The inadequate dissemination of information about the practical benefits of space activities to the general population and government leadership, beyond the scientific community, in developing and non-spacefaring countries has been a barrier to better international cooperation. More information about the practical benefits of the technology would probably increase interest among government decision makers in participating in the projects or in directing more funding toward strengthening science and technology education programmes.

82. Many developing countries also must deal with political instability, which hinders continuity in national strategies and policies, making it difficult to achieve any sustained commitment among the appropriate national institutions in planning the adaptation of space technology and in determining the national objectives and priority areas for which the technology will be used.

C. No involvement of end users

83. Developing countries often have very little choice in accepting most foreign offers of hardware and training programmes, which are usually tied directly to governmental organizations. Such a situation occurs because many countries are without appropriate policies that explicitly specify the following: the needs to be met; the requirements for meeting those needs (for example, financial, human and material resources); actions to be taken; the establishment of an organizational structure within which the specified actions would be taken; priorities in target-setting; standards to be set for products; and mechanisms for coordination.

84. The fact that many developing countries are without space-literate personnel who can act as advocates for utilizing space technology and further its development on a local level greatly magnifies the isolation of the user communities in those countries. There are many cases in which highly qualified persons in developing countries are not given the opportunity to contribute to national plans because of the lack of communication with national policy and decision makers, who are unaware of the benefits that space applications could bring to national efforts in achieving sustainable development.

D. Data access and cost

85. Earth environment monitoring offers a very promising opportunity for greater international cooperation. Developing countries have a major interest in gaining access to such data, yet access is sometimes restricted because of market considerations. For instance, the growing profitability of commercial applications of Earth observation data or advanced technology satellites could prove beneficial to private firms that are operating a particular type of satellite, and may lead that entity to consider restricting the availability of the gathered data to its international partners.

86. Another facet of accessibility to various forms of data is its high cost. Though many institutions have traditionally provided interested users with various kinds of satellite-derived data such as meteorological data free of charge, the growing trend towards the commercialization of remote sensing imagery has resulted in high costs which many developing countries cannot afford. Those high costs are limiting the access of developing countries to vital information just when it appeared that, as a result of commercialization, such information would become available to them.

87. National security concerns, especially in light of the high spatial resolution of remote sensing satellites today, are another reason for the narrowing of data access. Information acquired by such means may have strategic value and raise security implications, particularly if the information is commercially available to third parties without the consent of the sensed State, an issue that is broadly addressed in the Principles Relating to Remote Sensing of the Earth from Outer Space, adopted by the General Assembly in its resolution 41/65.

E. Commercialization of space activities

88. The commercialization of space activities has raised new issues for the international community to consider. In general, the growth of private industry and the levelling off of government funding for space programmes reflects the transition of space technology applications from being a government-dominated enterprise to a commercial one. With the private sector enjoying greater prominence in space activities and many Governments of spacefaring States unable or unwilling to continue subsidizing non-revenue-generating space ventures, there is the fear that the needs of developing countries may be squeezed out by purely commercial market interests.

89. The growth in commercial space transportation systems has blurred the definition of launching States, as spelled out in several of the existing legal instruments adopted by the General Assembly. With various agencies and States making their launch vehicles available to carry commercial and non-commercial payloads for different

international cooperative programmes, issues such as liability and compensation and intellectual property rights deserve more attention.

V. WAYS AND MEANS OF ENHANCING COORDINATION AND COOPERATION

A. Information

90. Support for various programmes is often dependent upon the nature of the information available. In many countries, disinterest in or even skepticism about a number of space activities among the general population and government leaders can be attributed to the inadequate dissemination of information about the practical benefits to be derived from those programmes.

91. To remedy the situation, leaders within the space community of spacefaring States, including policy advisers and heads of space agencies, could stress to their heads of Government the value of international cooperation in space technology and of promoting the practical benefits that accrue in the process, in support of domestic, economic and political objectives.

