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United Nations International Workshop on the Use of Space Technology for Disaster Management

(Munich, 18-22 October 2004)

Contents

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I. Introduction

A. Background and objectives

1. In its resolution entitled "The Space Millennium: Vienna Declaration on Space and Human Development",[1] the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) recommended that activities of the United Nations Programme on Space Applications promote collaborative participation among Member States at both the regional and international levels by emphasizing the development of knowledge and skills in developing countries and countries with economies in transition.

2. At its forty-sixth session, in 2003, the Committee on the Peaceful Uses of Outer Space endorsed the programme of workshops, training courses, symposiums and conferences planned for 2004.[2] Subsequently, the General Assembly endorsed the activities of the United Nations Programme on Space Applications for 2004 in its resolution 58/89 of 9 December 2003.

3. Pursuant to resolution 58/89 and in accordance with the recommendation of UNISPACE III, the United Nations International Workshop on the Use of Space Technology for Disaster Management was organized jointly by the Office for Outer Space Affairs of the Secretariat and the German Aerospace Center (DLR) on behalf of the Government of Germany, co-organized by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the secretariat of the International Strategy for Disaster Reduction and co-sponsored by the European Space Agency (ESA). The Workshop was hosted by DLR and held at the European Patent Office in Munich, Germany, from 18 to 22 October 2004.

4. In order to promote the use of space technology for disaster management and risk reduction in developing countries and in countries with economies in transition, the Office for Outer Space Affairs, within the framework of the United Nations Programme on Space Applications, organized five regional workshops on the use of space technology for disaster management. The overall objective of the workshops was to contribute to building an understanding of how space technology could contribute to risk reduction and disaster management and to defining a common vision that could contribute to the incorporation of space technologies, in a sustainable manner, into operational disaster management programmes of Member States.

5. The first of the five regional workshops was hosted by the University of La Serena and held in La Serena, Chile, from 13 to 17 November 2000, for the benefit of countries in Latin America and the Caribbean. The second of the regional workshops was organized in cooperation with the Economic Commission for Africa and was held in Addis Ababa from 1 to 5 July 2002, for the benefit of African countries. The third workshop was organized jointly with the Economic and Social Commission for Asia and the Pacific (ESCAP) and held in Bangkok, from 11 to 15 November 2002, for the region of Asia and the Pacific. In 2003, the fourth regional workshop was organized, in cooperation with the Romanian Space Agency in Poiana-Brasov, Romania, from 19 to 23 May 2003, for the benefit of European countries. The final regional workshop was held in Riyadh from 2 to 6 October 2004, for the benefit of the region of Western Asia, and was co-organized with the King Abdulaziz City for Science and Technology of Saudi Arabia. Over

600 participants from 96 countries participated in the five regional workshops, contributing to the discussions and the definition of the conclusions and recommendations that were formulated.

6. The regional workshops contributed to increasing the awareness of managers and decision makers involved in disaster management of the potential benefits of using space-based technologies; to the definition and implementation of a global network of national and regional institutions interested in working together; and most importantly, to the development of regional plans of action with specific strategies and activities that would contribute to consolidating the use of space technologies for disaster management in each region.

7. The United Nations International Workshop on the Use of Space Technology for Disaster Management brought together the results of the above-mentioned series of regional workshops with the overall objective of structuring a common global strategy aimed at promoting the use of space technologies for disaster management.

8. The specific objectives of the International Workshop were: (a) to review the information and communication needs of the disaster management community and the extent to which they were being met or could be met by space technologies; (b) to review the results of the previous five regional workshops and discuss a common strategy for all regions to support the use of space technology in disaster management activities; (c) to review ongoing and planned initiatives as well as case studies that could contribute to an integrated space-based global system to support disaster management; (d) to discuss a common vision and proposals for an integrated space-based global system to support disaster management; and (e) to define recommendations and findings to be forwarded as a contribution to the World Conference on Disaster Reduction, to be held in Kobe-Hyogo, Japan, from 18 to 22 January 2005.

B. Programme

9. At the opening ceremony, statements were made by the President of the European Patent Office, the Director of the German Remote Sensing Data Centre (DFD) as well as by the representatives of UNESCO, the secretariat of the International Strategy for Disaster Reduction, ESA and the Office for Outer Space Affairs. Representatives of DLR, ESA and the Centre national d'études spatiales (CNES) of France delivered the keynote presentations. A total of 71 presentations were delivered during the seven presentation sessions, the two discussion panels and the one open session, all contributing to building an understanding of the current and potential use for using space technology and derived information for both risk reduction and disaster management.

10. The keynote addresses set the tone for the discussions carried out during the five days of the Workshop, emphasizing the important role of Earth observation programmes in providing support to disaster management and also the increasing international recognition of the importance of Earth observation information, which was demonstrated in the outcome documents of the various international conferences and programmes. Additionally, the Charter on Cooperation to Achieve the Coordinated Use of Space Facilities in the Event of Natural or Technological Disasters (International Charter "Space and Major Disasters"), the ESA Terrestrial

Initiative of Global Environmental Research (TIGER) programme and the activities and findings of the Action Team on Disaster Management of the Committee on the Peaceful Uses of Outer Space were presented as demonstrations of joint support to disaster management.

