Annex I

List of documents

A. Basic Conference documentation

Symbol	*Title or description*
A/CONF.184/1	Provisional agenda of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III)
A/CONF.184/2	Provisional rules of procedure of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space
A/CONF.184/3 and Corr.1-3	Draft report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space
A/CONF.184/4	Report of the Chairman of the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space to the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III)
A/CONF.184/5/Rev.1	Credentials of representatives to the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space: report of the Credentials Committee
A/CONF.184/L.1	Report of the pre-Conference consultations held in Vienna on 18 July 1999
A/CONF.184/L.2	Amendments to the draft Vienna declaration on space and human development
A/CONF.184/L.3	India (on behalf of the Group of 77 and China): amendments to the draft Vienna declaration on space and human development
A/CONF.184/L.4	Chile: amendment to the draft Vienna declaration on space and human development
A/CONF.184/L.5	Morocco: amendments to the draft Vienna declaration on space and human development
A/CONF.184/L.6	Provisional agenda of the Credentials Committee
A/CONF.184/L.7	Russian Federation: amendments to the draft Vienna declaration on space and human development
A/CONF.184/L.8 and Corr.1	Proposals of the Space Generation Forum: note by the Secretariat

Symbol	*Title or description*
A/CONF.184/L.9	Canada: amendments to the draft Vienna declaration on space and human development
A/CONF.184/L.10	Bolivia: amendment to the draft report of the Conference
A/CONF.184/L.11	Australia: amendment to the draft Vienna declaration on space and human development
A/CONF.184/L.12 and Corr.1	Venezuela: amendments to the draft Vienna declaration on space and human development
A/CONF.184/L.13	Report of the Technical Forum
A/CONF.184/L.14	Technical report of the Space Generation Forum
A/CONF.184/L.15	Republic of Korea: amendments to the draft Vienna declaration on space and human development
A/CONF.184/L.16 and Add.1-3	Draft report of the Plenary
A/CONF.184/L.17	Report of Committee I
A/CONF.184/L.18	Report of Committee II
A/CONF.184/C.1/1	Technical Forum: conclusions and proposals of the Workshop on Mars Exploration
A/CONF.184/C.1/L.1	Technical Forum: conclusions and proposals of the Scientific Forum on Climate Variability and Global Change
A/CONF.184/C.1/L.2	Technical Forum: conclusions and proposals of the International Astronomical Union/Committee on Space Research/United Nations Special Environmental Symposium “Preserving the Astronomical Sky”
A/CONF.184/C.1/L.3 and Corr.1	Technical Forum: conclusions and proposals of the Workshop on Managing Space Programmes in Developing Countries: Experience and Needs
A/CONF.184/C.1/L.4	Technical Forum: conclusions and proposals of the International Forum on the Integrated Global Observing Strategy: Into the Next Millennium
A/CONF.184/C.1/L.5	Technical Forum: conclusions and proposals of the Round Table on the Integration of Earth Observation into Secondary Education
A/CONF.184/C.1/L.6	Technical Forum: conclusions and proposals of the Symposium on Recent Progress and Future Plans for Exploration of the Solar System

Symbol	*Title or description*
A/CONF.184/C.1/L.7	Technical Forum: conclusions and proposals of the Workshop on Meteorological Satellite Systems of the Coordination Group for Meteorological Satellites
A/CONF.184/C.1/L.8	Technical Forum: conclusions and proposals of the International Astronomical Union/Committee on Space Research/United Nations Special Workshop on Education in Astronomy and Basic Space Science
A/CONF.184/C.1/L.9	Technical Forum: conclusions and proposals of the Workshop “Blue Planet, Green Planet”
A/CONF.184/C.1/L.10	Technical Forum: conclusions and proposals of the Symposium on the Contribution of Space Techniques to the Exploration of the Universe
A/CONF.184/C.1/L.11 and Corr.1	Space Generation Forum: visions and perspectives of youth
A/CONF.184/C.1/L.12	Technical Forum: conclusions and proposals of the Workshop on Space Law in the Twenty-first Century, organized by the International Institute of Space Law
A/CONF.184/C.1/L.13	Technical Forum: conclusions and proposals of the Forum on Space Activities in the Twenty-first Century
A/CONF.184/C.1/L.14	Technical Forum: conclusions and proposals of the session on the results from the 5th International Cooperation in Space Workshop: “International Space Cooperation: Solving Global Problems”
A/CONF.184/C.1/L.15	Technical Forum: conclusions and proposals of the Workshop on Geospatial Data Access
A/CONF.184/C.1/L.16	Technical Forum: conclusions and proposals of the Workshop on Space Debris
A/CONF.184/C.1/L.17	Technical Forum: conclusions and proposals of the Workshop on Observations of Near-Earth Objects
A/CONF.184/C.1/L.18	Technical Forum: conclusions and proposals of the Workshop on Intellectual Property Rights in Space
A/CONF.184/C.1/L.19	Technical Forum: conclusions and proposals of the Special Workshop on Education
A/CONF.184/C.1/L.20	Technical Forum: conclusions and proposals of the Workshop on Life Science Activities on the International Space Station

Symbol	*Title or description*
A/CONF.184/C.1/L.21 and Add.1-4	Draft report of Committee I
A/CONF.184/C.2/L.1	Technical Forum: conclusions and proposals of the Workshop on Disaster Management
A/CONF.184/C.2/L.2	Technical Forum: conclusions and proposals of the Workshop on Resource Mapping from Space
A/CONF.184/C.2/L.3	Technical Forum: conclusions and proposals of the Workshop on Remote Sensing for the Detection, Monitoring and Mitigation of Natural Disasters, organized by the International Society for Photogrammetry and Remote Sensing and the European Association of Remote Sensing Laboratories
A/CONF.184/C.2/L.4	Technical Forum: conclusions and proposals of the Seminar on Environment and Remote Sensing for Sustainable Development
A/CONF.184/C.2/L.5	Technical Forum: conclusions and proposals of the Seminar on Global Health
A/CONF.184/C.2/L.6	Technical Forum: conclusions and proposals of the Round Table on Tele-education
A/CONF.184/C.2/L.7	Technical Forum: conclusions and proposals of the Workshop on Small Satellites at the Service of Developing Countries
A/CONF.184/C.2/L.8	Technical Forum: conclusions and proposals of the Forum on Industrial Utilization of the International Space Station
A/CONF.184/C.2/L.9	Technical Forum: conclusions and proposals of the Workshop on Developing Indigenous Earth Observation Industrial Capabilities in Developing Countries
A/CONF.184/C.2/L.10	Technical Forum: conclusions and proposals of the Workshop on Global Navigation Satellite Systems
A/CONF.184/C.2/L.11	Technical Forum: conclusions and proposals of the Workshop on Clean and Inexhaustible Space Solar Power
A/CONF.184/C.2/L.12	Technical Forum: conclusions and proposals of the Workshop on Telemedicine
A/CONF.184/C.2/L.13 and Add.1-5	Draft report of Committee II
A/CONF.184/C.2/L.14	Technical Forum: conclusions and proposals of the Session on International Standardization for Space Systems

B. Information documents

Symbol	*Title or description*
A/CONF.184/INF/1 and Corr.1	Information for participants
A/CONF.184/INF/2	List of documents
A/CONF.184/INF/3 and Corr.1	List of participants

C. Background papers

Symbol	*Title or description*
A/CONF.184/BP/1	The Earth and its environment in space
A/CONF.184/BP/2	Disaster prediction, warning and mitigation
A/CONF.184/BP/3	Management of Earth resources
A/CONF.184/BP/4	Satellite navigation and location systems
A/CONF.184/BP/5	Space communications and applications
A/CONF.184/BP/6	Basic space science and microgravity research and their benefits
A/CONF.184/BP/7	Commercial aspects of space exploration including spin-off benefits
A/CONF.184/BP/8	Information systems for research and applications (with emphasis on global environmental issues)
A/CONF.184/BP/9	Small satellite missions
A/CONF.184/BP/10	Education and training in space science and technology
A/CONF.184/BP/11	Economic and societal benefits
A/CONF.184/BP/12	Promotion of international cooperation
A/CONF.184/BP/13	Space Benefits for Humanity in the Twenty-first Century
A/CONF.184/BP/14	Highlights in Space 1998: Progress in Space Science, Technology and Applications, International Cooperation and Space Law
A/CONF.184/BP/15	United Nations Treaties and Principles on Outer Space: A Commemorative Edition
A/CONF.184/BP/16	Space Activities of the United Nations and International Organizations

D. National papers and abstracts

Country	*Symbol of abstract*	*Symbol of national paper*
Algeria	A/CONF.184/AB/23	A/CONF.184/NP/23
Argentina	A/CONF.184/AB/8	
Australia	A/CONF.184/AB/37	A/CONF.184/NP/37
Austria	A/CONF.184/AB/24	A/CONF.184/NP/24
Azerbaijan		A/CONF.184/NP/52
Belarus	A/CONF.184/AB/13	A/CONF.184/NP/13
Bolivia	A/CONF.184/AB/19	
Brazil	A/CONF.184/AB/14	A/CONF.184/NP/14
Bulgaria	A/CONF.184/AB/44	A/CONF.184/NP/44
Canada	A/CONF.184/AB/32	A/CONF.184/NP/32
Chile	A/CONF.184/AB/38	A/CONF.184/NP/38
China	A/CONF.184/AB/26	A/CONF.184/NP/26
Colombia	A/CONF.184/AB/33	A/CONF.184/NP/33
Cuba	A/CONF.184/AB/31	A/CONF.184/NP/31
Czech Republic	A/CONF.184/AB/6	A/CONF.184/NP/6
Denmark	A/CONF.184/AB/2	
Egypt	A/CONF.184/AB/28	A/CONF.184/NP/28
Finland	A/CONF.184/AB/11	A/CONF.184/NP/11
France	A/CONF.184/AB/25	A/CONF.184/NP/25
Germany	A/CONF.184/AB/29	A/CONF.184/NP/29
India	A/CONF.184/AB/35	A/CONF.184/NP/35
Indonesia	A/CONF.184/AB/12	A/CONF.184/NP/12
Iran (Islamic Republic of)		A/CONF.184/NP/53
Iraq	A/CONF.184/AB/36	A/CONF.184/NP/36
Israel	A/CONF.184/AB/9	
Italy	A/CONF.184/AB/21	A/CONF.184/NP/21
Japan	A/CONF.184/AB/4	A/CONF.184/NP/4

Country	*Symbol of abstract*	*Symbol of national paper*
Jordan	A/CONF.184/AB/15	A/CONF.184/NP/15
Kazakhstan	A/CONF.184/AB/48	
Libyan Arab Jamahiriya		A/CONF.184/NP/54
Malaysia	A/CONF.184/AB/34	A/CONF.184/NP/34
Mexico	A/CONF.184/AB/45	
Morocco	A/CONF.184/AB/10	A/CONF.184/NP/10
Netherlands	A/CONF.184/AB/3	A/CONF.184/NP/3
Nigeria	A/CONF.184/AB/17	A/CONF.184/NP/17
Pakistan	A/CONF.184/AB/40	A/CONF.184/NP/40
Philippines	A/CONF.184/AB/56	A/CONF.184/NP/56
Poland	A/CONF.184/AB/22	A/CONF.184/NP/22
Portugal	A/CONF.184/AB/51	
Republic of Korea	A/CONF.184/AB/7	A/CONF.184/NP/7
Romania	A/CONF.184/AB/39	A/CONF.184/NP/39
Russian Federation	A/CONF.184/AB/47	A/CONF.184/NP/47
Saudi Arabia	A/CONF.184/AB/30	A/CONF.184/NP/30
Slovakia	A/CONF.184/AB/42	A/CONF.184/NP/42
South Africa	A/CONF.184/AB/50	
Spain	A/CONF.184/AB/5	A/CONF.184/NP/5
Sri Lanka		A/CONF.184/NP/55
Sweden	A/CONF.184/AB/1	A/CONF.184/NP/1
Switzerland		A/CONF.184/NP/46
Syrian Arab Republic	A/CONF.184/AB/57	
Thailand	A/CONF.184/AB/49	A/CONF.184/NP/49
Tunisia	A/CONF.184/AB/18	
Ukraine	A/CONF.184/AB/20	A/CONF.184/NP/20

Country	*Symbol of abstract*	*Symbol of national paper*
United Kingdom of Great Britain and Northern Ireland	A/CONF.184/AB/27	A/CONF.184/NP/27
United States of America	A/CONF.184/AB/16	A/CONF.184/NP/16
Uzbekistan	A/CONF.184/AB/41	
Viet Nam	A/CONF.184/AB/43	A/CONF.184/NP/43

E. Papers and abstracts submitted by intergovernmental organizations

1. Abstracts of papers

Symbol	*Title or description*
A/CONF.184/AB/IGO/1	Abstract of the paper of the International Organization of Space Communications
A/CONF.184/AB/IGO/2	Abstract of the paper of the European Space Agency
A/CONF.184/AB/IGO/3	Abstract of the paper of the United Nations Institute for Training and Research
A/CONF.184/AB/IGO/4	Abstract of the paper of the Economic and Social Commission for Asia and the Pacific
A/CONF.184/AB/IGO/5	Abstract of the paper of the International Telecommunications Satellite Organization
A/CONF.184/AB/IGO/6	Abstract of the paper of the World Meteorological Organization
A/CONF.184/AB/IGO/7	Abstract of the paper of the Food and Agricultural Organization of the United Nations
A/CONF.184/AB/IGO/11	Abstract of the paper of the United Nations Educational, Scientific and Cultural Organization

2. Papers

Symbol	*Title or description*
A/CONF.184/IGO/2	Paper of the European Space Agency
A/CONF.184/IGO/4	Paper of the Economic and Social Commission for Asia and the Pacific
A/CONF.184/IGO/5	Paper of the International Telecommunications Satellite Organization
A/CONF.184/IGO/6	Paper of the World Meteorological Organization
A/CONF.184/IGO/7	Paper of the Food and Agriculture Organization of the United Nations
A/CONF.184/IGO/8	Paper of the South Pacific Applied Geoscience Commission/South Pacific Forum
A/CONF.184/IGO/9	Paper of the International Telecommunication Union
A/CONF.184/IGO/10	Paper of the Economic Commission for Africa

F. Abstracts of papers submitted by non-governmental organizations

Symbol	*Title or description*
A/CONF.184/AB/NGO/1	Abstract of the paper of the International Astronomical Union
A/CONF.184/AB/NGO/2	Abstract of the paper of the Committee on Space Research
A/CONF.184/AB/NGO/3	Abstract of the paper of the International Society for Photogrammetry and Remote Sensing

