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Study on the possibility of creating an international entity to provide for coordination and the means of realistically optimizing the effectiveness of space-based services for use in disaster management

Summary

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 livelihoods. From 1994 to 2003 there were more than 300 natural disasters on average each year, impacting more than 100 countries, killing over 50,000 people, affecting nearly 260 million people and causing economic damage totalling $55 billion each year. Those figures do not take into account mega-disasters that have taken place since then, such as the tsunami of December 2004 in the Indian Ocean and Hurricane Katrina of August 2005. The economic cost associated with natural disasters has increased 14-fold since the 1950s. Disasters invariably divert funds from development programmes to emergency relief and recovery. Space-based technologies, such as meteorological and Earth observation satellites, communication satellites and satellite-based positioning technologies offer the potential for improved risk reduction, accurate prediction, early warning and monitoring of the impact of disasters for enhanced relief and rehabilitation operations, use of which would lead to major reductions in loss of life and property.

At its forty-fourth session, the Committee on the Peaceful Uses of Outer Space agreed to establish action teams composed of interested Member States in order to implement the recommendations of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III). One of the action teams focused on studying and recommending the implementation of an integrated operational global system, especially through international cooperation, to manage

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natural disaster mitigation, relief and prevention efforts through Earth observation, communications and other space-related services, making maximum use of existing capabilities and filling gaps in worldwide coverage. The Action Team on Disaster Management was co-chaired by Canada, China and France, with the Office for Outer Space Affairs of the Secretariat providing substantive assistance and secretariat services. The Action Team consisted of 41 Member States and 13 intergovernmental and non-governmental organizations.

The Action Team made a number of recommendations, including the establishment of an international space coordination body for disaster management, provisionally identified as the disaster management international space coordination organization (DMISCO). Its recommendations were included in the report of the Committee on the Peaceful Uses of Outer Space on the five-year review of the implementation of the recommendations of UNISPACE III submitted to the General Assembly at its fifty-ninth session.

Recognizing that potential, in its resolution 59/2 of 20 October 2004, the General Assembly agreed that a study should be conducted on the possibility of creating an international entity to provide for coordination and the means of realistically optimizing the effectiveness of space-based services for use in disaster management and that the study should be prepared by an ad hoc expert group, with experts to be provided by interested Member States and relevant international organizations. The present report outlines the outcome of that study, carried out by a group of experts from 26 Member States and five specialized agencies of the United Nations and non-governmental organizations having permanent observer status with the Committee on the Peaceful Uses of Outer Space. The work of the ad hoc expert group was supported by the Office for Outer Space Affairs.

The experts of the ad hoc expert group, after reviewing the current status of the use of space technology for risk reduction and disaster management, agreed that the establishment of an entity to provide for coordination and the means of realistically optimizing the effectiveness of space-based services for use in disaster management would contribute greatly to helping Member States gain access to and use space-based services to support risk reduction and disaster management activities, contributing to bridging the gap between ongoing and planned programmes and systems and the user community. The ad hoc expert group agreed that the international space coordination body recommended by the Action Team on Disaster Management would constitute such a coordinating entity.

The expert group noted that there existed a number of important space-related initiatives, either ongoing or planned, that could support different phases of disaster management (i.e. risk reduction, prevention, mitigation, early warning, relief and rehabilitation). Those initiatives include the Global Earth Observation System of Systems, 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 Integrated Global Observing Strategy Partnership, the Global Monitoring for Environment and Security and the Natural Disaster Prevention and Mitigation Programme of the World Meteorological Organization. There were also initiatives such as UNOSAT of the United Nations, RESPOND of the Global Monitoring for Environment and Security, Map Action and Global Map Aid being implemented by non-governmental organizations and initiatives by private companies that provided value-added products for disaster management. The ad hoc

expert group concluded that gaps existed in the awareness of the disaster management community of those resources, in knowledge of how to access them and in the capacity to use them.

However, those activities were driven by different mandates, often with a focus on specific disaster phases or types of crisis. Consequently, there was no single, global coordination mechanism to implement an integrated disaster monitoring system that made maximum use of available space technologies and services as called for in "The Space Millennium: Vienna Declaration on Space and Human Development", adopted by UNISPACE III.