C. Attendance

11. A total of 170 participants from the following 51 countries attended the Workshop: Afghanistan, Albania, Algeria, Argentina, Austria, Bangladesh, Belgium, Benin, Brazil, Canada, Chile, China, Czech Republic, Ecuador, France, Germany, Greece, Hungary, India, Iran (Islamic Republic of), Italy, Japan, Jordan, Kenya, Lao People's Democratic Republic, Luxembourg, Mauritius, Mexico, Morocco, Mozambique, Netherlands, Nigeria, Norway, Peru, Philippines, Romania, Russian Federation, Saudi Arabia, Senegal, South Africa, Spain, Sudan, Switzerland, Tajikistan, Thailand, Turkey, United Kingdom of Great Britain and Northern Ireland, United States of America, Venezuela (Bolivarian Republic of), Viet Nam and Zimbabwe.

12. The Workshop was also attended by representatives of the United Nations Office for Project Services, the Office for Outer Space Affairs of the Secretariat, ESCAP, the United Nations Development Programme, the Office of the United Nations High Commissioner for Refugees, the United Nations Institute for Training and Research, the secretariat of the International Strategy for Disaster Reduction, UNESCO, the European Organization for the Exploitation of Meteorological Satellites and ESA.

13. Funds allocated by the United Nations, the Government of Germany and the co-sponsor (ESA) were used to defray the costs of air travel and daily subsistence allowance of 24 participants and 2 representatives of the Office for Outer Space Affairs.

II. Current status of the use of space technology for disaster management

14. Each year, disasters such as storms, floods, volcanoes and earthquakes cause thousands of deaths and tremendous damage to property around the world, displacing tens of thousands of people from their homes and destroying their livelihood. Many of those deaths and losses could be prevented with better information regarding the onset and course of such disasters. Space-based technologies, such as Earth observation satellites, communication satellites and satellite-based positioning technologies can contribute to improved prediction and monitoring of potential hazards, which in turn can lead to sharp reductions in loss of life and property.

15. The presentations made at the five regional workshops, the contributions received from experts in the months preceding the International Workshop in Munich, as well as the presentations made at the final Workshop provided a synopsis of the current status of the contribution of space technology to reducing losses to life and property, which is presented in the section below.

A. Space-based technology solutions for disaster management

16. It was reported that Earth observation satellites had demonstrated their utility in providing data for a wide range of applications in disaster management. Pre-disaster uses included risk analysis and mapping; disaster warning, such as cyclone tracking, drought monitoring, the extent of damage due to volcanic eruptions, oil spills, forest fires and the spread of desertification; and disaster assessment, including flood monitoring and assessment, estimation of crop and forestry damages and monitoring of land use/change in the aftermath of a disaster. Remotely sensed data might also provide a historical database from which hazard maps could be compiled, indicating which areas were potentially dangerous. Information from satellites was often combined with other relevant data in geographical information systems (GIS) in order to carry out risk analysis and assessment. GIS might model various hazard and risk scenarios for the future development of an area.

17. Meteorological satellites could monitor weather patterns, detect and track storms and monitor frosts and floods. Derived products were produced routinely several times per day, many of them focusing on particular hazard events. Tracking sequences of tropical cyclone images from geostationary satellites as well as storm intensities and atmospheric winds derived from those images provided vital information for forecasting landfall, thus contributing to saving lives. Additionally, the integration of experimental products, such as ocean surface winds from scatterometer instruments and moisture or rainfall from microwave instruments, had improved such forecasts.

18. Global navigation satellite systems (GNSS), such as the Global Positioning System (GPS), provided accurate position, velocity and time information that was readily accessible at ground level to anyone with a receiver. The reduction in size and cost of receivers was contributing to an increased number of persons using such technological solutions to collect data to support risk reduction and emergency response activities.

19. Restoring communication in disaster-stricken areas was usually the main priority when responding to an emergency. Additionally, there was a need to receive information from and send information to the various emergency response teams working in the field, including large data files such as maps and satellite images. Communication satellites—Earth-orbiting satellites that enabled the setting up of emergency communication channels—were being used increasingly by all those responding to an emergency.

B. Operational and planned programmes

20. So far, disaster management activities had been taking advantage of existing technologies to support multiple types of user and application. Space missions were being designed and launched to specifically support disaster-type users and activities such as the Bi-spectral Infrared Detection (BIRD) mission of DLR, the Disaster Monitoring Constellation and the Constellation of Small Satellites for Mediterranean basin Observation (COSMO-SkyMed).