G. Documents of the preparatory bodies of the Conference

1. Document for the pre-Conference consultations

Symbol	*Title or description*
A/CONF.184/PRE-CONF/L.1	Note by the Secretariat on matters for consideration in the pre-Conference consultations to be held in Vienna on 18 July 1999

2. Documents of the Preparatory Committee

Symbol	*Title or description*
A/CONF.184/PC/6	Note verbale dated 12 July 1999 from the Permanent Mission of the Russian Federation to the International Organizations in Vienna addressed to the Office for Outer Space Affairs of the Secretariat
A/CONF.184/PC/L.1	Note by the Secretariat on the draft report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, prepared for consideration by the Preparatory Committee at its 1998 session
A/CONF.184/PC/L.2	European position paper on the draft report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space: working paper submitted by the United Kingdom of Great Britain and Northern Ireland on behalf of the following member States of the European Space Agency (ESA) and States having cooperation agreements with ESA: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Portugal, Romania, Spain, Sweden and Switzerland
A/CONF.184/PC/L.3	Note by the Secretariat on the draft provisional rules of procedure for the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space
A/53/20	Report on the forty-first session of the Committee on the Peaceful Uses of Outer Space, including preparations for the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space by the Preparatory Committee
A/52/20	Report on the fortieth session of the Committee on the Peaceful Uses of Outer Space, including the report on the 1997 session of the Preparatory Committee

3. Documents of the Advisory Committee

Symbol	*Title or description*
A/CONF.184/PC/1	Note by the Secretariat on the draft report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, prepared for consideration by the Advisory Committee at its 1999 session
A/CONF.184/PC/L.4	Report by the Secretariat on organizational matters relating to the holding of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space

Symbol	*Title or description*
A/AC.105/C.1/L.218	Note by the Secretariat on the draft report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, prepared for consideration by the Advisory Committee at its 1998 session

4. Documents of the regional preparatory conferences

Symbol	*Title or description*
A/CONF.184/PC/2	Report on the Regional Preparatory Conference for the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space for Asia and the Pacific (Kuala Lumpur, 18-22 May 1998)
A/CONF.184/PC/3	Report on the Regional Preparatory Conference for the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space for Latin America and the Caribbean (Concepción, Chile, 12-16 October 1998)
A/CONF.184/PC/4	Report on the Regional Preparatory Conference for the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space for Africa and the Middle East (Rabat, 26-30 October 1998)
A/CONF.184/PC/5	Report on the Regional Preparatory Conference for the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space for Eastern Europe (Bucharest, 25-29 January 1999)
A/CONF.184/PC/L.5 and Add.1	Recommendations of the regional preparatory conferences for the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space
A/C.4/53/8	Note verbale dated 23 October 1998 from the Permanent Mission of Chile to the United Nations addressed to the Secretary-General, transmitting the text of the Concepción Declaration

Annex II

Report of the Space Generation Forum*

I. Procedures

1. In December 1997, the Secretariat invited the International Space University to organize a youth forum as part of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space.

2. The 160 participants of the Space Generation Forum were from 60 nations. Their expertise covered all fields of space, including science, technology, law, ethics, art, literature, anthropology and architecture, and many other fields relevant to space.

3. The participants of the Space Generation Forum were encouraged from the beginning to think in terms of a broader perspective, encompassing all humanity, and to disregard national agenda. All participants spoke only as concerned individuals, guided by their conscience and a belief in the power of space to change humanity in positive ways.

4. The discussions of the Space Generation Forum resulted in 49 recommendations (A/CONF.184/L.8 and Corr.1, annex). On 23 July, the participants were asked to choose the 10 best recommendations. Consensus was achieved concerning the selection of the 10 recommendations.

II. Guiding vision

5. It was noted that the cosmos naturally inspired wonder and curiosity. Throughout history, space had provided humanity with both fertile soil for the imagination and practical benefits for daily use. In ancient times, people had learned to navigate ships, plant crops and determine the seasons by observing objects in the night sky. In the twentieth century, people had developed the ability to go into space and had even visited some of those objects which had once guided their way.

6. It was noted that the combination of human ingenuity and the rich province of space had yielded benefits that had not been possible to imagine only 100 years ago. Although what lay ahead was unknown, the more important question was “In what manner will the space millennium unfold?”.

7. The participants of the Space Generation Forum expressed the hope and the conviction that the common future of persons living on Earth ought to proceed ethically, with an understanding of the long-term consequences of their action and with all peoples walking forward together as one.

* The recommendations of the Space Generation Forum are presented in more detail, together with implementation plans, in document A/CONF.184/L.14

III. Recommendations

8. The participants of the Space Generation Forum agreed on the following recommendations:

Universal space education

1. An appeal should be made to the Office for Outer Space Affairs and the United Nations Educational, Scientific and Cultural Organization to develop a space education curriculum, to be implemented by Member States in their education curricula. The dissemination of resources and knowledge should be a cooperative effort to improve literacy involving Governments, corporations and non-governmental organizations at the national and international levels.

2. A Space Prize, having the equivalent status of the Nobel Prize, should be awarded in recognition of outstanding achievement in the area of peaceful applications of outer space for the benefit of society, in order:

(a) To advocate the peaceful uses of outer space;

(b) To increase awareness of achievements made towards bringing outer space closer to society;

(c) To promote international cooperation through professional interaction.

Meeting basic needs from an ethical standpoint

3. The United Nations and mobile satellite communication operators should work together to establish a memorandum of understanding on priority access to mobile satellite communication networks during disasters and emergencies.

4. Given the many programmes throughout the world aimed at providing developing countries with useful space technologies, there should be a programme for promoting the implementation of those technologies, taking into account cultural and ecological differences, in exchange for the discontinuation of activities harmful to the Earth.

Cooperation among nations

5. An international space authority should be constituted to make possible:

(a) Oversight and enforcement of a balanced optimization of the multiple interests in space;

(b) Access for all peoples to the material benefits and knowledge and understanding resulting from the exploration and use of space resources;

(c) The pooling of resources of nations and industries for the creation of space infrastructure, missions and enterprises for the optimal development of large-scale space endeavours.

6. An international entity should be created, charged with maximizing the economic value of all space activities by facilitating long-term investments to accelerate space exploration and development, bringing the full benefits of space technology to all nations and promoting public awareness worldwide.

An enduring human presence on Earth and in space

7. An appeal should be made to the United Nations to recognize the hazards and dangers in outer space that threaten the Earth and to take adequate, proactive measures to mitigate or prevent the risks involved.

8. An international centre for space medicine should be established to provide a sound basis for the development, promotion and application of state-of-the-art space medicine for the benefit of humanity on Earth and in space.

Maintaining accountability with regard to the objectives

9. Given that young people have a responsibility to take an active role in the promotion and development of space, it is recommended that a youth advisory council be established as part of the Committee on the Peaceful Uses of Outer Space.

10. The Space Generation Forum should be held every five years, with an annual follow-up meeting. The link with the International Space University should be maintained, and the annual follow-up meeting should be held in parallel with the annual conference of the International Astronautical Federation.

Annex III

Conclusions and proposals emanating from the activities of the Technical Forum

Contents

I. Conclusions and proposals of the Scientific Forum on Climate Variability and Global Change*

1. The climate of the Earth's system is a consequence of a complex interplay of external solar forcing and internal interactions among the atmosphere, the oceans, the land surface, the biosphere and the cryosphere. Surface climate generally defines thresholds for the sustainability of water resources, agriculture, human shelter, transportation and health, among other things. Variability within the climate system has a significant impact on natural and managed resources throughout space and on all time-scales, posing a particularly acute challenge to better observe the Earth's system, improve understanding of interactive processes and produce more sophisticated conceptual models of the Earth's system.

2. Inter-annual variability in the coupled ocean-atmosphere system is best exemplified by the well-known El Niño/Southern Oscillation phenomenon and its corresponding cold phase, La Niña; their impact is generally worldwide. It is now known that human activities are increasingly being recognized as a potential factor forcing change in the global system by altering the chemical composition of the atmosphere and the oceans, as well as the character of the land surface and vegetation cover. Of particular interest is the potential regional impact of such changes on coastal areas, freshwater resources, food production systems and natural ecosystems.

3. Over the past 10 or more years, substantial improvements have been made in observing technology and in constructing sophisticated computer models of the Earth's system. Currently, predictions are routinely made of detailed weather anomalies as well as inter-annual climate variability and global climate change. Improving the accuracy of those predictions requires more comprehensive global observations of key variables, better calibration procedures and, importantly, the uninterrupted maintenance of observing systems over long periods of time. In that connection, special efforts are required to ensure the continuity of monitoring systems and the incorporation of proven research or experimental observing technology into stable operational platforms. It is also considered crucial that the next generation of operational observing systems be designed specifically to meet the more stringent requirements imposed by the need for the detection of climate and global change. With some exceptions, those requirements are not adequately met by most of the existing operational observing systems.

4. During the first decade of the next millennium well over 30 new Earth observing satellites are expected to be launched. They will provide an unprecedented capability to monitor, on a global basis, nearly all aspects of the Earth's climate system. In order to take advantage of those observations, a parallel effort is required in data assimilation, data analysis and modelling technology. In particular, improvements are required in high-resolution regional and local applications. Several scientific issues remain to be addressed with regard to the observation and parameterization of processes in conceptual and mathematical computer models of the global Earth system and its interactive component subsystems. Of particular importance are the quantification and representation of hydrological and biogeochemical cycles in models. The modelling of biogeochemical processes, which involve the cycling of nutrients and carbon by and through land and ocean ecosystems, is less developed than the models dealing with the physical atmosphere and the ocean.

* A/CONF.184/C.1/L.1.

5. The Scientific Forum on Climate Variability and Global Change recognized the considerable progress made in observing technology and also in the improved delivery of products for resource management. Also recognized were the strides made in the improvement of weather and climate predictions, both critical aspects in nearly all activities of the world. Notwithstanding past achievements, the Scientific Forum considered it necessary actively to pursue improvements in global observing systems and in research into climate and global change. To that end the Scientific Forum recommended that action be taken:

(a) To improve scientific knowledge of the interactions between the interlinked components of the global Earth system, namely, the atmosphere, the oceans, the land surface and vegetation and the cryosphere, and, in particular, the global water, energy and carbon cycles;

(b) To improve monitoring and understanding of external and internal forcing and feedback processes governing climate and global change, including the effects of anthropogenic influences;

(c) To improve space-based observing technology in conjunction with surface-based and *in situ* networks to observe the composite global Earth system and to develop integrated data assimilation models, as well as diagnostic and prediction models of the behaviour of the Earth's system and climate throughout space and on all timescales, paying particular attention to the transition from research and observing platforms to operational systems and to the calibration and long-term stability of operational observing systems for climate variability and global change applications;

(d) To improve, through monitoring, the preparation and distribution of assessment products and information to mitigate, where possible, the potential impact of climate and global change on food supply, water resources and managed and natural ecosystems; and to improve the monitoring and prediction of extreme events and other natural disasters;

(e) To encourage all States to participate in the development of a cohesive, internationally coordinated, global Earth observing strategy in order to provide, on a long-term basis, the data required for operational management and decision-making services, as well as for research into global change.

Amendments to the draft report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) for consideration of Committee II and/or Committee I

6. In order to incorporate the conclusions and recommendations of the Scientific Forum on Climate Variability and Global Change into the report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), the following changes are suggested to the draft report of the Conference (A/CONF.184/3 and Corr.1 and 2):

Paragraph 84

(a) Replace the subheading "Applications in weather forecasting" with the subheading "Applications in weather and climate forecasting";

(b) Replace the words "The weather" with the words "The weather and climate";

Paragraph 85

(c) Replace the words "Since many weather phenomena" with the words "Since many weather and climate phenomena";

Paragraph 126

(d) Replace the words "To improve the understanding of weather phenomena" with the words "To improve the understanding of weather and climate phenomena";

Paragraph 88

(e) Insert paragraphs 1, 2 and 3 from the conclusions of the Scientific Forum contained in the present document as new paragraphs 88 *bis*, 88 *ter* and 88 *quater*;

Paragraph 90

(f) Insert paragraph 4 from the above conclusions as paragraph 90 *bis*.

Chapter V: The space millennium—Vienna declaration on space and human development

(g) Add a new section to read:

III. *bis* Advancing scientific knowledge of the Earth-climate system and global environmental change

Action should be taken:

[*Insert paragraphs 5 (a)-(e) from the conclusions of the Scientific Forum.*]

II. Conclusions and proposals of the International Astronomical Union/Committee on Space Research/United Nations Special Environmental Symposium "Preserving the Astronomical Sky"*

Recalling the paragraphs of the draft report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) (A/CONF.184/3 and Corr.1 and 2) referenced in parentheses below, and noting that:

(a) Understanding the nature of the universe is one of humanity's oldest and strongest fascinations and has been of immense scientific, cultural and practical value for many centuries. Observations at all wavelengths of the electromagnetic spectrum, from the ground and from space, have been vital in the phenomenal progress in all areas of astronomy in the twentieth century, from the exploration of the solar system to discoveries of the echo of the big bang and the beginnings of structure in the universe (paras. 1, 2, 6 and 28);

(b) The space treaties adopted by the United Nations have defined outer space and the space environment as the province of all mankind, to be protected from harmful contamination and adverse changes of all kinds, the exploration and peaceful use of which should be carried on for the benefit and in the interests of all mankind (para. 313). This principle is also strongly supported by the International Astronomical Union and the Committee on Space Research;

(c) Nevertheless, continued scientific studies of the origin and evolution of the universe and mankind's place within it are being jeopardized worldwide by man-made environmental problems of rapidly growing severity. In space, interference in radio frequencies by telecommunications satellites and their ever-increasing demand for frequency space (para. 158) cloud the future of radio astronomy and the operation of scientific satellites for astronomy and remote sensing; space debris is a growing threat to

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scientific satellites and interferes with ground-based observations (para. 70); and projects to launch bright objects into space to illuminate the Earth or for artistic, celebratory or advertising purposes present a growing danger to observational astronomy against which no international protection at present exists (para. 73). On the ground, man-made light pollution has already made large areas of the world unsuitable for astronomical observations and is beginning to influence wildlife;

(d) Space is not just another place to do business (para. 273), but a finite natural resource common to all of humanity and already showing inexorable symptoms of over-exploitation (para. 70). The problems enumerated above are global in extent and some are long-term or irreversible in time. Owing to the extreme sensitivity of astronomical observations, science has been the first to detect and suffer from these effects, but it will not be alone for long;

It is recommended that:

(a) Member States should continue to cooperate, at the national and regional levels, and with industry and through the International Telecommunication Union, to implement suitable regulations to preserve quiet frequency bands for radio astronomy and remote sensing from space (para. 162), and to develop and implement, as a matter of urgency, practicable technical solutions to reduce unwanted radio emissions and other undesirable side-effects from telecommunications satellites;

(b) Member States should cooperate to explore new mechanisms to protect selected regions of Earth and space from radio emissions (radio quiet zones), and to develop innovative techniques that will optimize the conditions for scientific and other space activities to share the radio spectrum and coexist in space;

(c) Member States should cooperate, as a matter of urgency, to ensure that future space activities that would cause potentially harmful interference with the scientific research or natural, cultural and ethical values of other nations (para. 73) are subjected to an environmental impact assessment and international consultations before approval;

(d) Member States should cooperate to ensure that the implementation of measures, at the international level, to preserve all aspects of the space environment in the long term, are included in the work plan of the Committee on the Peaceful Uses of Outer Space and its Subcommittees (paras. 318-321). It is proposed that section III, subparagraph (b), of the draft Vienna declaration on space and human development be formulated more adequately as follows:

> "To improve the protection of the near and outer space environment through further research in, and implementation of, measures to control and reduce the amounts of space debris and unwanted emissions at all wavelengths of the electromagnetic spectrum";

(e) Member States should act to control pollution of the sky by light and other causes, for the benefit of energy conservation, the natural environment, night-time safety and comfort and the national economy, as well as science.