Once established, the proposed DMISCO would contribute to harnessing existing opportunities and provide support to a coherent, integrated disaster response and management community. It would promote improved communication throughout and between the disaster management and space communities, enabling a truly multi-hazard, multi-phase approach, and would foster alliances and the transfer of knowledge and information between the respective actors.

The key aspect that the experts emphasized was that proposed DMISCO had to be identified as a platform for fostering alliances of international initiatives and mechanisms (space technology and disaster management). Its functions would include:

(a) Coordination and interaction with the secretariat of the International Strategy for Disaster Reduction to meet the commitments of the Hyogo Framework for Action 2005-2015 as well as with the relevant national authorities, scientific institutions, organizations implementing and/or providing space-based solutions, humanitarian, environmental and civil protection actors and the space community;

(b) Information support through a website including case studies and best practices, information on or provision of archived data for disaster studies and response and on outreach activities;

(c) Operational activities such as the development of risk information at the national level by disaster theme and linking risk assessment to economic development strategies for poverty alleviation and contributing to the implementation of international programmes or initiatives (e.g. the Group on Earth Observations, the International Charter "Space and Major Disasters" and the Integrated Global Observing Strategy).

An in-depth review of the advantages and disadvantages of possible implementation options by the ad hoc expert group demonstrated that in order to expedite the establishment of proposed DMISCO, it should initially be implemented as a United Nations programme under the leadership of the Office for Outer Space Affairs. Its final status would be determined at a later time by its stakeholders.

The experts estimated, based on the initial list of the functions identified, that the establishment of proposed DMISCO would require an approximate yearly budget of $1.3 million, which would cover personnel (a staff of 10), facilities (operation and maintenance) and operational costs. Whether the organization was hosted by a Member State or located within the Office for Outer Space Affairs, the United Nations contribution to it should be utilized to cover the cost of three staff members (two Professional and one General Service).

Contents

I. Background

1. At its forty-fourth session, the Committee on the Peaceful Uses of Outer Space agreed to establish action teams composed of interested Member States in order to implement the recommendations of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) in accordance with the resolution adopted at the Conference, entitled "The Space Millennium: Vienna Declaration on Space and Human Development".[1] One of the action teams established focused on studying and recommending the implementation of an integrated operational global system, especially through international cooperation, to manage natural disaster mitigation, relief and prevention efforts through Earth observation, communications and other space-related services, making maximum use of existing capabilities and filling gaps in worldwide coverage. That team, known as Action Team 7, was co-chaired by Canada, China and France, with the Office for Outer Space Affairs of the Secretariat providing substantive assistance and secretariat services. Action Team 7 comprised 41 Member States and 13 intergovernmental and non-governmental organizations.

2. After a comprehensive process of consultations, surveys and analyses of gaps and needs, the Action Team on Disaster Management submitted its findings and recommendations to the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space (see A/AC.105/C.1/L.273) at its forty-first session. In its report, the Action Team stressed that natural and man-made disasters struck all parts of the world indiscriminately and concluded that to successfully reduce their impact would require coordinated international efforts to manage their effects and supplement the ongoing global approaches. The Action Team concluded that currently there were some initiatives in the area of disaster response that took advantage of space technologies, but few initiatives in the area of disaster prevention and mitigation. A large number of countries had little or no exposure to the benefits of space systems and national points of contact for facilitating access to space-based information and services were lacking. The Action Team made a number of recommendations, including the establishment of an international space coordination body for disaster management, provisionally identified as the disaster management international space coordination organization. Such a body would have the mandate to provide the necessary means to optimize the access to and use of current and future space-based services for disaster management.

3. Those recommendations were included in the report of the Committee on the Peaceful Uses of Outer Space on its five-year review of the implementation of the recommendations of UNISPACE III, which was submitted to the General Assembly at its fifty-ninth session (A/59/174). At that session, the Assembly agreed, in its resolution 59/2 of 20 October 2004, that a study should be conducted on the possibility of creating an international entity to provide for coordination and the means of realistically optimizing the effectiveness of space-based services for use in disaster management and that the study should be prepared by an ad hoc expert group, with experts to be provided by interested Member States and relevant international organizations.