21. Since November 2001, BIRD, which was useful for fire and land surface monitoring, had been conducting worldwide thermal anomaly observations

providing high-resolution/sub-pixel data products of selected wild land fires and volcanic activity. In the summer of 2001 BIRD had been used semi-operationally on FUEGOSAT for wildfire detection and monitoring over Portugal and Spain in the framework of the ESA Earth Watch Initiative. The Portuguese emergency centre was able to have access to BIRD images of the forest fires three hours after acquisition. Future systems to be developed by ESA would build upon lessons learned during those events. The BIRD data collection contained various worldwide high-temperature events since 2001 archived at DLR, which could be used further for development of new thermal anomaly-related satellite data.

22. The Disaster Monitoring Constellation (DMC) was the first Earth observation constellation, which once fully implemented would consist of five to seven low-cost small satellites providing daily images for applications, including global disaster monitoring. DMC was being implemented through an international consortium in which each partner owned an independent small satellite mission that serviced national needs and also made the imagery available to the global community. By sharing space and ground assets, membership of the DMC consortium conferred the unique benefit of access to a seamless global monitoring service. Currently the following countries had already launched a satellite as part of DMC: Algeria, Nigeria, Turkey and United Kingdom. China, which was also a member, would be launching its satellite in 2005.

23. COSMO-SkyMed was a planned four-spacecraft constellation to be implemented by the Italian Space Agency (ASI). Each of the four satellites would be equipped with a Synthetic Aperture Radar (SAR) instrument capable of operating in all visibility conditions at high resolution and in real time, providing information for the following risk management applications: floods, droughts, landslides, volcanic/seismic activity, forest fires, industrial hazards and water pollution. Other applications were monitoring marine and coastal environments, agriculture, forestry, cartography, geology and exploration, telecommunications, utilities and planning. The high revisit frequency of the X-band SAR spacecraft would have unique potential for the operational meteorological user community by providing ancillary data and/or data on meteo-correlated phenomena, in particular, ice monitoring and the study of ocean wave patterns. The launch of the first satellite, with the construction of the ground segment, was scheduled for June 2005.

C. Coordinating and support mechanisms

24. One of the main recommendations put forward in the Vienna Declaration was for a joint effort to implement an integrated, global system, especially through international cooperation, to manage natural disaster mitigation, relief and prevention efforts, especially of an international nature, through Earth observation, communications and other space-based services, making maximum use of existing capabilities and filling gaps in worldwide satellite coverage. This had led to the establishment of an action team working under the Committee on the Peaceful Uses of Outer Space, known as the Action Team on Disaster Management, led by Canada, China and France, which had met several times from 2001 to 2004 and in its final report put forward three recommendations for further action, one of which was the establishment of a coordinating entity to provide for coordination and the means for optimizing the effectiveness of space-based services for use in disaster management.

25. In its resolution 59/2 of 20 October 2004, the General Assembly endorsed the proposal of the Committee on the Peaceful Uses of Outer Space for a study to be conducted on the possibility of creating such an international entity. An ad hoc expert group was currently preparing the study, with experts being provided by interested Member States and relevant international organizations.

26. Also as a result of UNISPACE III, a proposal for the International Charter "Space and Major Disasters" was put forward by ESA and CNES, with the Canadian Space Agency signing the Charter shortly after. In September 2001, the National Oceanic and Atmospheric Administration (NOAA) of the United States and the Indian Space Research Organization also became members of the Charter. The National Commission on Space Activities (CONAE) of Argentina became a member in July 2003 and more recently, in February 2005, the Japan Aerospace Exploration Agency (JAXA) also joined. The National Space Research Institute (INPE) of Brazil and DMC had plans to join in 2005.

27. The International Charter aimed at providing a unified system of space data acquisition and delivery to those affected by natural or man-made disasters through authorized users. Each member agency of the Charter had committed resources to support the initiative, which was contributing to mitigating the effects of disasters on human life and property in countries around the world. As at April 2005, the Charter had been activated over 70 times (20 times in 2004) in response to landslides, oil spills, floods, tsunamis, volcanic eruptions, forest and bush fires, earthquakes, storms and hurricanes.

28. At the eighth meeting of the Charter Board, the Office for Outer Space Affairs was accepted as a cooperating body to the Charter, a mechanism through which the United Nations system could request imagery from members to help respond to emergency situations. Beginning on 1 July 2003, the Office had set up a round-the-clock hotline. United Nations focal points could fax in requests for imagery to support disaster response. Requests were subsequently resent to the Charter. Statistics showed that, since the United Nations joined the Charter in 2003, 80 per cent of the activations had been in response to disasters in developing countries and more than 60 per cent of the activations had been initiated by the United Nations.

29. The Charter had made Earth observation data available to emergency relief teams. Building upon that opportunity were several initiatives ensuring that a full range of end-to-end services, and not only satellite imagery, was being provided. Those initiatives included UNOSAT, RESPOND and the Center for Satellite Based Crisis Information (ZKI) of DLR.

30. UNOSAT was a United Nations initiative aimed at expanding direct access to satellite imagery and value-added products through the Internet and other multimedia tools for humanitarian applications. The overall goal was to facilitate physical planning and programme implementation by local authorities, project managers and field personnel working in emergency response, disaster management, risk prevention, peacekeeping, environmental rehabilitation, post-conflict reconstruction and social and economic development. UNOSAT was a service-oriented project spearheaded by the United Nations Institute for Training and Research and implemented by the United Nations Office for Project Services.