III. Conclusions and proposals of the Workshop on Managing Space Programmes in Developing Countries: Experience and Needs*

1. Space technology and its applications have been widely recognized as one of the major instruments for enhancing capabilities to manage the environment, shrinking distances for effective communications and for promoting economic development, in particular for developed countries. While there is increasing recognition in most developing countries of the need to use such high technology input in support of sustainable development and of developmental activities, interestingly there are two interrelated issues to be addressed: firstly, promoting the technology itself and the associated problems encountered and, secondly, effective utilization of the high technology knowledge, once acquired, for sustainable development activities.

2. Many developing countries have initiated their own space technology and applications programmes. The essential impetus for embarking on such programmes is the need to support the nation's developmental needs and to deal with the problems of education, pollution, health, telecommunications, environmental management, utilization of natural resources, weather and climate applications, food security, urban and rural infrastructure, land-use management and many other local-level resource problems. Technology development is a major issue that is being addressed by developing countries, specifically by means of small satellites and their launches.

3. In that connection, the Workshop participants examined the overall objectives and achievements of space programmes of different developing and developed countries, with special emphasis on the management models used and applications of space science and technology that could be gainfully integrated into the developmental programmes in developing countries.

4. Presentations were made by participants from Brazil, India, Indonesia, Malaysia, Pakistan and South Africa on the experience in organizing the national space programmes in their countries. Subsequently, in the panel discussion, many participants from developing countries addressed issues highlighting the developmental imperatives and the methods by which they could be addressed using space technology. The Workshop participants also noted the advances made in many developing countries in organizing national space programmes and effectively maximizing the benefits from space technology for people.

5. The major recommendations emanating from the Workshop are:

(a) Developing countries need to be encouraged to utilize space in support of their national developmental activities and to address the basic requirements of their people: education, pollution monitoring, health, telecommunications, environmental management, weather and climate applications, utilization of natural resources, food security, urban and rural infrastructure, land-use management and many other local-level resource problems;

(b) An institutional framework within individual developing countries would help in developing national space programmes. The framework could address policy and programme issues, as well as the implementation of the programme. The framework could also address the key research and development issues and operational development plans and lay stress on the involvement of industry;

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(c) Given the lack of educated and trained manpower, international efforts are required to ensure that sufficient opportunities are available to developing countries to build their human resource base in different areas of space technology and its applications;

(d) Enhancing indigenous capacities in developing countries needs to be the objective of international cooperation, addressing the effective transfer of knowledge and know-how to developing countries;

(e) There is a need for a forum for the sharing of experience among developing countries in the use of space technology, perhaps in the form of a clearing house for technology and applications. The United Nations and other intergovernmental agencies could take a lead role in such an initiative;

(f) Efforts should be made by international bodies and developed countries to share technology elements in support of space programme development in developing countries. Some areas where developing countries are making efforts in the development of small satellites and the initiation of such activities need to be supported further;

(g) There is a need to look at innovative solutions to meet space technology and applications in support of developing countries. One such proposal put forward is the possibility of a series of small equatorial-orbit satellites to meet imagery requirements. This needs further study and definition.

IV. Conclusions and proposals of the International Forum on the Integrated Global Observing Strategy: Into the Next Millennium*

1. The Integrated Global Observing Strategy (IGOS) Partnership, established in 1998, links the major satellite- and surface-based systems for global environmental observations of the atmosphere, oceans, land and biota. IGOS is a strategic planning process, involving many partners, that combines research, long-term monitoring and operational programmes, as well as data producers and users, in a framework that delivers maximum benefit and effectiveness. It recognizes that data collection must be user-driven, leading to information products that increase scientific understanding and guide early warning, policy-setting and decision-making for sustainable development and environmental protection.

2. The complex global observing activities needed to understand and monitor Earth processes and to assess the impact of human activity require integration and cooperation at many levels. Such cooperation is imperative because of the impossibility for any single nation to equip itself to carry out all its necessary observations either because of the costs involved in space observations or the complexity of the logistic of many *in situ* observations. The need for collaboration between data providers also arises from the fact that contemporary data products often require the combination of multiple observations from multiple sources.

3. IGOS provides both a strategic framework and a planning process to bring together remotely sensed and *in situ* observations, from both research and operational programmes. Major thrusts of IGOS as it proceeds will include strengthening space-based and *in situ* linkages to improve the balance between satellite remote sensing and ground- or ocean-based observing programmes; encouraging the transition from research to operational environmental observations within appropriate institutional structures; improving data policies and facilitating data access and exchange; stimulating better

* A/CONF.184/C.1/L.4.

archiving of and access to data to build the long-term time-series necessary to monitor environmental change; and increasing attention to harmonization, quality assurance and calibration and validation so that data can be used more effectively. IGOS encourages the use of modular approaches to strategies for specific components or processes that need to be integrated and thematic approaches to particular categories or cross-cutting themes of observations such as oceans, disaster management and carbon storage and cycling.

4. Most environmental observations come from national activities, carried out by national Governments through agencies, ministries and research programmes, and their commitment is essential to the effective implementation of IGOS. The IGOS process promotes awareness of the benefits arising from integrated global observations in contributing to meeting the political objectives that have been set to improve the way the Earth is understood and managed. Moreover, IGOS can make a significant contribution to assisting national Governments and international organizations in implementing the international environmental conventions through both improved data and information access and quality of observations.

5. The Integrated Global Observing Strategy is implemented through an IGOS Partnership that includes the Committee on Earth Observation Satellites (CEOS), the World Climate Research Programme and the International Geosphere-Biosphere Programme, the International Group of Funding Agencies for Global Change Research, the Food and Agriculture Organization of the United Nations, the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (UNESCO), the International Council for Science, the United Nations Environment Programme, and the World Meteorological Organization, as well as the Global Climate Observing System, the Global Ocean Observing System and the Global Terrestrial Observing System. The Partnership provides a continuing mechanism to oversee the IGOS process, with meetings arranged among the partners twice a year in association with the plenary sessions of CEOS and meetings of the Sponsors Group for the Global Observing Systems. New partners willing to contribute to the implementation of IGOS can be added.

6. Participants in the Technical Forum on IGOS were briefed on the status of the development of IGOS and the creation of the IGOS Partnership. Participants underscored the relevance of IGOS to many of the themes of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) and encouraged the continued implementation of IGOS. In particular, support was voiced for the role of IGOS in:

(a) Enhancing international cooperation in general and between data providers, users and policy makers in particular;

(b) Promoting more effective means of using space-based data in addressing practical problems and environmental issues of local, regional and global significance;

(c) Capacity-building in the area of Earth observation and global environmental monitoring, especially in developing countries.

7. The main recommendations of the Forum are as follows:

(a) The efforts of the IGOS Partnership to achieve a coherent articulation of the requirements for data from Earth observing systems and to stimulate the coordinated development and integration of remote sensing and *in situ* data collection systems should be supported. This is an essential process to combine current and planned space capabilities with those on the ground and in the oceans, and should involve international bodies and national agencies and organizations, including industry;

(b) The rapid improvement in the quality, frequency and resolution of satellite data acquisition must be matched by a comparable strengthening of the complementary surface observation and ground "truthing" activities;

(c) The reinforcement of a full range of data collection programmes and of the institutional structures for processing, archiving, integrating and assessing environmental data from all sources is essential to build the reliable long-term time-series of data necessary for global change research on critical environmental problems;

(d) Special attention should be given to strengthening the research, operational, data collection and analysis and application capacities of developing countries to fill critical gaps in global data sets and their utilization to improve local knowledge of changes in and pressures on environmental resources;

(e) As observing systems for environmental data collection prove their usefulness, Governments should support the transition from research and development programmes to operational environmental observing programmes with appropriate institutional arrangements and budgetary support;

(f) The systematic assessment of user needs and of the ability of satellite instruments to meet those needs should be continued and extended. Commitments will be needed from space agencies to meet the resulting requirements and also from users to maximize the use of satellite-derived inputs in their modelling and decision-making processes.

V. Conclusions and proposals of the Round Table on the Integration of Earth Observation into Secondary Education*

1. The consensus among participants of the various meetings of the European Association for the International Space Year (EURISY) on the subject of Earth observation as a tool for learning (notably the meeting held in Frascati, Italy, in 1998) is that enhancing education and training opportunities about space is a major educational challenge. In accordance with the draft report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) (A/CONF.184/3 and Corr.1 and 2), referenced in parentheses below, EURISY recommends:

(a) That efforts should be undertaken to improve education on space subjects by using space tools, namely, satellite-based observation (e.g. satellite images) and communication systems. In fact, it is becoming increasingly cheaper and easier to obtain access to space-related databases, freely accessible World Wide Web sources on Earth observation and courses for teachers on remote sensing (para. 227) through a satellite network than by other means of transmission. This is true both for developed countries, which often face high telecommunication charges, and for vast, sparsely populated areas or developing countries;

(b) Since successful knowledge of the benefits brought by space activities depends on well-trained teachers, that initial and in-service teacher training in the field be made part of long-term strategies for human resource development (para. 229). Space programmes are multi-disciplinary by nature (environmental subjects, biology, geography, physics, astronomy, telecommunications information technologies, etc.), global in their scope and local in their applications. They provide an ideal basis for those multidisciplinary projects

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which stimulate teachers, help to build bridges across disciplines and borders, provide on-the-spot in-service training and broaden students' horizons;

(c) That the United Nations and the United Nations Educational, Scientific and Cultural Organization (para. 231) urge the relevant decision-making bodies in ministries of education to institutionalize space studies in national curricula and teacher training programmes as the best way to meet the needs and demands of present and future generations.

2. It is also desirable for some inter-European ventures on Earth observation for primary and secondary school purposes to be made known, through the United Nations, to other countries beyond Europe, thereby developing satellite image material and enriching the World Wide Web databases on Earth observation that are currently being created, as recommended at the EURISY meeting in Frascati in 1998. This will also foster among students an interest in individual research, the ability to visualize abstract concepts and the development of skills in using information technology-based tools (para. 228).

3. On the basis of the EURISY and other cross-border initiatives, the creation of an international partnership for cooperation in space education along the lines of the Integrated Global Observing Strategy is now needed to address this matter worldwide.

VI. Conclusions and proposals of the Symposium on Recent Progress and Future Plans for Exploration of the Solar System*

1. Reports were made by the four large space agencies. The Institute of Space and Astronautical Science of Japan had a rather wide programme covering exploration of the Moon, all terrestrial planets and asteroids. The Russian Federation, in spite of its present severe financial situation, maintained a Mars programme at the Russian Aviation and Space Agency that it planned to expand in future to other terrestrial planets. The European Space Agency (ESA) programme included projects to study Mars, Mercury and small bodies (comets, asteroids and Titan). The National Aeronautics and Space Administration (NASA) of the United States of America had a large programme for Moon and Mars exploration, small bodies, outer planets and moons.

2. The presentations made by the representatives of the four agencies had brought into perspective the worldwide effort to reach a new level of knowledge in the exploration of the solar system, more specifically of Mars, the Moon and the small bodies, including near-Earth objects. Quite clearly, such a vast enterprise would profit, on both scientific and economic grounds, from international collaborative and coordinated activities such as those carried out by the Inter-Agency Consultative Group in relation to the exploration of Halley's Comet and the International Solar-Terrestrial Physics programme.

3. Composed of the four agencies mentioned above, ESA, the Institute of Space and Astronautical Science, NASA and the Russian Aviation and Space Agency, the Inter-Agency Consultative Group had in its first phase coordinated the missions of the five spacecraft directed towards Halley's Comet and the ground-based Halley Watch. Some 40 spacecraft were involved in the second phase, providing data on the solar-terrestrial environment that were being analysed through scientific campaigns set up and coordinated by the Consultative Group. In both phases, through the coordination of the Consultative

* A/CONF.184/C.1/L.6.

Group, a significantly higher level of scientific return had been obtained than the mere sum of individual results from the different spacecraft.

4. Exploration of the solar system would constitute the third phase of the work of the Inter-Agency Consultative Group. The latter had already initiated the creation of the Mars Exploration Working Group and of the International Lunar Exploration Working Group specifically to address and coordinate Mars and lunar activities. The Consultative Group was also setting up a Working Group on Solar System Exploration to address and coordinate the several missions of the four agencies to explore the small bodies (e.g. asteroids and comets), including near-Earth objects.