92. In parallel, dissemination of information on the status of technology is an important element in space activities. Many publications contain suggestions on possible applications of new technologies. More information is being distributed through computer networks, which in turn stimulate demand for further development of databases. The use of the Internet and its various services, including e-mail, File Transfer Protocol, LISTSERV and the World Wide Web, is considered a highly appropriate means of improving coordination among the organizations in the United Nations system and of enhancing the dissemination of information in general, and could be further expanded.

B. Education and training*

93. For developing countries to make full use of space technology, they will need to develop national capabilities rather than relying on foreign experts and suppliers, because the effectiveness with which any policy or programme is implemented is influenced significantly by the culture and attitudes of the organizations and the people involved. Without trained and qualified personnel in developing countries, the benefits of space technology cannot flow into those countries. Their Governments should address the best means of finding and sustaining trained national experts to work with space resources. There is also a need for education and training in developed countries. The vast array of data currently derived from satellite remote sensing, for example, far outpace the understanding within the user community of the different applications and users of the information.

94. Building up indigenous capacity requires support, either in the form of direct financial contributions or through individual fellowships, for more education and training programmes such as training courses, workshops and seminars. ESA and several States Members of the United Nations have ongoing programmes that support various activities.

95. Efforts should also be directed at improving the educational and training environment by establishing new facilities and providing new educational tools. The latter should bring together experts in various space-related fields and serve to facilitate the exchange of information among experts and scientists from developed and developing countries.

Centres for space science and technology education

*For a complete discussion of education and training in space science and technology, see background paper 10.

96. In 1990, the General Assembly 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 institutions in developing countries.

97. In 1995, the Centre for Space Science and Technology Education in the region of Asia and the Pacific, located in India, became the first operational institution, to be followed by centres in Latin America and the Caribbean (to be established in Brazil and Mexico) and in Africa (to be established in Morocco and Nigeria). Discussions are in progress for the establishment of a regional centre in western Asia as well as a network for central eastern and south-eastern Europe. Once established, each centre could expand and become part of a network that could cover specific programme elements in established institutions related to space science and technology in each region.

98. The purpose of the centres is to offer developing countries an opportunity to build a firm foundation of human resources and to enhance the academic and professional capabilities and technical infrastructure of each region, thereby enabling developing countries not only to solve local problems, but also to participate in international programmes dealing with global issues.

99. Developing countries with very limited resources may also find the centres a useful way to share the cost of modest but essential training programmes. Countries therefore may be able to obtain the benefits of training and education for only a share of the cost involved in making such opportunities possible, as well as to take advantage of an informal caucus of personnel trained at the same institutions and providing useful contacts that may lead to further cooperative ventures.

C. Coordination

100. More effective coordination policies could be established at all levels nationally and internationally in many areas of space activities. CEOS and IADC, as mentioned above, and the Coordination Group for Meteorological Satellites (CGMS) are good examples of coordinating bodies in their respective fields. CGMS has provided a forum in which satellite operators have studied jointly with WMO the technical and operational aspects of the global network, so as to ensure maximum efficiency and usefulness through proper coordination in satellite design and in the procedures for data acquisition and dissemination. Regular meetings of the group have permitted a gathering and exchange of results during the course of development of each system and a considerable measure of coordination has been achieved.

101. Ongoing intraregional communication between States with space agencies or between those States and others that would like to participate in space activities should be encouraged. Annual meetings such as the Space Agency Forum, attended by representatives from almost all of the States with space agencies, the Space Conference of the Americas in Latin America and the Asia-Pacific Satellite Communications Council allow for sharing of information and needs and increase opportunities for developing ideas for mutual cooperation.

102. Within the United Nations system of organizations, proactive coordination of the use of space technology and increasing the awareness of the capabilities of such applications could also improve the effectiveness of various programmes. Satellite remote sensing images could help determine the location of illicit narcotics crops or show refugee movements to assist humanitarian relief efforts, and geographic information systems could assist in the production of uniform and up-to-date maps that could be used for peacekeeping operations.

VI. REVIEW OF THE CURRENT STATUS OF THE LAW OF OUTER SPACE

103. Space law is an important function in international cooperation, providing space activities with order and guidance, and its development has taken many forms over the years. Bilateral and multilateral cooperative ventures,

such as INTELSAT or ISS, obviously require legal agreements and in many cases are governed by existing statutory norms.