31. RESPOND was an alliance of European and international organizations working with the humanitarian community to improve access to maps, satellite

imagery and geographical information. RESPOND worked during all phases of the disaster cycle where geographical information helped deploy humanitarian and development aid, paving the way to a set of sustainable services. It had been set up to identify the space-based information that was regularly used by humanitarian agencies when anticipating or responding to disasters. In addition to base mapping and satellite-derived information, RESPOND was also committed to supporting training, providing support services and infrastructure, forecasting and alert services and thus covered a large part of the disaster management cycle. The services were intended to respond to slow onset disasters such as famine and desertification, as well as to sudden emergencies such as tsunamis, earthquakes and floods.

32. ZKI was a service of DLR. It was responsible for providing both rapid acquisition, processing and analysis of satellite data and satellite-based information products on natural and environmental disasters, for humanitarian relief activities, as well as in the context of civil security. The analyses were tailored to meet the specific requirements of national and international political bodies as well as humanitarian relief organizations.

33. One recent effort that was seeking comprehensive coordination and political commitment to guarantee the wide incorporation and use of space-based technology products and solutions was the proposal for a Global Earth Observation System of Systems (GEOSS). Launched at the first Earth Observation Summit, held in Washington, D.C., in July 2003, the intergovernmental Group on Earth Observations was responsible for developing a 10-year implementation plan for a GEOSS, which entailed the coordination of a wide range of space-, air-, land- and ocean-based environmental monitoring platforms, resources and networks, at present often operating independently. Membership in the Group currently included 63 countries and the European Commission, as well as a significant number of international organizations.

34. The GEOSS 10-year implementation plan recognized disasters as one of the main areas that would benefit from such a coordination effort, contributing to reducing loss of life and property from natural and human-induced disasters. The implementation of GEOSS would bring a more timely dissemination of information through better coordinated systems for monitoring, predicting, risk assessment, early warning, mitigation and response to hazards at the local, national, regional and global levels.

35. GEOSS would build upon existing initiatives such as Global Monitoring for Environment and Security (GMES), a joint initiative of the European Commission and ESA, designed to establish a European capacity for the provision and use of operational information for a global monitoring of the environment and security. The overall aim of GMES was to support Europe's goals regarding sustainable development and global governance, in support of environmental and security policies, by facilitating and fostering the timely provision of quality data, information and knowledge. This was achieved through three components: a partnership of key European actors, a European shared information system and a mechanism for permanent dialogue. By 2008, the foundations and the structuring elements of GMES should be in place and operating.

36. The Integrated Global Observing Strategy (IGOS) was an international partnership, established in June 1998, which brought together a number of

international organizations concerned with the observational component of global environment issues, from a research point of view as well as from an operational perspective. The IGOS GeoHazards Theme was a combined initiative of three IGOS members: UNESCO, the Committee on Earth Observation Satellites and the International Council for Science. The initiative intended to respond to the scientific and operational information needs for the prediction and monitoring of geophysical hazards, namely earthquakes, volcanoes and ground instabilities. The main goal of the initiative was to investigate and develop an integrated observational strategy that would greatly enhance the operational and research capabilities of end user agencies involved in geohazards mitigation at the national, regional and local levels. The GeoHazards Theme report had been concluded in April 2004 and could be downloaded from the ESA website (http://dup.esrin.esa.it/IGOS-Geohazards/home.asp).

37. The World Meteorological Organization, recognizing that it had, through its scientific and technical programmes and its network of regional specialized meteorological centres, world meteorological centres and the national meteorological and hydrological services, the global infrastructure needed to develop and deliver products and services that were critical for the development of international, regional and national natural disaster risk management and response strategies, had established its Natural Disaster Prevention and Mitigation Programme. The aim of the Programme was to develop an organization-wide coordinated framework, to enhance its contributions to risk reduction and disaster management by ensuring that fully integrated products and services were provided at the national, regional and international levels and to guide decisions for the prevention of, preparation for, response to and recovery from the impacts of disasters.

38. The Tampere Convention on the Provision of Telecommunication Resources for Disaster Mitigation and Relief Operations, adopted by the International Conference on Emergency Telecommunications (ICET-98), hosted by the Government of Finland in Tampere, Finland, in June 1998, was a legally binding international instrument aimed at helping relief workers bring telecommunication equipment across borders during and after an emergency, with minimum difficulty, and then use the equipment with safety and security during the crisis. The Convention also recognized the sovereign interests of States parties and the need to provide protection to host Governments from political and other potential abuse. The Convention was unanimously adopted by the delegations of the 60 States participating in the Intergovernmental Conference and entered into force on 8 January 2005 following ratification by the thirtieth country.