VII. Conclusions and proposals of the Workshop on Meteorological Satellite Systems of the Coordination Group for Meteorological Satellites*

1. Participants in the Workshop on Meteorological Satellite Systems of the Coordination Group for Meteorological Satellites, held in the framework of the Technical Forum of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), noted with satisfaction that, since its creation in 1972, the Coordination Group had provided a forum in which satellite operators had studied, jointly with the World Meteorological Organization (WMO), the technical and operational aspects of the global network, in order to ensure maximum efficiency and usefulness through proper coordination in the design of the satellites and in the procedures for data acquisition and dissemination. The Coordination Group could be credited with considerable accomplishments. For example, the participants noted that:

(a) The Coordination Group had played a key role in the coordination of satellite operators' activities. It had been very successful in coordinating the overall system in terms of orbital positions, contingency, dissemination schedules, data collection systems and frequency. Concerning the latter, the Coordination Group had noted that it was absolutely necessary to provide the required protection to passive sensor bands and to limit the sharing of such bands with active services. The Coordination Group should strive to continue to meet the requirements of the user communities and to provide even better coordination to maximize the efficiency of the system as a whole;

(b) The Coordination Group had been very successful in establishing standards for the betterment of all users. It had recently agreed upon the standardization of low-rate dissemination services, low-resolution picture transmission and low-rate information transmission. It should strive to standardize all the dissemination services;

(c) The Coordination Group had improved the products delivered to the user through the exchange of information concerning product development, both in plenary meetings and in co-sponsored workshops such as those in the Winds Workshop Series and International TIROS Operational Vertical Sounder (TOVS) Working Group Meetings and other conferences and workshops. The Coordination Group brought top scientists together to discuss specific problems. The scientific interactions greatly enhanced the value of the products;

(d) The Coordination Group should highlight the landmark contingency planning that had occurred between the various satellite operators. The initiatives of the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) and the

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National Environmental Satellite, Data and Information Service of the National Oceanic and Atmospheric Administration (NOAA) of the United States had contributed greatly to the stability of space-based observing systems by providing a reasonable level of assurance to the user communities that the satellite data, products and services would have continuity;

(e) Coordination Group satellite operators had responded directly to the requirements of the user communities through the user community representative, WMO. The direct interaction between user and provider was mutually beneficial and should continue in the future.

2. The Coordination Group was contributing and would contribute even more in the future to the global objectives of UNISPACE III, providing synoptic, continuous and long-term global observations needed to understand the Earth's system more comprehensively, in conjunction with the use of modelling technology. The data delivered by Coordination Group members would contribute to the improvement of the human condition, providing reliable weather forecasting and long-term climate prediction, making possible the better management of the limited resources of Earth. The Coordination Group was fully aware that that contribution would only be effective with the development of further knowledge and capacity-building within the user community. Therefore, the Coordination Group was developing important education and training activities. Finally, the Coordination Group was totally committed to promoting international cooperation, as stated in its charter, and therefore to enhancing weather forecasting by sharing information from all relevant satellites operated by its members in order to develop new meteorological applications.

VIII. Conclusions and proposals of the International Astronomical Union/Committee on Space Research/United Nations Special Workshop on Education in Astronomy and Basic Space Science*

1. Having considered the draft report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) (A/CONF.184/3 and Corr.1 and 2), the International Astronomical Union/Committee on Space Research/United Nations Special Workshop on Education in Astronomy and Basic Space Science noted the following (paragraphs in parentheses refer to paragraphs in the draft report):

(a) Human resources with appropriate knowledge and skills are the critical factor in developing and using space science and technology (para. 184). Nevertheless, many countries still lack the educational capacity to build and deploy such skilled human resources. Thus, promoting scientific literacy is one of the great challenges for the future (paras. 190-192);

(b) Astronomy and the origin of humankind in the universe have fascinated humans through the ages and astronomy is still viewed favourably by a public that is otherwise becoming increasingly sceptical about science. Thus, astronomy and basic space science have a unique ability to make an education in the physical and applied sciences attractive to young people. Astronomy has also long been an important vehicle for effectively passing on a wide range of scientific knowledge and teaching the basic principles of scientific reasoning and for communicating the excitement of science to the public (paras. 191, 192 and 213);

* A/CONF.184/C.1/L.8.

(c) Education in astronomy and basic space science in many developing countries remains impeded by the lack of trained instructors, teaching materials and a clear vision of the role of astronomy and basic space science within the broader context of education in physical and applied sciences (para. 325);

(d) Finally, many trained scientists remain unable to contribute effectively to the development of their countries because of scientific isolation and their lack of suitable employment and research tools (paras. 186, 206 and 325).

2. The Special Workshop made the following recommendations:

(a) All States should formulate national policies for education in basic space science. The International Astronomical Union (IAU), the Committee on Space Research (COSPAR) and other international organizations should help to collect and systematize information on experience with the build-up of education in astronomy and basic space science, at various levels of formal and informal education, in countries with differing conditions. That information could help interested States to assess their current situation and develop realistic national goals and expectations, as well as effective long-term educational strategies, adapted to local conditions. In implementing such strategies, it is recommended that a significant fraction (1-2 per cent) of the budgets of national space projects be devoted to education and public outreach activities (paras. 194, 229, 325 and 328);

(b) International organizations such as IAU and COSPAR should help to develop an inventory of teaching methods and materials that have proved effective in various countries at all levels of formal and informal education, up to and including the graduate level. The inventory should include methods and materials for the training and professional development of teachers, introducing multicultural and multidisciplinary elements as necessary. The materials should be disseminated to interested States and communities worldwide and adapted to local conditions as appropriate in collaboration with other partners (paras. 194, 196, 210, 211 and 229);

(c) Collaboration should be established between the regional centres for space science and technology education, affiliated to the United Nations, and IAU, COSPAR and other scientific organizations to strengthen components of their curricula that involve astronomy and basic space science and thus increase the attraction and effectiveness of their programmes in basic, environmental and applied space sciences (paras. 199, 205, 206, 215, 217 and 231);

(d) All States should recognize that, for space scientists and engineers to serve effectively in the technical, economic and social development of their country, they need suitable employment and adequate research tools, as well as appropriate training. Developing partnerships with industry and increasing the public's appreciation of science should be considered important steps towards achieving those goals (paras. 197, 198, 226, 229, 328 and 337).

IX. Conclusions and proposals of the Workshop "Blue Planet, Green Planet"*

1. The study of the environment is the study of the Earth system. It requires coordinated multidisciplinary action at every level. Global climate change is largely the result of the

* A/CONF.184/C.1/L.9.

growth of greenhouse gases, stemming from anthropogenic activity taking place on a regional or local scale. Global phenomena have a local and regional impact, however. Examples are the impact of El Niño on the living conditions of Peruvian fisherfolk and the impact of drought on nomads in the Sahel. The Workshop "Blue Planet, Green Planet" concentrated on those important scientific problems with a major short-, middle- or long-term social impact, especially on the poorest sections of the population. The regional impact of climate change can best be studied after more is known about their mechanisms and characteristics.

2. The Workshop examined the two major systems on the Earth's surface: oceans and dry land. It examined some local concerns, but concentrated more on regional and global phenomena, the means of observing them and model-building that make it possible to understand and predict their behaviour and their interactions.

3. The most crucial scientific issue in this field is learning more about the carbon cycle, in particular the role of carbon dioxide (and that of methane), and about the water cycle, together with their interactions. For example, it would be useful to know more about the impact of a change in the water cycle on the carbon cycle, from one year to another and in the long term.

4. There is a need to know more about the carbon flux: how much the land emits; how much it absorbs; what the role is of the anthropogenic factor; how the balance between oceans and dry land evolves; and what interaction there is between major oceanic phenomena such as El Niño and the carbon flux. Research has been done on some 2 billion tons, out of a total of about 100 billion tons, the anthropogenic contribution being around 6 billion tons.

5. Growth in modelling and data assimilation, together with progress in space techniques and orbital systems, has made important contributions to the knowledge and understanding of those mechanisms. Systems such as the advanced very high resolution radiometer (AVHRR) of the National Oceanic and Atmospheric Administration (NOAA) of the United States of America, the Satellite pour l'observation de la Terre (SPOT 4) Vegetation system, the Polarization and Directionality of the Earth's Reflectances (POLDER) system, Topex-Poseidon and ENVISAT, among others, have helped to increase not only the knowledge and understanding of the evolution of those phenomena, but also the possibility of predicting them.

6. It is important to set standards for space system products. In addition, there is a need to organize a coherent database and to ensure the continuity of space systems.

7. The Workshop made the following recommendations:

(a) Homogeneous, calibrated and validated databases of surface parameters (both land and ocean) of the last two decades should be established, with a view to providing a documented historical perspective of the Earth's evolution;

(b) The above-mentioned databases should be used to support improved global change models;

(c) The continuous acquisition of high-quality remote sensing surface data should be ensured;

(d) Data availability should favour the largest user community;

(e) The needs of the users, including developing countries, should be taken into account when designing new systems;

(f) New methods and associated databases that include socio-economic data should be developed that will make it possible to use new systems together with historical data records.

X. Conclusions and proposals of the Symposium on the Contribution of Space Techniques to the Exploration of the Universe*

1. The participants of the Symposium on the Contribution of Space Techniques to the Exploration of the Universe, organized by the Committee on Space Research (COSPAR), noted with satisfaction the following:

(a) Exploration of the universe using space techniques had made impressive progress since the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space, held in 1982, and major fundamental discoveries had been made in the study of the entire electromagnetic spectrum in relation to a number of scientific topics;

(b) New challenges were being addressed by the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) to ensure continued technological development so that even more complex future missions could be undertaken. Given its complexity, space research to explore the universe was an international endeavour, requiring global collaboration;

(c) The extensive, publicly accessible, scientific databases that were currently available or becoming available from space observatories also allowed global participation in scientific analysis and interpretation, including by developing countries.

2. Accordingly, the participants of the COSPAR Workshop recommended the following (paragraph numbers in parentheses refer to paragraphs in the draft report of UNISPACE III (A/CONF.184/3 and Corr.1 and 2)):

(a) Existing activities, such as the successful series of United Nations/European Space Agency workshops on basic space science, organized in the period 1991-1999, should continue to be supported (paras. 199 and 215);

(b) New initiatives, such as those of COSPAR and the International Astronomical Union aimed at organizing, together with the regional centres for space science and technology, workshops on more specific topics, should be encouraged (paras. 222 and 223).

XI. Conclusions and proposals of the Workshop on Space Law in the Twenty-first Century, organized by the International Institute of Space Law**

A. Introduction

1. The Workshop on Space Law in the Twenty-first Century, organized by the International Institute of Space Law, noted that 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, of 19 December

* A/CONF.184/C.1/L.10.

** A/CONF.184/C.1/L.12.

1966) and other international instruments built upon it had been successful in answering the challenge to create a legal framework for exploration and peaceful uses of outer space and had thereby preserved the space environment for the benefit of humankind. However, the present significant changes in space activities had given rise to a need for further developing that framework, while protecting what the international community had gained.

2. The Workshop also noted that the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space, as a vehicle for law-making within the United Nations, was currently in a unique position to take up issues related to space law in an exploratory way. Those issues could be dealt with by the Legal Subcommittee in a flexible manner, subject to decision by the Committee and the General Assembly on the sequence in which they should be included in the agenda of the Subcommittee.

3. The Workshop proposed the recommendations listed below.

B. Conclusions and proposals

4. The rapid expansion of private activities in and related to outer space requires examination of many aspects of existing space law, in particular:

(a) With respect to space application services, which give rise to responsibility, liability and jurisdiction issues not currently covered by space law;

(b) The impact of commercialization and privatization of space activities on the public service aspects of such services;

(c) Intellectual property rights and technology transfer issues that may require special treatment for global uniformity in practice;

(d) The protection of investors' rights as regards space objects and space artefacts, which may require totally new approaches in order for it to be effective and enforceable;

(e) The nationality of spacecraft;

(f) The protection of the environment, where private entities are currently not held directly accountable.

It is recommended that a new paragraph 319 *bis* be added to the draft report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (A/CONF.184/3 and Corr.1 and 2) as follows:

> "319 *bis*. Member States of the United Nations should initiate discussion of and seek solutions to emerging legal problems of relevance and should, in particular recognize the need to consider the expanding role of private enterprise when making new laws. With regard to the protection of the environment, the establishment of launch standards and environmental impact assessments should be examined. Specialized agencies should consider drafting standards and recommended practices as well as models for partnerships involving public and private enterprises in their respective sectors of space activity. The concept of 'public service' and its various manifestations should be developed further, paying particular attention to the global public interest and to the needs of developing countries. The principles of fair trade should be strengthened. Attention should also be paid to the various aspects of the issues of liability and security of ownership in order to arrive at a coherent global framework. The international organizations concerned should make arrangements for effective and focused joint forums."

5. The use of outer space is expanding and many of the resources (orbits, frequencies, access to ground infrastructure etc.) have turned out to be limited. Consequently, such

resources should be dealt with by means of coherent frameworks for global resource management. The global public interest in this field can be safeguarded primarily by public institutions. There is currently a need for coordination in this area. It is recommended that a new paragraph 319 *ter* be added to the draft report as follows:

> "319 *ter*. Member States of the United Nations should consider possible coordinating frameworks for space-related global resource management. This work should focus on the needs, the potential conflicts, the natural limits, the values, the costs and the growing privatization of space activities. International organizations involved in space activities should seek coordination at an early stage. There is a need to have at least a code of conduct concerning space debris. To this end, previous work in this area should be taken into account with a view to identifying possible models. The Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space, together with its Scientific and Technical Subcommittee, should discuss the topic without delay. The development of a legal regime for low-Earth orbits (LEOs) should be considered, taking into account recent changes in the ITU convention concerning the status of LEOs as limited natural resources. The issue of security of ownership regarding spacecraft should be addressed promptly, for example, by means of an international inventory linked to the Register of space objects maintained by the Secretary-General of the United Nations. The General Assembly should encourage Member States to adhere to the Convention on Registration of Objects Launched into Outer Space (Assembly resolution 3235 (XXIX), annex, of 12 November 1974). In the context of the role of international organizations, the issue of consumer rights should be dealt with. The General Assembly, through the Committee on the Peaceful Uses of Outer Space and/or through special meetings for this purpose, should consider soon how best to coordinate the burgeoning demands on global resources generated by expanding space activities, both governmental and non-governmental."

6. The ongoing development of space activities requires the resolution of a growing number of issues. Space activities are increasingly being affected by the expanding body of international economic law, which is blurring the boundaries between public and private law and generating more reliance on recommended standards and practices. In this environment, it is important to have appropriate dispute settlement mechanisms for giving effect to the principles of outer space law in a flexible and timely manner. It is recommended that a new paragraph 319 *quater* be added to the draft report as follows:

> "319 *quater*. The General Assembly should consider the development of effective mechanisms for the settlement of disputes arising in relation to space commercialization. Those mechanisms should take into account existing arbitration rules used in international practice for dispute settlement."

7. The expanding growth in areas such as commercial remote sensing services, commercial complexity, the effect on international cooperation and scientific and industrial applications of services necessitates consideration of appropriate regulations. National restrictions on access to data are emerging. It is recommended that a new paragraph 32 *bis* be added to the draft report as follows:

> "321 *bis*. The Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space should initiate the drafting of a treaty covering remote sensing from outer space on the basis of the Principles Relating to Remote Sensing of the Earth from Outer Space (General Assembly resolution 41/65, annex, of 3 December 1986), taking into particular account the expanding growth in commercial remote sensing services and preserving the principle of non-discriminatory access to data."