104. On a worldwide intergovernmental scale, the United Nations has so far adopted five treaties and five sets of principles on outer space.* Each of those legal instruments reinforce the notion that outer space, the activities carried out therein and whatever benefits that might accrue therefrom are to be undertaken in the interest of all countries and of all humankind. Other intergovernmental bodies, such as ITU, have elaborated rules and regulations governing various space activities; in the case of the ITU, its regulatory work has helped establish a standard procedure for the use of broadcast satellites and access to orbital slots.

105. In recent years, the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space has debated various aspects of international space law and it has become apparent that despite the flexibility and adaptability of the fundamental concepts delineated so far in the five treaties and principles, the legal instruments themselves have not necessarily kept pace with the development of space technology and the ensuing rapidly changing character of space-related activities.

106. New, highly technical issues such as space debris and the use of nuclear power sources in space, as well as the need to elaborate on intellectual property rights pose many challenging legal questions and may need refinement of common standards and practices in order to carry out the relevant activities in a systematic and orderly fashion. Yet even though matters pertaining to space law permeate virtually all aspects of international cooperation, many States have yet to become parties to several of the international legal instruments governing space activities** or, despite being parties to the treaties, fail to adhere to them.

107. The Legal Subcommittee has in the past heard suggestions on the possibility of transforming some of the principles adopted by the General Assembly into international treaties and of modifying some of the existing ones in order to reflect current realities and to encourage greater accession and adherence to them. However, as in the case of space debris and the use of nuclear power sources in outer space, there has been some resistance to amending the legal instruments before fully understanding the scientific bases for doing so.

108. The adoption by the General Assembly in its resolution 51/122, of the Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interests of All States, Taking into Particular Account the Needs of Developing Countries, which was constructed with the growing scope of space activities in mind, provides a useful framework for enhancing international cooperation in space activities.

VII. ISSUES OF INTEREST TO MEMBER STATES

109. The end of the cold war has dramatically expanded the opportunities for conducting space activities by replacing confrontation with cooperation. Valuable resources once directed to strategic considerations and competition are now being used to foster greater cooperation and attention to long-neglected global problems that require urgent action. The rapidly changing global economic landscape has also provided an impetus for nations to work together.

110. In the last 40 years, the development of space technology in communications, meteorology and the management of the Earth environment and its resources, to name but a few areas, has directly affected the social and

*See *United Nations Treaties and Principles on Outer Space* (A/AC.105/572/Rev.2) for the text of the legal instruments.

**For instance, only nine of the 185 States Members of the United Nations have ratified the Agreement Governing the Activities of States on the Moon and other Celestial Bodies (the Moon Agreement).

political life of human kind and enhanced the quality of life of people all over the world. Yet there are still many important global issues in which space technology can play a leading role in the coming century; international cooperation is essential to ensure that it does.

111. The time has come to expand international cooperation in space activities, through both a revitalization of existing mechanisms and the development of new strategies for international cooperation. New initiatives could be taken to ensure that the improved technologies available for communications, information-gathering, environmental monitoring and resource development are used for the benefit of all people. Through its global reach and global perspective, international cooperation in space technology can make a vital contribution to promoting international peace and security.

112. Member States, international organizations and space industries planning to attend UNISPACE III should consider the contents of the present paper when constituting their delegations and planning potential contributions to the conference. Suggestions on policies and practices for strengthening international cooperation will be welcomed by all delegations. Ideas for expanding the exchange of information and stimulating the establishment of indigenous cadres to support the utilization of space technologies will be constructive and useful.

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Note: The bibliographical listing contains a selection of the sources consulted in the preparation of the present paper. The annual reports of the Committee on Earth Observation Satellites, the European Organization for the Exploitation of Meteorological Satellites, the European Space Agency, the European Telecommunications Satellite Organization, the International Mobile Satellite Organization and the International Telecommunications Satellite Organization were also valuable sources of information.