39. Additional examples of organizations providing valuable support for emergency response and humanitarian relief were MapAction (http://www.mapaction.org/index.html) and Global MapAid (http://www.globalmapaid.rdvp.org/). MapAction was an international charity based in the United Kingdom that specialized in the mapping of disaster areas and supplying geographical information for humanitarian aid organizations and other relief agencies. Global MapAid had been formed with the aim of supplying specialist maps to humanitarian decision makers, predominantly in slow onset disasters such as famine, but also when necessary in rapid onset disasters such as floods. Global MapAid supported aid

efforts by assisting in the provision of mapping and corresponding communication systems for humanitarian organizations.

D. Development of knowledge and information-sharing

40. There were several initiatives that were contributing to providing information on potential hazards and existing disasters, such as the ReliefWeb project of the Office for the Coordination of Humanitarian Affairs of the Secretariat. Several other initiatives were contributing to providing a central location with information on any existing data that could be used for monitoring and assessment in disaster management, such as the Pacific Disaster Center's Asia Pacific Natural Hazards Information Network (APNHIN).

41. ReliefWeb was launched in October 1996 as an independent vehicle of information, designed specifically to assist the international humanitarian community in the effective delivery of emergency assistance, providing timely, reliable and relevant information, including maps, as events unfolded. Recognizing how critical the availability of reliable and timely information in time of humanitarian emergencies was, the General Assembly, in its resolution 51/194 of 17 December 1996, endorsed the creation of ReliefWeb and encouraged humanitarian information exchange through ReliefWeb by all Governments, relief agencies and non-governmental organizations. Currently ReliefWeb posted some 150 maps and documents daily from over 2,000 sources from the United Nations system, Governments, non-governmental organizations, academia and the media (see www.reliefweb.int).

42. RANET was another example of an initiative working to make weather, climate and related information more accessible to remote and resource-poor populations in order to aid day-to-day resource decisions and prepare against natural hazards, while using existing space-based technology solutions. The RANET programme was a successful example of how communication satellites could be used to inform individuals in remote locations for whom information might be of tremendous importance. The programme combined innovative technologies with appropriate applications and partnerships at the community level in order to ensure that the networks it created served the entirety of community information needs. Community ownership and partnership was the core principle of the RANET sustainability strategy. The programme currently operated in Africa (see www.ranetproject.net).

43. The Pacific Disaster Center aimed at providing applied information research and analysis support for the development of more effective policies, institutions, programmes and information products for the disaster management and humanitarian assistance communities of Asia and the Pacific. One initiative in particular was APNHIN, which directly supported disaster and resource managers, planners, Governments and non-governmental organizations with a range of applications and information services designed to search for, evaluate and access high-quality geospatial data for natural hazard applications in Asia and the Pacific. APNHIN comprised a community of organizations that created and shared disaster and hazard-related information (see www.pdc.org).

44. The Sentinel Fire Mapping website was an Internet-based mapping tool designed to provide timely fire location data to emergency service managers across Australia that could be accessed using a standard web browser. It was the result of collaboration between the Defence Imagery and Geospatial Organisation, the Land and Water Division of the Commonwealth Scientific and Industrial Research Organisation and Australian Geosciences, which came together to design and build a system that would contribute to helping protect Australians during bush fires. It provided a near-real-time continental-scale view of detectable hotspots, with their detailed location given to an accuracy of about 1.5 kilometres. There was also potential to further develop similar near-real-time application technology products, spinning off other applications for monitoring other events such as flooding, oil spills, coastal calamities and cyclones.

45. Similarly, in response to the global escalation of wildfires, the Global Fire Monitoring Center had been established by the Government of Germany with the aim of providing early warning of fire danger, near-real-time monitoring of fire events; interpretation and synthesis of fire information; and an archive of global fire information, all of which could be accessed through the Internet. The daily to periodically updated national to global products of the Center were generated by a worldwide network of numerous institutions and individuals. Additionally, the Center facilitated links between national and international institutions involved in fire research, development and policy development; supported local, national and international entities to develop long-term strategies or policies for wild land fire management; and provided an emergency hotline and liaison capabilities for providing assistance for rapid assessment and decision support in response to wild land fire emergencies in conjunction with the Office for the Coordination of Humanitarian Affairs of the Secretariat.

46. A recently initiated project aimed at obtaining satellite-based information to support epidemiologists was the EPIDEMIO project of ESA. Within the scope of the project, data obtained from existing satellites would be used as sources to study epidemics, contributing to predicting and helping to combat epidemic outbreaks, as well as joining in the effort to identify the geographical origin of pathogens. The study, which was currently ongoing, would demonstrate and use the potential of Earth observation as a source of environmental information for epidemiology, including information such as urban maps, digital elevation maps, maps of water bodies, vegetation maps, land cover maps, historical maps, land surface temperature maps and a service for monitoring wind-blown Sahelian dust (see www.epidemio.info).

47. A number of countries in Africa periodically experienced food insecurity as a result of adverse climatic conditions. The goal of the Famine Early Warning System Network (FEWS NET) was to strengthen the ability of African countries and regional organizations to manage risk of food insecurity through the provision of timely and analytical early warning and vulnerability information. This initiative was funded by the United States Agency for International Development and collaborated with international, national and regional partners to provide early warning and vulnerability information on emerging or evolving food security issues, information that was obtained from monitoring various data and information, including remotely sensed data and ground-based meteorological, crop and rangeland conditions (see www.fews.net).