8. Many emerging issues are influenced by rapid advances in space science and technology. Space law should be based upon a solid foundation of scientific and technological facts to ensure effective legal formulation. Interaction among scientific and legal experts will strengthen the relevance of space law. It is recommended that a new paragraph 321 *ter* be added to the draft report as follows:

> "321 *ter*. The Legal Subcommittee and the Scientific and Technical Subcommittee should in general meet at the same time so that there can be more interaction involving the work of those two bodies."

9. One of the most challenging new developments in space activities concerns expanding global navigation satellite services. It is recommended that a new paragraph 175 *bis* be added to the draft report as follows:

> "175 *bis*. The recommendations set forth in paragraphs [319 *bis*, 319 *ter*, 319 *quater*, 321 *bis* and 321 *ter*] below should apply, where relevant, to GNSS."

C. Final remark

10. The proceedings of the Workshop on Space Law in the Twenty-first Century should be referred to for clarification of the above-mentioned issues and recommendations.

XII. Conclusions and proposals of the Forum on Space Activities in the Twenty-first Century*

A. Introduction

1. A Forum on Space Activities in the Twenty-first Century, co-sponsored by the International Astronautical Federation, the International Space University and Prospective 2100, was held during UNISPACE III to address the question of the space activity in the next century that would best meet the needs of humanity. Participants from a broad range of nations and backgrounds developed the following high-level findings and recommendations on two major topics considered during both plenary sessions and workshops, namely, "Living on planet Earth" and "Leaving planet Earth".

B. General findings

2. During the next century, attention will shift from considering only living on planet Earth to considering both living on planet Earth and leaving planet Earth. Such a shift demands a reconsideration of space activity and its increasing role in human development.

3. Using Earth and solar energy, life developed and, finally, a small number of humans were accommodated in Earth's biosphere. Humankind is now positioned both to have a marked influence on Earth's biosphere and to migrate away. In the next century, space activity will be central to monitoring and controlling such human influence on Earth's biosphere and to human migration to other biospheres.

C. General recommendations

4. General recommendations applicable to both topics:

* A/CONF.184/C.1/L.13.

(a) Strategies for enhancing international cooperation in space should be explored and implemented, starting from the earliest phases of strategic planning;

(b) Space exploration should be widely used to provide motivating educational processes and materials;

(c) All people should be engaged in space activities through education about the position of humankind in the cosmos and its implications on humanity;

(d) All people should be involved in the adventure and discovery of space exploration and the search for life elsewhere and in the formulation of the goals for and implementation of space activities.

D. Living on planet Earth in the twenty-first century

1. Finding

5. Human activities on Earth will be increasingly dependent on space assets.

6. Space activity will support the sustainability of life on Earth:

(a) As the world's population increases, space activity makes possible or easier the continuing provision of the necessities of life such as food, water, protection of shelter, the health of the life support environment, education, the benign use of Earth's resources, energy, communications, transportation guidance and safety, and security against natural and hostile human interventions;

(b) Space activity helps define the place of humanity in the cosmos and generates adventure. It also adds to the quality of life by generating economic value, by being a positive human motivational force and by providing the tools leading to a just and equitable society.

2. Recommendations

7. It is recommended that space activity be pursued in such a manner as to maximize the benefits to society at large living on Earth by:

(a) Continuing the development of space assets to observe, measure, communicate, warn and increase knowledge about Earth and its environment;

(b) Measuring the capacity and limitations of Earth's resources as regards supporting life;

(c) Developing and applying space activity to make possible or easier the provision of the necessities of life such as food, water, shelter, the health of the life support environment, education, the benign use of Earth's resources, energy, communications, transportation guidance and safety, and security against natural and hostile human interventions;

(d) Developing new skills and space assets to free humankind from complete dependence on the biosphere;

(e) Developing effective, reliable, safe, clean and low-cost space transportation systems for space activity on a much larger scale than at present.

E. Leaving planet Earth in the twenty-first century

1. Finding

8. Humans have developed a limited capacity to explore the depths of the solar system and of the universe through robotic devices and also the capacity to support life outside the biosphere in a very limited way. Humankind is ready to develop those two capacities fully, allowing it to explore, understand, prospect and settle away from Earth.

2. Recommendations

9. Humans should prepare to follow their inexorable drive to explore and gain knowledge and understanding beyond Earth by:

(a) Developing integrated scenarios and strategies for space exploration, utilization, development and settlement;

(b) Investigating the synergy between and integration of robotic and human space exploration;

(c) Continuing the development of space assets to observe, measure, and warn about the elements of the universe, as well as to communicate and increase knowledge about those elements;

(d) Developing effective, reliable, safe, clean and low-cost space power and transportation systems for space exploration on a much larger scale than at present;

(e) Developing space-based energy sources, including *in situ* fuels, for use in space or transfer to Earth;

(f) Further developing, adapting and applying tools already developed for use on Earth for use on extraterrestrial bodies, in particular the Moon;

(g) Determining the resources required for long-term migration beyond Earth;

(h) Defining roles for the protection and preservation of the planetary and space environment and establishing a framework for implementation;

(i) Investigating the medical, psychological, social, ethical and legal frameworks for the development of communities in space;

(j) Establishing biospheres beyond Earth and establishing pilot space settlements, thereby learning to live away from the Earth's biosphere;

(k) Encouraging the development of space tourism.

XIII. Conclusions and proposals of the session on the results from the 5th International Cooperation in Space Workshop: "International Space Cooperation: Solving Global Problems"*

1. The 5th International Cooperation in Space Workshop consisted of five independent working groups addressing diverse topics. The major findings and recommendations of each working group are described below.

* A/CONF.184/C.1/L.14.

2. *The Working Group on the Government-industry Partnership in Space Projects: Towards Commercialization* found that effective public-private partnerships were vital for the continued growth and commercialization of the global space sector. Participants recommended that selection of a particular form of partnership and path to commercialization be based on the ratio of public to private sector investment and the degree of commercialization and risk. Partnerships should satisfy criteria for success such as the benefits to be offered to all partners, a predictable and adaptable policy and regulatory environment, and complementary and realistic objectives. Potential barriers, whether cultural and organizational, political and legal, technical and programmatic or economic, needed to be identified and then removed or minimized. Access by developing countries to the products and services of space systems would require the establishment of a trained workforce and the necessary ground infrastructure. For that to occur, such countries would have to provide an enabling environment.

3. *The Working Group on Global Navigation Satellite Systems* concluded that satellite navigation systems should be fully interoperable and transparent to the user and as a consequence recommended that the United States of America and the European Union develop a common definition of global navigation satellite systems (GNSS) for civil and public safety services. A consolidated definition of the modernized United States Global Positioning System and the technical characteristics of the proposed Galileo system of the European Union was required and should be generated as soon as possible by the relevant technical staffs. The European Union should also continue its dialogue with the Russian Federation concerning possible Russian involvement in the Galileo system and the maintenance of the Russian Global Navigation Satellite System (GLONASS). Globally recognized and rigidly protected GNSS frequency allocations were required and should be the subject of a common approach developed before the World Radiocommunication Conference in the year 2000. The dual civil and military use of GNSS services created security requirements that needed to be taken into account in both civil and military international dialogues. Developing countries needed to be made aware of the cost benefits and security issues related to satellite navigation, through GNSS-related workshops, seminars and internships organized under the auspices of the United Nations Programme on Space Applications of the Office for Outer Space Affairs.

4. *The Working Group on International Earth Observation Data Distribution Systems* determined that factors preventing developing countries from using international Earth observation data distribution systems included a lack of awareness of the benefits of Earth observation, lack of infrastructure and a need for education and training. Focused effort would be required on the part of the United Nations to make relevant information available; space agencies and commercial system operators should become more attuned to the needs of developing countries; and the developing countries themselves should be more active in obtaining archived data and training from the appropriate sources. Discussions to date on Earth observation data distribution had taken place for the most part at the intergovernmental level and needed to be expanded to include authorities at the regional and local levels also. The Working Group noted that the collection of Earth observation data over certain geographical regions conflicted with national security interests and, given that such restrictions impeded the development of diverse Earth observation products and services, recommended strong support for the Principles Relating to Remote Sensing of the Earth from Outer Space (General Assembly resolution 41/65, annex).

5. *The Working Group on Using Space Assets of Disaster Management* recognized that space assets could contribute greatly to the field of disaster management. A major communication gap existed between the space community and the disaster management community, however. To overcome this, the Working Group recommended establishing

and maintaining a one-call coordination and information resource, which would supply information and services, using space-based remote sensing, telecommunications and navigation assets, to disaster managers. Services could include monitoring potential disaster risk. The successful implementation and operation of such a resource would require the active support of the disaster management community in its initiation, definition and evaluation. Several members of the Working Group were currently engaged in establishing such a resource. Organizations of the United Nations system could play a major role in defining user requirements and support and should determine how and to what extent to contribute to that effort.

6. *The Working Group on the Growing Number of Satellites in Orbit: Facing the Issues* determined that commercial and government operators needed accurate, timely and dependable information regarding the location of satellites and the planned allocation of resources. They recommended the establishment of an international clearing house, or international orbital information centre, to collect, maintain and interpret data regarding existing and planned satellites constellations and to facilitate their distribution. The issue of collision avoidance also needed to be addressed from a number of standpoints, including in relation to collision warning, liability and avoidance strategies, which could be an additional task for the international orbital information centre to undertake. The Working Group was of the opinion that government and commercial operators would be willing to pay for such a service. An in-depth study to examine the feasibility of an advisory or regulatory framework to address issues of space traffic control should be carried out in cooperation with the United Nations. The Working Group was of the opinion that, while the situation of orbital crowding was not yet critical, it was important to move forward immediately on the above issues before the proliferation of space objects reached unmanageable proportions.

XIV. Conclusions and proposals of the Workshop on Geospatial Data Access*

1. The Workshop on Geospatial Data Access addressed issues concerning direct access to Earth observation and related geospatial databases through the World Wide Web. It was noted that the provision of global geospatial information services required the adoption of standards and common interfaces for accessing catalogues and databases. As international standards matured, then national and regional infrastructures would increasingly be able to interconnect into a truly global system.

2. The Workshop also considered the merging of three space technologies, global positioning systems, satellite digital data communications and Earth observation data, to satisfy the needs of resource and disaster management operations. Information was being created and exchanged through geographic information systems and transferred between mobile units in the field and central databases.

3. Geospatial data and other information were crucial to the effective resolution of problems at the local, national, subregional, regional and global levels. Many of those problems—poverty, natural disasters, desertification and deforestation, to name but a few—had no regard for international borders. Those problems required cooperation and sharing of infrastructure between agencies.

4. The participants of the Workshop recommended that action be taken:

* A/CONF.184/C.1/L.15.

(a) To recognize the importance of geospatial data and other information in resolving the important environmental, economic and social issues faced by humanity;

(b) To recognize the importance of and interaction between geospatial data and space technologies such as communications, Earth observation and geopositioning;

(c) To facilitate the development of fundamental and useful geospatial data in a form that could be used in many applications;

(d) To share geospatial data to the maximum extent possible; metadata, in particular, should be made as freely available as possible;

(e) To engage industry in an appropriate way to collaborate in the development and implementation of spatial data infrastructure;

(f) To communicate, collaborate and participate in the many networks existing at the national, subregional, regional and global levels;

(g) To recognize the importance of training, transfer of technology and capacity-building in support of the management of the application of those technologies.

5. In conclusion, the Workshop encouraged the United Nations and space agencies to provide active support to the many initiatives aimed at developing geospatial data infrastructures (for example, the Global Spatial Data Infrastructure).

XV. Conclusions and proposals of the Workshop on Space Debris*

1. The objective of the Workshop on Space Debris was to inform participants of the current status of the knowledge and the extent of the space debris problem, applied space debris mitigation measures and activities related to space debris by professional societies, the Inter-Agency Space Debris Coordination Committee and the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space.

2. Presentations were given on the following aspects of the space debris problem:

(a) The complete technical spectrum of the space debris issue, including measurements, modelling, mitigation (active and passive protective measures and debris preventative and reduction measures), the effects of the particulate environment on space systems, hazards in space and on the ground, and risk analysis;

(b) Space debris mitigation measures currently in use by space agencies and space operators;

(c) Activities related to space debris involving space agencies and the Inter-Agency Space Debris Coordination Committee, including the definition of space debris mitigation guidelines and standards;

(d) Activities related to space debris involving professional organizations (the International Academy of Astronautics, the Committee on Space Research and the International Astronautical Federation) and their recommendations;

(e) Deliberations of the Scientific and Technical Subcommittee on space debris.

3. The Workshop participants strongly supported the work being done by the United Nations, the Inter-Agency Space Debris Coordination Committee, the International

* A/CONF.184/C.1/L.16.

Academy of Astronautics and others to develop guidelines designed to minimize the creation of new debris objects.

4. In particular, it was recommended that:

(a) The United Nations should continue its work on space debris;

(b) Debris minimization measures should be applied uniformly and consistently by the entire international space-faring community;

(c) Studies should be continued on future possible solutions to reduce the population of on-orbit debris.

5. The Workshop concluded with a round-table discussion on the theme "Future directions of space debris research". In the discussion, the issue of the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space considering space debris was addressed.

6. It was noted that the current technical knowledge on space debris had been summarized in the technical report on space debris (A/AC.105/720) of the Scientific and Technical Subcommittee, which was fully supported by the International Academy of Astronautics.

XVI. Conclusions and proposals of the Workshop on Observations of Near-Earth Objects*

1. The Workshop on Observations of Near-Earth Objects reviewed the problem of possible collisions of asteroids and comets with the Earth. It was stressed that the Earth, like all other solid bodies in the solar system, had been continuously bombarded by cosmic debris ranging in size from microscopic to up to several kilometres in diameter.

2. The chances of a major collision in the near future were extremely small, but the consequences would be so large as to require that the scientific and political communities made every effort possible to reduce major risks and to identify possible countermeasures for smaller ones.

3. The field of near-Earth object research should be viewed not only as an exciting scientific discipline, but also as a service to humankind and a very good opportunity to encourage and promote international collaboration.

4. The International Astronomical Union had already promoted collaboration and coordination of activity, through the establishment of the Spaceguard Foundation. All countries in the world were invited to join those efforts, which did not require extremely sophisticated or expensive instrumentation.

5. The Workshop therefore recommended:

(a) That the United Nations promote education and information on near-Earth objects, especially in developing countries;

(b) That the United Nations take the initiative of inviting all Member States to support near-Earth object research in their own countries, through the establishment of national or regional "spaceguard" centres to be coordinated by the international Spaceguard Foundation;

* A/CONF.184/C.1/L.17.

(c) That every effort be made to provide financial support for near-Earth object research, both theoretical and observational (from ground and space), and especially for the encouragement of exchanges and training of young astronomers in developing countries;

(d) That the United Nations support and promote greater involvement of scientists and observatories from nations in the southern hemisphere as an opportunity for cultural and scientific development.

6. The Workshop endorsed the following paragraphs of the draft report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (A/CONF.184/3 and Corr.1 and 2): paragraphs 212 and 224 and paragraph (c) of section III of the draft Vienna declaration on space and human development (see A/CONF.184/3/Corr.2).

7. The Workshop welcomed the discussion and initiatives of the Space Generation Forum and encouraged participation in future near-Earth object research.

XVII. Conclusions and proposals of the Workshop on Intellectual Property Rights in Space*

1. The results of the discussions held by the participants of the Workshop on Intellectual Property Rights in Space may be summarized as follows:

(a) It was recognized that significant changes and developments in space activities gave rise to new issues, such as those relating to intellectual property rights;

(b) It was realized that the protection of intellectual property rights played an essential role in the development and transfer of space technology under current political and economic conditions, which had resulted in a shift in the focus of space activities towards a greater emphasis on commercial opportunities and the potential benefits of privatization, as described in paragraphs 283, 317 and 321 of the draft report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) (A/CONF.184/3 and Corr.1 and 2);

(c) It was noted that effective and appropriate protection of intellectual property rights should encourage and facilitate the transfer of technology to developing countries;

(d) It was recognized that the increasing number of international cooperative programmes in outer space required the continued harmonization of international intellectual property standards and legislation;

(e) It was noted that the subject of commercial aspects of space activities, including property rights, was discussed for possible inclusion as an item on the agenda of the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space, as described in paragraph 321 of the draft report of UNISPACE III.

2. The participants of the Workshop recommended the following action to address the common challenges:

(a) More attention should be paid to the protection of intellectual property rights, in view of the dramatic growth in the commercialization and privatization of space-related activities. However, the protection and enforcement of intellectual property rights should be considered together with the international legal principles developed by the United

* A/CONF.184/C.1/L.18.

Nations in the form of treaties and declarations, such as those relating to the principle of non-appropriation of outer space;

(b) The feasibility of harmonizing international intellectual property standards and legislation relating to intellectual property rights in outer space should be further explored with a view to enhancing international coordination and cooperation at the level of both the State and the private sector. In particular, the possible need for rules or principles covering issues such as the following could be examined and clarified: applicability of national legislation in outer space; ownership and use of intellectual property rights developed in space activities; and contract and licensing rules;

(c) Steps should be taken to increase awareness of the importance of protecting intellectual property rights as a means of promoting the transfer of technology, or providing developing countries with reasonable access to data, and of fostering spin-off benefits. All States should provide appropriate protection of intellectual property rights involving space-related technology, while encouraging and facilitating the free flow of basic science information;

(d) Educational activities concerning intellectual property rights in relation to outer space activities should be encouraged;

(e) The United Nations, through the Committee on the Peaceful Uses of Outer Space and its Legal Subcommittee, should investigate ways to enhance understanding of the issues outlined above. In view of the highly technical aspects of intellectual property rights, the involvement of other intergovernmental organizations, in particular, the World Intellectual Property Organization, would be highly desirable.

XVIII. Conclusions and proposals of the Special Workshop on Education*

1. The object of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space is to strengthen the capabilities of countries in the use of space applications to promote economic, social and cultural development. Education and training have a major role to play within that objective.

2. The participants of the Special Workshop on Education examined the various key elements that are prerequisites for efficient training in the field of space applications and made the following recommendations:

(a) The involvement of Governments and other public bodies should be encouraged:

(i) To create educational tools to answer the needs of national teaching in primary and secondary schools and to adapt them to the needs of other countries;

(ii) To incorporate knowledge of space applications into educational programmes;

(iii) To create appropriate incentives for teachers;

(iv) To provide and disseminate knowledge and know-how to developing countries;

* A/CONF.184/C.1/L.19.

(v) To encourage cooperation between secondary-level teachers through specialized meetings, forums, summer schools and special networks;

(vi) To examine the recognition of university-level degrees, to facilitate exchanges of students between universities and training centres and to propose courses in the field of space applications;

(vii) To encourage joint courses and diplomas;

(b) Space agencies, space centres and industry should contribute to the expansion of the various areas of space applications for education: remote sensing, communications, planetology, orbitography and so on. In that respect, each new space programme should establish, within its project specifications, educational and training objectives. In order to do so, engineers, researchers and education specialists should together study the financial investment involved, the content of the information and data to be gained and their dissemination. Communication and dialogue between space agencies, universities and industry, directly or through special associations, should increase;

(c) Regional centres in developing countries should be strengthened, as recommended by the General Assembly in its resolution 45/72 of 11 December 1990, with the support of industrialized countries and that of all Member States:

(i) By facilitating exchange of experts, researchers and postdoctoral students;

(ii) By providing materials, teaching know-how and funding to the centres;

(iii) By training teachers to answer the needs of national centres;

(iv) By creating links and cooperation with national centres in order to avoid duplication of effort and to offer a large range of solutions.

More generally, the delegations should give support to universities, institutions and training centres involved in educational development in order to meet the needs of the space sector;

(d) Attention should be given to the creation and dissemination of knowledge and training practices using new information and communication technologies such as World Wide Web sites and CD-ROMs and documents, as well as special systems, including satellite systems (e.g. for tele-education). Special attention should be paid to the development of curricula adapted to the needs of each country, to the technical equipment available and to the country's cultural environment;

(e) Efforts should be made to motivate the younger generation at all levels of education—primary, secondary and university. This has already been started in some countries by industry, space agencies and scientific and technological associations for youngsters and should benefit from:

(i) Increased international cooperation;

(ii) Better synergy with public bodies, industry and Governments.

XIX. Conclusions and proposals of the Workshop on Life Science Activities on the International Space Station*

1. The Workshop on Life Science Activities on the International Space Station noted with satisfaction that over the past decades, life science research activities in space, especially in manned space flight and biological research, had faced a huge development challenge. The Space Shuttle and the MIR manned space station had offered tremendous possibilities for experimentation during both short and long periods of exposure to microgravity. The results of and spin-offs from those experiments had influenced terrestrial research and industrial development. Most of the results obtained were the outcome of international research activities and interdisciplinary cooperation. The satisfactory development of space research opportunities in the first century of the new millennium required the definition of rational methods of coordination of research in space and the provision to all of access to the results. To utilize the potential scientific and industrial outcome and to plan for efficient future development of space life science were the basic goals of the years to come.

2. Problems involved in the internationalization of the International Space Station and the life science research projects being carried out on it constituted a very important issue for the future development of research in microgravity, which concerned space research in general, but more particularly the research on the International Space Station. The new domain of space life science research, its internationalization and the increased opportunities offered by it to use the results for scientific, economic and cultural development would benefit both developed and developing countries. It was only through international cooperation that access could be made available to the wide range of facilities in order to reap maximum benefits from the investments made in the International Space Station and other space life science projects. It was also indispensable to include the space industry in the research consortia, together with governmental and non-profit research institutions.

3. The future of life science research in space required enhanced international and interdisciplinary cooperation, scientific excellence and terrestrial applications, which would in turn lead to numerous benefits and industrial partnerships. Wide access to space life science and the efficient organization of the transfer to terrestrial applications of the spin-offs, one of the key points of the life science programmes, were also essential. The technological transfer would provide new and effective solutions to technical problems, expand business opportunities for space industries and create new business and jobs for space and non-space companies. The public needed to be made aware of the benefits of such space programmes and their terrestrial applications. Finally, the commercialization of the spin-offs and their development into practical applications would also make a huge contribution to the growth of space life science research in the twenty-first century.

4. It was noted that, to ensure high-quality research, a coordinated international recruitment, review and selection process would be used to develop the life science research programme to be conducted by the agencies involved in the International Space Station.

5. It was also noted that the life science hardware for space biology and medicine (unified technical and sanitary/hygienic means, as well as specialized medical modules) on the International Space Station would be available to the international research community.

* A/CONF.184/C.1/L.20.

6. Unified international standards for systems of medical support of human space flight, including flight medical supervision systems and systems for prognosticating crew members' state, prevention, diagnosis and treatment of the crew, should be worked out, as should unified standards for life-support systems. There should be international coordination of pre-, in-, and post-flight medical examination and international selection and training of the astronauts and cosmonauts.

7. It was further noted that, given the necessity of space exploration and its benefits to Earth, it was important to continue with the existing plans for a manned mission to Mars and further plans for space exploration such as the creation of a lunar research base.

8. The following proposals were made:

(a) Future space life science programmes should be developed through international and interdisciplinary cooperation, taking into account all space programme elements (i.e. high-quality research, industrial sponsoring, marketing plans for spin-offs and information programmes for the general public);

(b) Access to the International Space Station for researchers from States not represented in the international space life science working group should be facilitated. In view of the enhanced flow of information and the selection process, in the twenty-first century, developing countries should also have better access to research carried out by highly qualified international space experts, by, among other things, having the possibility of sponsoring proposed space life science projects.

XX. Conclusions and proposals of the Workshop on Disaster Management*

1. As part of the workshops organized within the framework of the Technical Forum of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), a Workshop on Disaster Management was organized jointly by the European Space Agency and the National Space Development Agency of Japan. The Workshop provided an opportunity to illustrate the relevance and benefits of space techniques for the improvement of disaster aid and rescue measures implemented by concerned authorities around the world.

2. During the Workshop, participants made presentations describing different cases such as forest fires, volcanoes, floods and hurricanes, which had been monitored by Earth observation satellites. They also highlighted the importance of other space assets, such as telecommunication satellites, which are instrumental in the emergency support to be provided to the disaster scene. Finally, a project on disaster management support was described, which is part of the involvement of the Committee on Earth Observation Satellites in a broader initiative known as the Integrated Global Observing Strategy.

3. Further to a review of the experience gained in recent years in using satellites in the context of disaster management and mitigation activities, all participants at the Workshop came to the following conclusions:

(a) Earth observation, telecommunication, navigation and other services from satellites are effective means to improve monitoring, management and mitigation of disasters around the globe. Those techniques make it possible to limit the suffering of the population and damage to society;

* A/CONF.184/C.2/L.1.

(b) Given the transboundary nature of disasters, international cooperation between operators and data providers of relevant space assets should be enhanced in order to provide the best possible service to improve rescue efforts and the assessment of rehabilitation measures. It is recommended that timely release of data and services offered by space assets be one of the major focuses of such cooperation.

XXI. Conclusions and proposals of the Workshop on Resource Mapping from Space*

1. The conclusions and proposals below concern paragraphs 102-115 and 119-127 of the draft report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (A/CONF.184/3 and Corr.1 and 2).

A. New global developments in technology

2. In the last 100 years, natural resource industries have developed from an economy based on access to land and labour into industries where capital (i.e. investment in equipment) dominates. Today, the most rapidly growing segment of the economy is "information": spatial information derived from remote sensing and geographic information systems can help natural resource managers, in both developed and developing countries, to improve food production and water management, decrease costs or reduce environmental degradation.

B. Resource issues

3. Agricultural statistics clearly show that the world food balance is becoming more and more fragile. Since the mid-1980s per capita food production at the global level has decreased steadily.

4. There will be a considerable shortage of water for drinking, for sanitation and, most importantly, for growing crops in the twenty-first century. Water, being a scarce commodity, needs to be properly managed.

5. The degradation of limited arable land by various processes, namely, soil erosion by water and wind, salinization and alkalinization, waterlogging, shifting cultivation, mining and so on, resulting from over-exploitation has resulted in a significant decrease in per capita arable land.

C. Conclusions

6. The capability to monitor changes in vegetation and land use in the major production regions of the world is important and remote sensing is the only technique offering such a capability.

7. New satellite remote sensing systems are being launched that will be of use at both the local and regional levels for natural resource managers. Those systems offer improvements in spatial, spectral or temporal accuracy. As more satellites are placed in orbit, imagery over a geographical location will be accessible at shorter time periods.

8. Operational low-cost satellites, such as the advanced very high resolution radiometer of the National Oceanic and Atmospheric Administration (NOAA-AVHRR) of the United

* A/CONF.184/C.2/L.2.

States of America, create the possibility to monitor on a daily basis the status of land and water resources and crop performance.

9. With the advantage of providing synoptic coverage of large areas at regular intervals, coupled with the advances made in computer-aided digital analysis and data fusion, spaceborne multi-spectral measurements made by Earth observation satellites offer an immense potential for generating reliable, timely and cost-effective information on natural resources.

10. Judicious use of the full capabilities of Earth observation missions and data should lead to an increase in the quality of remote sensing products, in the information delivered to the customer and in decisions taken by the customer.

11. The continuous availability of free or low-cost data for resource mapping on a global scale (e.g. NOAA-AVHRR, and the Satellite pour l'observation de la Terre (SPOT) vegetation mapper) is an urgent priority for environmental monitoring.

XXII. Conclusions and proposals of the Workshop on Remote Sensing for the Detection, Monitoring and Mitigation of Natural Disasters, organized by the International Society for Photogrammetry and Remote Sensing and the European Association of Remote Sensing Laboratories*

1. The conclusions and proposals below concern paragraphs 34, 41, 42, 44, 69, 74, 75, 79, 80, 82, 86, 90, 91, 94-99, 102, 106-119, 127, 136-139, 301, 302 and 339 of the draft report of the Third United Nations Conference on the Peaceful Uses of Outer Space (A/CONF.184/3 and Corr.1 and 2).

2. Remote sensing provides scientists with the data needed for predictive modelling of natural disasters, for appraisal of the damage caused and for mitigation of the deleterious effects that precede or accompany such disasters. Remote sensing is also recognized as an essential source of information in the initial detection and near real-time observation of the effects of search, rescue and assistance efforts. Many international cooperative activities are now being developed through the efforts of organizations such as the Committee on Earth Observation Satellites and through international bilateral arrangements. The Workshop on Remote Sensing for the Detection, Monitoring and Mitigation of Natural Disasters reviewed the status of those international efforts and offered the following conclusions:

(a) In order to use remotely sensed data effectively in relation to natural disasters, crisis management systems must be in place. That would allow for planning and collaboration between relevant agencies and rapid response to emergencies;

(b) Considerable international cooperative efforts are needed to use remote sensing data and other information to develop indicators of disaster-prone areas and mitigation strategies and scenarios;

(c) Space-imaging, communication and positioning systems can be effective tools for the management of earthquake hazards. Space-borne imaging systems can provide indicators, maps and measurements of quake-prone areas that can be used for evacuation routing, urban planning and vulnerability statistics;

* A/CONF.184/C.2/L.3.