48. Similarly, Global Monitoring for Food Security aimed to provide Earth observation-based services and to encourage partnerships in monitoring global food security and related environmental processes, by concerting efforts to bring data and information providers together to guarantee a state-of-the-art operational monitoring and forecasting service on agricultural production and food security issues. In cooperation with existing local early warning units, the service currently concentrated on sub-Saharan Africa, where it had been set up and demonstrated in Senegal (2003 and 2004) and Malawi (2004) (see www.gmfs.info).

49. A further example of an existing initiative that aimed at providing decision makers with information on current drought, fire risk and vegetation conditions based on interpreted NOAA satellite data and climate data was the Umlindi (Zulu for "watchman") system run by the Institute for Soil, Climate and Water of the Agricultural Research Council.

E. Capacity-building and strengthening of institutions

50. Capacity-building and strengthening of institutional arrangements at all levels should be aimed at increasing the capability of organizations and individuals to effectively use geospatial information for disaster preparedness, response and recovery. Institutional strengthening needed to include support to the development of sound and far-reaching disaster management policies and integrated disaster risk management plans that covered the areas of risk assessment, early warning systems, training and public awareness and should also take into consideration the need to strengthen existing community-based organizations.

51. An important example of capacity-building in developing countries was the project to establish regional centres for space science and technology education at existing institutions of research and higher education in each region covered by the regional commissions of the Economic and Social Council, which was being carried out by the United Nations Programme on Space Applications. To date, centres had been established in Dehra Dun, India, in Rabat and in Ile-Ife, Nigeria, and a joint centre had been established in Brazil and Mexico. Each centre was conceived as an institution that should offer the best possible education, research and applications programmes, opportunities and experience to participants in the following four areas: remote sensing and GIS; meteorological satellites and global climate; satellite communications; and space and atmospheric sciences.

52. Similarly, the Regional Centre for Training in Aerospace Surveys in Nigeria and the Regional Centre for Mapping of Resources for Development in Kenya had been contributing to building capacity in Africa in digital mapping, aerospace surveys, resource survey, remote sensing, GIS and natural resource assessment.

53. The project known as the Preparation for Use of MSG (Meteosat Second Generation) in Africa (PUMA) had been initiated by the European Organization for the Exploitation of Meteorological Satellites, together with its African user community, in 1996. The successful launch of the new MSG weather satellite brought significant benefits to the meteorological services of 41 African countries and 4 countries around the Indian Ocean. The PUMA project would strengthen the network of national meteorological services of 45 African countries and four regional centres in Africa with equipment, training and application support to obtain

and use data from the satellite for a multitude of purposes. The idea of bringing at the same time equipment, training, software and linkages with end-users to African meteorological services would enable them to build capacity and responsiveness to user demand, thus contributing to project sustainability.

54. ESRI, a geospatial software company based in the United States, had been contributing to strengthening existing institutional arrangements by delivering free-of-charge GIS software and training to more than 90 countries in the world, thereby providing direct support to the Global Map programme and to the development of global spatial data infrastructure. The Global Map programme was an outreach and spatial infrastructure capacity-building programme of the Government of Japan, which worked with over 100 national mapping agencies or other lead national government institutions to train and firmly establish GIS skills for utilization by Governments for purposes of better governance and in establishing a worldwide seamless GIS data set available on the Web. Building upon that programme, Global Spatial Data Infrastructure was contributing to sharing practices with policymakers and GIS practitioners on the development of spatial data infrastructure. ESRI was also supporting the Global Urban Observatory of the United Nations Human Settlement Programme, which was working to establish geospatial capacity in 1,000 of the poorest cities in the world in order to equip city leaders with tools for better governance, including disaster preparedness and response.

III. Conclusions and recommendations

55. Three discussion sessions were held as part of the International Workshop. During the two initial discussion sessions, three working groups met in parallel to discuss the following themes: “Helping developing countries use space technology for disaster management”; “Coordinating the use of space technology for disaster management”; and “Bringing space technology into Kobe”. The recommendations resulting from the working groups were presented to the plenary for discussion and the final recommendations were combined as “The Munich Vision: a Global Strategy for Improved Risk Reduction and Disaster Management Using Space Technology” (see annex).

56. Participants recognized that space-based technologies such as Earth observation satellites, communication satellites, meteorological satellites and GNSS played an important role in risk reduction and disaster management. Participants formulated a number of conclusions and recommendations with regard to capacity development and knowledge-building; data access, data availability and information extraction; enhancing awareness; and the need for national, regional and global coordination.

57. With regard to capacity development and knowledge-building, participants recognized that it was the responsibility of the space technology community to reach out to understand the specific needs of the user community and to develop end-to-end solutions that would meet its requirements. Furthermore, there was a need for continuous education and training in space science and technology, at the technical, institutional and decision-making levels, and for the development and consolidation of national and regional expertise.