(d) More research is needed on the potential advantages of new Earth observing remote sensing systems with higher resolution, more spectral bands or active sensors (interferometric synthetic aperture radar and light radar (lidar));

(e) Space-borne synthetic aperture radars have demonstrated their effectiveness in producing all-weather remote sensing imagery of oil pollution effects, especially for the detection of oil pollutants, in measuring extent, direction and growth and in identifying pollutant sources in international waters;

(f) Many remote sensing methods have been developed to assess the potential of geological hazards and to appraise the damage caused. They include methods for the integration of multi-sensor data to improve lithological mapping in tropical environments, landslide mapping and analysis of volcanic and associated hazards;

(g) Satellite remote sensing has been shown to be beneficial in identifying environmental indicators to produce risk maps of desertification, soil erosion and desalinization, deforestation, overgrazing and overdevelopment;

(h) Early warning systems rely on satellite imaging systems for the detection of early stages of flooding, forest fires, volcanic eruptions and the effects of certain pollutants;

(i) The detection and characterization of hazardous waste sites require high spatial and spectral resolution remote sensing from visible, infra-red and radar satellite images.

3. Satellite data are used operationally to lessen the impact of natural disasters such as tropical cyclones, flash floods, heavy snowstorms, volcanic ash clouds, sea ice, toxic effects on coastal waters and harmful algal blooms.

4. In conclusion it can be stated that many techniques using Earth observation data are being used effectively to manage natural disasters, but more effort is needed to make disaster prediction a reality and to plan responses. More research is needed to integrate new data sources and to exploit them effectively.

XXIII. Conclusions and proposals of the Seminar on Environment and Remote Sensing for Sustainable Development*

1. The Seminar on Environment and Remote Sensing for Sustainable Development focused on the application of space remote sensing science and technology to issues of importance to developing countries, such as agriculture, infrastructure, environment and decision-making, from the perspective of Governments and private space technology providers, as well as from that of regional representatives of the user community.

2. During the Seminar eight panel members made presentations describing existing programmes and future missions planned with a view to providing data and information products and the potential value of those products to developing countries. Subsequently, participants discussed with members of the panel issues concerning remote sensing and sustainable development.

3. Both the presentations and the subsequent discussion revolved around issues that condition the ability of developing countries to make full use of remote sensing data and information products. Those issues were as follows:

* A/CONF.184/C.2/L.4.

(a) Limitations in the capacity available in developing countries in terms of hardware, software and human resources;

(b) Problems of data pricing, access and standards;

(c) New missions by "space-faring" nations that were likely to have an adverse effect on both of the above factors;

(d) New models for the exploitation of remote sensing that had emerged in Brazil and India.

4. The Seminar made the following recommendations for incorporation in the text of the draft report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (A/CONF.184/3 and Corr.1 and 2):

Paragraph 139

(a) Insert a new paragraph 139 *bis* to read:

"The questions of access, dissemination and archiving of Earth observation data are growing in importance. Because issues of data policy, and in particular pricing policy, present obstacles to the effective utilization of Earth observation data, greater clarity in statements of data policy by the supplier organizations would be helpful to the development of the Earth observation sector. The advantages and disadvantages of different pricing models should be explored and assessed against the opportunities to use Earth observation data for specific applications, including disaster management and global observations. The experience of those organizations which have already established Earth observation data policies, such as the National Space Development Agency of Japan and the European Space Agency, should be harnessed by national and international Earth observation programmes";

Paragraph 140

(b) Insert a new paragraph 140 *bis* to read:

"To provide a venue for the discussion and resolution of technical and policy matters among data and information users and providers, both public and private, a series of regional forums should be held. To ensure their transparency and credibility, those forums should be organized and hosted by a non-governmental organization such as the International Society for Photogrammetry and Remote Sensing";

Paragraph 142

(c) Insert a new paragraph 142 *bis* to read:

"The work of the Food and Agriculture Organization of the United Nations in using geographic information systems to analyse Earth observation and other environmental data to assist policy and decision makers should be communicated more fully to developing countries through literature, pilot project descriptions, data sets on CD-ROMs and the World Wide Web";

Paragraph 144

(d) Add the following sentence at the end of paragraph 144:

"There should be a wider and more effective communication of lessons learned on the use of Earth observation for sustainable development in developing countries, including India's Integrated Mission for Sustainable Development

and the cooperation between Brazil and China to launch their own Earth observation satellite, the China-Brazil Earth Resources Satellite (CBERS)";

Paragraph 218

(e) Add a new subparagraph (e) to read:

"(e) Assisting the centres in developing strategies that would help administrators and managers to understand better the benefits available from the use of remote sensing in sustaining and enhancing the quality of life in developing countries";

Paragraph 283

(f) Add the following sentence at the end of paragraph 283:

"Such cooperation will benefit from public/private partnerships, in appropriate circumstances, with suitable arrangements being made for risk-sharing and for developing operational systems that build on successful research and development activities";

Paragraph 321

(g) Add a new section after paragraph 321 to read:

"(c) Specific action programmes

"Open access to space is essential to the widest possible utilization of all applications that bring benefits to humankind, including sustainable development. Full participation in the information society of the twenty-first century requires that all nations have open access to environmental information gathered by Earth observation platforms. The principle of non-discriminatory access to Earth observation data contained in the Principles Relating to Remote Sensing of the Earth from Outer Space (General Assembly resolution 41/65, annex), in particular principle XII, should continue to be safeguarded and should be enhanced by a clearer definition of its meaning. The United Nations and its Committee on the Peaceful Uses of Outer Space should work with experts in international space law and space policy to define more precisely the issues of practical implementation behind the term 'non-discriminatory access'. That work should include an assessment of how developing countries can put the principle of non-discriminatory access into practice and thereby gain maximum benefits from space-based Earth observation".

XXIV. Conclusions and proposals of the Seminar on Global Health*

1. The Seminar on Global Health considered issues relating to the use of remote sensing and geographic information systems (GIS) to improve human health throughout the world.

2. The Seminar reached the following conclusions:

(a) The use of remote sensing and GIS can help prevent infectious disease, in particular in developing countries;

(b) Remote sensing and GIS are most effective when used to eradicate endemic disease through identification of disease reservoirs and disease vectors.

* A/CONF.184/C.2/L.5.

3. The Seminar made the following recommendations:

(a) States should raise awareness about the possibilities of remote sensing technology and the action required to meet the need for education at the highest level. In that context, the involvement of trained personnel, such as statisticians and epidemiologists, is an efficient and necessary way to speed up the process of capacity-building;

(b) Institutional support and cooperation should be recognized as having an essential role to play in any programmes undertaken;

(c) Programmes at the regional level should be established to prevent the re-emergence of diseases;

(d) Issues relating to the cost of, and timely access to, data should be addressed;

(e) The development of affordable GIS software should be encouraged.

XXV. Conclusions and proposals of the Round Table on Tele-education*

1. The participants in the Round Table on Tele-education noted that more and more countries throughout the world were recognizing education as the key to the development process. Literacy, especially education of females, had been established as a crucial determinant for gender equity, good health and voluntary population control. The full development of the potential of society and individuals was dependent upon education also fostering involvement in decision-making at various levels, giving substance and meaning to the concept of participatory democracy.

2. The participants also noted that, given the huge number of illiterate people in many developing countries and the need to continuously update and upgrade the quality of education, it was quite clear that traditional means of education had been grossly inadequate. In developed countries as well, rapid advances in the accumulation of knowledge had made it necessary to develop new means of providing regular and lifelong education, especially for working professionals.

3. Tele-education, using the tools of the space technology, provided proven solutions to many problems. Satellite communication and broadcasting made it possible to cover vast areas and to reach out to remote and inaccessible places. New technologies and techniques not only made it possible to take distance learning to all corners of a country, but also facilitated true education through interactive communication, apart from two-way audio or even two-way video (videoconferencing). Broadband satellite-based connectivity enabled a user in a remote location to do fast downloads of text, graphics, animation or video clips from the Internet. Those and other capabilities could also be used for applications such as tele-medicine, enabling high-level or expert medical advice to be provided for a patient in some remote location.

4. Experiments, pilot projects and a few operational systems throughout the world had demonstrated the feasibility and potential of a whole range of tele-education options. Elementary education, technical training, adult education, literacy classes, professional education, skill-training and a whole host of other applications had been carried out by the Open University, literacy organizations, educational institutions, industry, non-governmental organizations and others.

* A/CONF.184/C.2/L.6.

5. It was noted that, on the threshold of a new century—indeed, a new millennium—the world could not afford pockets of illiteracy and educational deprivation. Space technology offered an important means of eradicating illiteracy and taking people everywhere to a new level of awareness, empowerment and development. The realization of those possibilities must be an important part of the agenda of each nation, and of all nations collectively.

6. Having discussed and noted the above-mentioned issues, the Round Table on Tele-education made the following recommendations:

(a) All countries should recognize the importance of education and acknowledge its crucial role in the growth of the individual, the development of the nation and the sustainability of the social, economic and environmental health of the world;

(b) The United Nations, through the Committee on the Peaceful Uses of Outer Space and its Secretariat, should promote the sharing of best practices and experiences in tele-education among countries by:

(i) Organizing well-structured regional and international seminars;

(ii) Promoting and supporting the documentation of experiments and projects and ensuring the dissemination of reports on those experiments and projects;

(iii) Initiating study-tours of projects of relevance for decision makers and experts;

(c) The United Nations, through the International Programme for the Development of Communication of the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Telecommunication Union (ITU), should promote research and studies on the planning, configuration and use of tele-education systems that utilize new and emerging information and communication technologies. The focus of such systems should be on female education, literacy and universalization of elementary education;

(d) The United Nations should draw on its Secretariat, UNESCO, ITU and experts from Member States to undertake a study on the feasibility and desirability of regional and/or international systems for tele-education;

(e) The regional centres for space science and technology education should use and promote tele-education to reach out to more persons in their areas of operation;

(f) The Secretariat should work with the World Health Organization to study the feasibility of tele-health systems, especially in developing countries, for training paramedics and health professionals;

(g) The United Nations should work with ITU on putting together data to convince Member States and bilateral and multilateral agencies of the importance of providing universal access, through individual or community facilities, to means of information retrieval (radio/television sets, telephones, computer access to databases etc.), giving special attention to means of quickly expanding access to the Internet;

(h) The United Nations should promote studies to develop curriculum using space imagery and findings from space science and space exploration to increase awareness of the fragility of the eco-system, humanity’s unique place in the universe and the basic oneness of all humanity;

(i) In view of the potential of the Internet, each State should ensure the establishment of a policy and regulatory frameworks that encourage and facilitate the wide use of and access to the Internet.

XXVI. Conclusions and proposals of the Workshop on Small Satellites at the Service of Developing Countries*

1. The Workshop on Small Satellites at the Service of Developing Countries concluded that small satellites were valuable tools in the development of a space infrastructure and scientific and application programmes. They could also have an important role to play in every country's space plan. Small satellites had offered and would continue to offer opportunities for international cooperation.

2. Scientific missions using small satellites could provide very valuable results and make important contributions to advances in knowledge of the Earth's environment and of the universe. Any country that developed or participated in a scientific space mission made it possible for its scientists to contribute to the advancement of science. Small, more focused space missions could yield greater benefits for the national scientific community.

3. In the field of Earth observation, small satellites could carry instrumentation devoted to the particular needs of a country. The data could then be used independently or in conjunction with data from other, larger spacecraft in order to provide information for such applications as mapping, fisheries, agriculture, land use and environmental monitoring. The characteristics of the spacecraft, such as wavelength, resolution, time and frequency of observation, could be tailored to those particular needs.

4. The applications of data collection and message store-and-forward communications had already been used on several spacecraft. Novel types of constellations of small satellites were currently being designed that could serve the development needs of a number of developing countries. Such examples showed that it was important to take into account the particular situation of the country (geography, remote settlements and so on) in order to develop a more appropriate communication system.

5. The Workshop recommended that each country prepare a space plan that identified how space assets could best be used to support its development. In such a plan, small satellites should be considered one of the most valuable tools to initiate and develop an indigenous space capability.

6. Although limited in size and mass, small satellites could still benefit from advances in technology. The development of complex software could be used to enhance satellite missions further. Each country planning to develop a space infrastructure should identify those hardware and software technologies which were most relevant to its current and planned status of development.

7. Small satellites offered an ideal opportunity for training. On-the-job training in cooperative programmes had proved to be a valuable method of learning all the techniques associated with the design, development, manufacturing, testing and operation of a spacecraft. Developing countries were encouraged to include such training programmes in their space plans.

8. Small satellites offered opportunities to developing and developed countries to establish cooperative programmes not only for the purpose of training, but also with a view to preparing scientific or application missions. They also made it possible for developing countries to pool their efforts in building their individual space capabilities. It was therefore recommended that, in preparing its space plan, each country consider incorporating into it an element of international cooperation.

* A/CONF.184/C.2/L.7.

XXVII. Conclusions and proposals of the Forum on Industrial Utilization of the International Space Station*

1. The conclusions and proposals below concern paragraphs 30, 33 and 34 of background paper 6, entitled “Basic science and microgravity research and their benefits” (A/CONF.184/BP/6, sect. IX).

2. The purpose of the Forum on Industrial Utilization of the International Space Station was to provide countries currently not involved in the International Space Station programme, commercial users and any other interested parties with innovative solutions geared towards the commercial utilization of the International Space Station.

3. This very complex issue was approached by first examining all the common features that could make the commercial exploitation of the International Space Station viable. Those common features were then illustrated by examples of how research in the International Space Station could be applied in different fields that were also of interest in terms of the priorities of countries that had not participated in projects involving human space flight.

4. Some typical applications were medicine (development of new medicines by means of protein crystallization in space), technology (testing and demonstration of new space communication technology) and the examination of properties of high-precision materials.

5. It was noted that commercial users of the International Space Station would expect low cost, short deadlines and ensured access for the services that they would purchase. Utilization of the International Space Station must be transformed into routine business. There was a discussion on how the transition might be managed, how potential commercial users viewed space-based opportunities and what they expected to receive for their investment in space-based investigations. The discrepancies between what existed and what was needed were highlighted. An outline was presented of an approach to making the transition from the current system to a system that could mesh with the established mechanisms of industrial capitalism.

6. There was a discussion on mechanisms for sharing the use of the International Space Station with the general public and for encouraging the involvement of developing countries in its utilization.

7. The Forum on Industrial Utilization of the International Space Station agreed on the following conclusions and proposals:

(a) International partnerships and cooperation between countries and companies involved in the operation and utilization of the International Space Station and those countries not yet participating in that endeavour should determine how to utilize the Space Station for their benefit;

(b) Information about access to use of the International Space Station needed to be disseminated throughout the world in order to increase awareness of the matter in countries not yet participating in that endeavour;

(c) Mechanisms for improving accessibility from a technical and financial point of view (for example, loans from the World Bank) should be established to simplify utilization of the International Space Station, especially for developing countries.

* A/CONF.184/C.2/L.8.

XXVIII. Conclusions and proposals of the Workshop on Developing Indigenous Earth Observation Industrial Capabilities in Developing Countries *

1. The discussion concerned technical and policy-related issues dealt with in the draft report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (A/CONF.184/3 and Corr.1 and 2, paras. 29-31, 36-38, 44, 46, 47, 82, 83, 91-96, 102-117, 119, 129-131, 136, 142, 235-243, 245-249, 252-254, 258, 260, 261, 270, 274, 276-280, 282, 283, 285 and 290). Furthermore, the discussion was directly concerned with the draft Vienna declaration on space and human development (A/CONF.184/3 and Corr.1 and 2, chap. V).

2. Presentations were made by individuals representing both developed and developing countries in Africa, Asia and North America. Those attending included individuals from countries in those regions, as well as in Europe and South America.

3. It was noted that space technology had successfully contributed to the development of the necessary baseline, exploratory and monitoring information on all aspects of human needs.

4. It was agreed that, whereas maps and geospatial data derived from a combination of Earth observation information and other data were as much a part of a nation's infrastructure as the transportation network, the health-care system, telecommunications and education, the creation of a national geospatial infrastructure should be accorded the same level of support as the other elements of national infrastructure.

5. It was noted that the need for geospatial infrastructure suggested that Governments should become knowledgeable customers and users. Governments should look to indigenous industry to support government requirements, to improve the ability to extract knowledge from data and add local understanding and to identify and develop new markets. Furthermore, the creation of an indigenous industry would reduce countries' dependence on imported technology and services.

6. Experience had shown that indigenous private sector activity could help developing countries to meet, in a cost-effective manner, not only their own real information needs, but also those of the agencies that served them. Accordingly, it was proposed that Governments foster an environment in which private industry could operate better, in which it could develop international partnerships. Such indigenous industrial capabilities had been developed with direct and continuing benefits to countries as diverse as Brazil, Mongolia and the Philippines.

XXIX. Conclusions and proposals of the Workshop on Global Navigation Satellite Systems**

1. The objective of the Workshop on Global Navigation Satellite Systems, organized by the European Tripartite Group (the European Commission, the European Space Agency and the European Organization for the Safety of Air Navigation), was to demonstrate how navigation and positioning technology could help solve problems of regional or global significance, given that global navigation satellite systems (GNSS) are considered one of the key technologies in stimulating economic and social development, especially in

* A/CONF.184/C.2/L.9.

** A/CONF.184/C.2/L.10.

developing countries. The Workshop also served to contribute to education and awareness about satellite navigation technology in global user communities.

2. The Workshop noted that two satellite navigation systems existed at present, the Global Positioning System (GPS) of the United States of America and the Global Orbiting Navigation Satellite System (GLONASS) of the Russian Federation, which were originally developed for military purposes and currently did not fully meet civilian user requirements. The international user communities (transport, timing, geomatics, agriculture and disaster management and so on) were becoming increasingly convinced of the need to develop a GNSS that provided a safer, more reliable navigation and positioning service for civil use. That implied improving the performance of the current service in terms of accuracy, integrity, continuity and reliability.

3. The main conclusions of the Workshop were as follows:

(a) International cooperation at both the political and the technical level is needed for the successful implementation of satellite navigation and positioning technology. System provider nations, potential contributor and end-user States, industry, service providers, users and international organizations need to cooperate closely to ensure the provision of a safe, seamless global satellite navigation and positioning system;

(b) Since it is universally accepted that differences in the pace of development around the world should not lead to incompatibility between elements of navigation and positioning systems, it is intended to achieve full compatibility and inter-operability of regional satellite navigation systems throughout the implementation process;

(c) A public-private partnership approach is recommended in Europe as the way forward for infrastructure and service development. Industry has also been examining ways to provide value-added services and applications. A strong institutional framework has been put in place to enable industry and users to benefit from satellite navigation;

(d) In selecting new or upgrading existing technology, many States (especially from the developing world) are facing difficulties in securing financing. Different innovative approaches, supported by cost-benefit analyses and solid business cases, have proved to be helpful in convincing banks and other lending institutions to invest in the aviation infrastructure;

(e) In order to increase awareness in developing nations of the benefit of GNSS, the Committee on the Peaceful Uses of Outer Space should consider the expansion of the United Nations Programme on Space Applications to include support for appropriate workshops, seminars and internships in conjunction with other relevant international organizations and institutions such as the members of the European Tripartite Group, the International Civil Aviation Organization, the International Maritime Organization, the World Bank and the European Bank for Reconstruction and Development. Service provider nations should accept the responsibility for funding such new activities;

(f) Issues related to a general GNSS liability and certification regime commensurate with the expectations of users should be developed, notwithstanding the increased role of the private sector in the provision of GNSS services;

(g) Satellite navigation services require protected frequency bands. It is therefore recommended that public and private sector frequency spectrum experts within the GNSS community urge their respective Governments to adopt a common approach to spectrum issues before the World Radiocommunication Conference in the year 2000. That should serve to maximize the protection and use of spectrum for current and future GNSS services.

XXX. Conclusions and proposals of the Workshop on Clean and Inexhaustible Space Solar Power*

1. The Workshop on Clean and Inexhaustible Space Solar Power arrived at the following findings:

(a) Solar power facilities in space can provide abundant and clean new electric power for Earth;

(b) Solar electric power from space can:

(i) Accelerate ongoing global electrification;

(ii) Lead to decreasing electric energy costs through ongoing technological advances in electronics;

(iii) Progressively reduce the pollution and uncertainties associated with present large-scale commercial power systems (oil, coal, natural gas, nuclear and terrestrial renewables);

(c) Some 2 billion people now live without the services that commercial energy provides. Without a new supply of abundant, clean and low-cost power, that number will increase, with attendant poverty and worldwide inequity;

(d) The concerted efforts of many individuals and organizations internationally are required to ensure provision of new and renewable global energy, including space solar power.

2. The Workshop made the following recommendations:

(a) The Committee on the Peaceful Uses of Outer Space should examine how to facilitate the development and demonstration of clean and inexhaustible space solar power;

(b) The Committee should consider taking the following action:

(i) Encouraging organizations around the world to investigate further the technical and economic feasibility of space solar power over the next few years and in particular to perform demonstrations on the ground and in space that can validate needed technology advances and engender familiarization with space solar power worldwide;

(ii) Encouraging countries to examine ways in which space solar power might be uniquely suited to meeting a portion of their energy needs;

(iii) Examining how space solar power will improve the quality of life in all countries of the world (e.g. cleaner air, cleaner water, better communications and higher standard of living);

(iv) Stimulating international collaboration, cooperation and data-sharing regarding space solar power;

(v) Working with the appropriate national and international organizations responsible for standards and regulation in order to ensure due consideration of space solar power matters, for example, as they concern health, the environment, spectrum management, orbit allocations and other topics;

(vi) Organizing and sponsoring an international conference on space solar power involving both developing and developed countries;

* A/CONF.184/C.2/L.11.

(vii) Forming a standing committee for the long-term consideration of space solar power.

XXXI. Conclusions and proposals of the Workshop on Telemedicine*

1. The Workshop on Telemedicine highlighted the significance of telecommunications in general, including space-based communications, to the health sector and medical services. It was agreed that the pace and impact of developments in that area were such that telecommunications would come to be such a routine support to health and medical care that the prefix "tele-" would become superfluous.

2. The Workshop stressed the need for harmonization and collaboration between local and global programmes in telemedicine and tele-health, both in the technical and in the medical and health-care sectors. Special emphasis was given to cooperation with and support of developing countries and the requirements for global services. Easy access at affordable costs to space infrastructure such as low-Earth and geostationary Earth orbit satellites for communications and Earth observation (such as climate and biotop monitoring for disease prediction and prevention) was considered a key prerequisite for the necessary quick implementation and dissemination of telemedicine services.

3. The Workshop made the following recommendations:

(a) Telemedicine should be promoted in a way that enabled developing countries to adapt their health-care systems to their own specific needs and local conditions (environment, economy, social structure and so on);

(b) Telemedicine should be implemented with a view to improving work in two areas of concern:

(i) Care for the individual citizen, in particular in the under-served population, by introducing electronic patient records, electronic prescriptions and concepts of shared and integrated care;

(ii) Health-care systems as such (cost containment and better and faster information services with better generation and dissemination of knowledge);

(c) The continuous improvement of the health-care system must be based upon cost-benefit analyses, efficacy and efficiency and should take into account national socio-economic characteristics;

(d) Basic and continuous medical education for professionals and awareness programmes for the public should be an integral part of the telemedicine solutions promoted and adopted. Those programmes should be developed on the basis of international cooperation and should be made part of national medical education activities;

(e) Existing regional applications and networks should be supported and made to interlink with each other;

(f) Appropriate technical and medical standards need to be agreed upon;

(g) The international cooperation within the framework of the International Space Station programme should be seen as a unique chance to foster international and multicultural collaboration and the interoperability of services and technologies;

* A/CONF.184/C.2/L.12.

(h) Summarizing the results of the ongoing experiments of global medical emergency networks and their evaluation and promotion should be organized. Such networks should offer services to governmental and non-governmental organizations in the case of natural and/or man-made disasters;

(i) A unique, globally valid emergency call number should be established that is available to individual citizens worldwide;

(j) Space nations and agencies should offer access points within their space and terrestrial infrastructure for services that support the daily needs of citizens.

4. The Workshop also recommended that continuous concerted efforts be made by the working groups of the Group of Eight and by the World Health Organization, the International Telecommunication Union and the United Nations with a view to:

(a) Defining and promoting concepts for a flexible technical infrastructure, adaptable to health services in different economic and cultural environments, including developing countries, and based on a clear vision of the existing and the emerging growth of telecommunications and information-processing capabilities;

(b) Defining a generally acceptable legal and ethical framework that would also cover aspects of privacy and confidentiality to enable cooperation and the cross-border exchange of services;

(c) Orienting the above activities to the needs of patients and to criteria of cost-benefit and sustainability.

5. The Workshop strongly recommended support for the organization and funding of concerted action to achieve the above objectives.

XXXII. Conclusions and proposals of the Session on International Standardization for Space Systems*

1. Representatives from regional and national space agencies, a major systems contractor, a commercial satellite communications corporation, and the International Organization for Standardization (ISO) presented the major areas of current activity in standardization for space technology. It was reported that some of those activities were being conducted using the ISO international consensus procedures. There were two ISO committees devoted to the purpose; Space Data and Information Transfer Systems (TC20/SC13) and Space Systems and Operations (TC20/SC14). The Consultative Committee for Space Data Systems conducted all of the technical work of the first committee.

2. A presentation was made of the work of the ISO committees and regional standards bodies in the space field in the areas of satellite communications, man in space, data transfer and data archiving. Topical details focused on how the results of standardization could benefit all nations, with emphasis on developing countries.

3. The session submitted the following conclusions to the Conference:

(a) The results of international standardization not only provided obvious benefits to the major space agencies and corporations, but also facilitated the sharing of organizations in developing countries in the benefits of such extraterrestrial endeavours.

* A/CONF.184/C.2/L.14.

A comprehensive set of standards for space systems would accelerate achievement of that goal;

(b) The concept of open standardization permitted smaller organizations to participate in the use of space assets, including off-the-shelf products in the least expensive manner;

(c) International standards for space systems and operations also made possible the utilization of space programmes and services in the broadest possible manner through common design of experiments, spacecraft interfaces, ground stations and product-qualification methods. The principle of universality ensured that the needs of developing countries were integrated into standards;

(d) The session recommended that the Committee on the Peaceful Uses of Outer Space formally endorse open standards as a mechanism to enable developing countries to gain access to space and recognize ISO and affiliated organizations for their efforts towards achieving this goal.

XXXIII. Conclusions and proposals of the Workshop on Mars Exploration*

1. The Workshop on Mars Exploration underscored the extraordinary cooperative effort among nations that was developing in current and continuing robotic exploration of Mars. The questions that needed to be answered about the planet's climate history, which might ultimately address the possibility of past or even present life on Mars, would be one element of an exploration programme with synergistic and ever-expanding international components.

2. On the Mars Polar Lander nearing Mars, a Russian instrument, the Lidar, would measure atmospheric dust and haze. The Lidar was the first Russian experiment on a planetary mission by the United States of America. The Planetary Society's microphone was part of that instrument and was the first instrument on a planetary mission to be funded by a public interest group. In future years, the proposed framework for the exploration of Mars would not be the sole domain of any one nation. The French Ariane-5 would supply the means for a Mars surface sample to be returned to Earth, cored from Mars by a drill supplied by the Italian Space Agency, on board two upcoming missions, Mars Surveyor 2003 and 2005, of the National Aeronautics and Space Administration of the United States.

3. In addition, Ariane-5 would deliver micro-missions, including four Netlanders, to the surface of Mars, which would study the interior of the planet and further track the evolution of water on it. An aggressive study of both exobiology and geochemistry was required to address the issue of past or present life on Mars. International contributions by the European space agencies and European countries ranged from experiments to determine why no sedimentary meteorites from Mars had been found on Earth to high-accuracy position location on Mars identifying samples returned to Earth. All nations would have access to the returned samples in a peer review process. The Japanese Nozomi mission, with its new arrival date on Mars, would also be complementary to the Mars Express of the European Space Agency which had the ability to map "backwards" to reconstruct the loss of surface water on Mars.

4. The issues of planetary protection from contamination of Earth by Mars samples and contamination of Mars samples by Earth bacteria, the protection of astronauts from radiation and the concept of an Internet-enabled Mars all posed new challenges, with a

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better informed public than perhaps at any time in the past, but also with a continued need to educate and engage the public on planetary exploration missions, with announcements of opportunity in Mars robotic exploration open to all nations and with developing nations encouraged to participate. A virtual armada of missions with an infrastructure based on international cooperative efforts on and around Mars would carry forward the commitment to Mars exploration.

5. The Workshop recognized that all national participation in missions was subject to the vagaries of political and economic support from Governments. The economic difficulties of the Russian Federation had prevented its completion of a national programme to explore Mars; Europe had had a long period of uncertainty with Mars Express and there was a need for national agencies to support their respective country's role in the international Mars sample return; and, even as the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space was being held, the United States' programme was under attack in Congress and Mars exploration was being threatened with potential cutbacks. International cooperation and global participation were valuable added benefits of Mars exploration and should be included in efforts to build public support for such exploration.