58. The discussion on data access and availability and information extraction concluded that there were limited or no mechanisms in place to make data rapidly available at all levels of decision-making during disaster response and that, when data were available, they were not always in a user-friendly format. Participants recommended the development of standards for information extraction from remotely sensed data and disaster mapping procedures, which in turn would foster better understanding and acceptance of space-based information by civil protection and disaster relief communities.

59. The discussion on the need to enhance awareness led to recognition of the importance of creating awareness among national and international stakeholders that the incorporation of space-based solutions reduced risk and vulnerability and was cost-effective. Furthermore, lessons learned from the application of space-based technologies for the mitigation of hazards should be disseminated to the public, beginning with schoolchildren and including the scientific community and the media. Additionally, institutions within each country that used space technology should take on the responsibility of periodically carrying out activities that contributed to raising awareness, such as promoting World Space Week, which was held annually from 4 to 10 October.

60. Participants discussed the coordination of mechanisms at all levels. At the national level, it was recommended that institutions within a country should be responsible for coming together to define actions to be carried out collectively, with the appropriate space technology institutions taking the lead. At the regional level, interested international, regional and national institutions should come together as a regional task force to advance actions that were relevant to the particular region as a whole.

61. At the global level, participants recognized the importance of and urgent need for the coordination entity being proposed by the Committee on the Peaceful Uses of Outer Space, which should be seen as a comprehensive source for knowledge- and information-sharing (best practices) and also as a platform for fostering alliances.

Notes

[1] *Report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 19-30 July 1999* (United Nations publication, Sales No. E.00.I.3), chap. I, resolution 1.

[2] *Official Records of the General Assembly, Fifty-eighth Session, Supplement No. 20* (A/58/20), para. 75.

Annex

The Munich Vision: a Global Strategy for Improved Risk Reduction and Disaster Management Using Space Technology

1. The United Nations International Workshop on the Use of Space Technology for Disaster Management was organized jointly by the Office for Outer Space Affairs of the Secretariat and the German Aerospace Center (DLR), on behalf of the Government of Germany, and co-organized by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the secretariat of the International Strategy for Disaster Reduction. Co-sponsored by the European Space Agency (ESA) and hosted by DLR, the Workshop was held at the European Patent Office in Munich, Germany, from 18 to 22 October 2004.

2. A total of 170 participants from the following 51 countries attended the Workshop: Afghanistan, Albania, Algeria, Argentina, Austria, Bangladesh, Belgium, Benin, Brazil, Canada, Chile, China, Czech Republic, Ecuador, France, Germany, Greece, Hungary, India, Iran (Islamic Republic of), Italy, Japan, Jordan, Kenya, Lao People's Democratic Republic, Luxembourg, Mauritius, Mexico, Morocco, Mozambique, Netherlands, Nigeria, Norway, Peru, Philippines, Romania, Russian Federation, Saudi Arabia, Senegal, South Africa, Spain, Sudan, Switzerland, Tajikistan, Thailand, Turkey, United Kingdom of Great Britain and Northern Ireland, United States of America, Venezuela (Bolivarian Republic of), Viet Nam and Zimbabwe. The Workshop was also attended by representatives of the United Nations Office for Project Services, the Office for Outer Space Affairs of the Secretariat, the Economic and Social Commission for Asia and the Pacific, the United Nations Development Programme, the Office of the United Nations High Commissioner for Refugees, the United Nations Institute for Training and Research, the secretariat of the International Strategy for Disaster Reduction, UNESCO, the European Organization for the Exploitation of Meteorological Satellites and ESA.

3. Recognizing that space-based technologies (Earth observation satellites, communication satellites, meteorological satellites and global navigation satellite systems) played an important role in risk reduction and disaster management, participants formulated a number of recognitions and recommendations, presented below, which together form a global strategy for improved risk reduction and disaster management using space technology.

I. Developing capacity and building knowledge

4. Participants recognized that the disaster management user community had limited understanding of the potential of space-based technologies for disaster management and therefore recommended that the space technology community reach out to understand their specific needs and develop end-to-end solutions based on space technology that met their requirements. Furthermore, the space technology community often had insufficient understanding about the operational mechanisms of and interactions within the disaster management user community and interdependence among players at the local, provincial and national levels.

5. After identifying all relevant players, interested national institutions should work together in developing and implementing joint cooperative projects involving international, regional and national institutions, which would lead to the sharing of expertise and the development of suitable solutions for the country and the region. Space technologists have the responsibility to reach out and bring together all relevant players to take advantage and build upon available space-based technologies to support disaster management.

6. While recognizing existing institutional capabilities within each region, the participants noted the lack of consolidation of such capacities at the national and regional levels. There was an urgent need to compile such information on existing and planned operational space systems that had the capability to support disaster reduction and management efforts. Participants agreed on the need to compile a list of national capabilities, including a list of recognized institutions in the field of space technologies.

7. Participants further recognized that there was a need to educate people at the technical, institutional and decision-making levels on space capabilities and for continuous development of national and regional expertise. This could be achieved by the provision of long- and short-term training and education programmes at the regional centres for space science and technology education affiliated with the United Nations and also through other academic and thematic centres of excellence worldwide. Such programmes should include in their curriculum specific case studies of relevance to the countries concerned.

8. Efforts were also needed to develop a plan to secure funding from development banks and other funding organizations for disaster management efforts where space technology formed an integral part. National and international stakeholders had to be made aware that space-based solutions were cost-effective and contributed to reducing risk and vulnerability. In the long term this would also contribute to ensuring appropriate incorporation of space-based technology solutions into disaster management activities.

II. Data access, data availability and information extraction

9. Participants recognized that there were limited mechanisms in place to make data rapidly available at all decision-making levels during disaster response and that when data were available they were not always in a user-friendly format. There was a need for consolidation of national spatial databases and specific thematic databases to support disaster management activities. The content and standards of the national datasets should be defined by a collective effort of all stakeholders, taking into account existing international data standards so as to facilitate the sharing of data.

10. Participants recommended that a web portal be set up where users could acquire information on existing data, existing networks of excellence and opportunities for support. The portal should include links to existing initiatives such as the Global Mapping Project (www.iscgm.org), Global Spatial Data Infrastructure (www.gsdi.org) and the United Nations Geographic Information Working Group (www.ungiwg.org).

11. Participants recognized that the generally high cost of remotely sensed data limited its use and that there were limited mechanisms in place to facilitate the sharing of data obtained from satellites. Additionally, every effort should be made to publicize and disseminate free and low-cost data. Furthermore, participants recommended that satellite operators make efforts to reduce the cost of imagery to be used for disaster management activities, especially in developing countries.

12. It was noted that there was a great need to develop standards for information extraction from remotely sensed data and disaster mapping procedures. Such standardization would foster better understanding and acceptance of space-based information by civil protection and disaster relief communities.

III. Enhancing awareness

13. Each country should be encouraged to evaluate the potential impact of the various types of disaster within its borders and to assess the likely benefits from increased use of solutions based on space technologies. A concerted and sustained effort should be made to raise awareness among decision makers of the potentials of space technology, so as to obtain appropriate political support for space-based solutions on a sustained basis.

14. Lessons learned from the application of space-based technologies for the mitigation of hazards should be disseminated to the public and this awareness-raising initiative should begin with schoolchildren and also involve the scientific community and the media. Furthermore, raising awareness was a continuous process and institutions within each country that used space technology should assume responsibility for periodically carrying out activities that contributed to raising awareness, such as promoting World Space Week (held annually from 4 to 10 October) and focusing on the use of space technologies and how such technologies could contribute to sustainable regional development and disaster management.

IV. National, regional and global coordination

15. Participants recognized that all actions should be coordinated at the national, regional and global levels.

16. At the national level, participants recognized that institutions within a country should be responsible for coming together to define actions to be carried out collectively. Each country should assume responsibility for determining data needs, consolidating the data and making them available to the user community. The appropriate space technology institutions should be responsible for strengthening ties with the disaster management community and reaching out to understand its needs. The provision of training to this user community should also be the responsibility of each country. Particular attention should be paid to local communities, involving local leadership and grassroots organizations.

17. Additionally, participants agreed that the channelling of space technology for risk reduction and disaster management activities at the national and regional levels should be carried out through a partnership of interested institutions and United

Nations entities, to be registered in the context of the World Conference on Disaster Reduction, to be held in Kobe-Hyogo, Japan, from 18 to 22 January 2005.

18. At the regional level, interested international, regional and national institutions should come together as a regional task force to advance actions that were relevant to the region as a whole. Institutions in all countries of the region should nominate one or more focal points to participate in the task force.

19. The regional task forces should develop a work plan taking into consideration the recommendations put forward at the regional workshops: development of meta-database/catalogue(s), a database of available experts, institutional capabilities and space technology infrastructure and solutions in the region; development of a training curriculum with case studies; definition of the information needs for disaster management; and compilation of such information.

20. The Office for Outer Space Affairs would provide support to the regional task forces by contributing to maintaining the list of institutional focal points, bringing into the task forces relevant institutions from other regions and linking and synergizing the work of the task forces with other international initiatives such as the coordination entity being proposed by the Committee on the Peaceful Uses of Outer Space, the proposed Global Earth Observation System of Systems, the Global Monitoring for Environment and Security initiative and the Charter on Cooperation to Achieve the Coordinated Use of Space Facilities in the Event of Natural or Technological Disasters. Collectively, the regional task forces would form a global network for space technology and disaster management.

21. At the global level, participants recognized the importance of and urgent need for the coordination entity being proposed by the Committee on the Peaceful Uses of Outer Space, which once implemented would provide for the coordination and the means of optimizing the effectiveness of space-based services for use in disaster management. This coordinating entity would be a one-stop shop for knowledge- and information-sharing (best practices) and also a platform for fostering alliances of international initiatives. Participants also recognized the need for each country to define one national focal point, originating in the user community, who would be the primary link between the proposed coordinating entity and the national institutions.