4. At the sixtieth session of the General Assembly, several Member States expressed their support for the work being carried out by the ad hoc expert group,

emphasizing the importance of creating the proposed entity in that it could promote more effectively the application of space technology in disaster reduction and management at the global level, and in developing countries in particular, and their preference of setting up such an entity under the umbrella of the United Nations in order to guarantee universal access.

A. Establishment of the ad hoc expert group

5. The ad hoc expert group was established and met during the forty-second session of the Scientific and Technical Subcommittee in February-March 2005. At that meeting, the ad hoc expert group finalized its draft terms of reference and an outline of its workplan for the preparation of the present study and presented it to the Subcommittee for review and approval. The Subcommittee approved the draft terms of reference and outline of the workplan, as amended.

6. Experts from the following Member States, specialized agencies of the United Nations and non-governmental organizations having permanent observer status with the Committee were nominated as members of the ad hoc expert group and have participated in the preparation of this study: Algeria, Argentina, Austria, Belarus, Canada, China, Colombia, Czech Republic, Finland, France, Germany, Greece, India, Indonesia, Iran (Islamic Republic of), Italy, Japan, Latvia, Morocco, Nigeria, Philippines, Republic of Korea, Romania, Russian Federation, Spain and United States of America; the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the World Meteorological Organization (WMO); and the Committee on Space Research, the International Astronautical Federation and the International Society for Photogrammetry and Remote Sensing. The work of the ad hoc expert group was supported by the Office for Outer Space Affairs.

B. World Conference on Disaster Reduction

7. The World Conference on Disaster Reduction, held in Kobe, Hyogo, Japan, in January 2005 recognized the contribution of space technology to disaster reduction and emphasized the need to incorporate space-based services routinely to support risk reduction. The Conference was the largest gathering ever of the disaster community, totalling 4,000 participants in the plenary activities and the thematic sessions and around 40,000 people in the public segment. A list of commitments is set out in the Hyogo Framework of Action 2005-2015: Building the Resilience of Nations and Communities to Disasters,[2] which will contribute to substantially reducing loss of life and damage to the social, economic and environmental assets of communities and countries. Specifically with regard to space technology, in the final documents the group recognized the contribution of space technology to risk reduction during the last 10 years and recognized the need to promote the use, application and affordability of recent information, communication and space-based technologies and related services, as well as Earth observations, to support disaster risk reduction.

II. Impact of disasters on development

8. 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 livelihoods. Many of these deaths and losses could be prevented if better information were available regarding the onset and course of such disasters. Space-based technologies, such as meteorological and Earth observation satellites, communication satellites and satellite-based positioning technologies offer the potential to contribute to improved prediction and monitoring of potential hazards, which in turn would lead to sharp reductions in losses to life and property. The tsunami that swept through the Indian Ocean region in late 2004 demonstrated that space-based technologies are increasingly being made available to be used for early warning and emergency response. It also demonstrated that developing countries still do not have wide access to such solutions, not only during the disaster response phase, but also during the more important preparedness phase of the disaster cycle, which invariably results in unnecessary loss of life and property when disaster strikes.

9. From 1994 to 2003 there were more than 300 natural disasters on average each year, impacting more than 100 countries, killing over 50,000 people, affecting nearly 260 million people and causing economic damage totalling $55 billion each year. In 2004, the Indian Ocean tsunami caused a jump in the statistics, contributing to bringing up the total of people killed in 2004 to 241,400 and the staggering total of economic damage to $103 billion. The economic cost associated with natural disasters has increased 14-fold since the 1950s. The total number of countries affected by a natural disaster in 2004 was 123, higher than the previous 10-year average. Disasters invariably divert funds from development programmes to emergency relief and recovery, and the Indian Ocean tsunami highlighted once again the need for integration of disaster planning in development programmes, including the building of local capacities for disaster preparedness and response.

III. Current uses of space-based services to support risk reduction and disaster management activities

10. Earth observation satellites have demonstrated their utility in providing data for a wide range of applications in disaster management. Pre-disaster uses include 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 disasters. Remotely sensed data also provide a historical database from which hazard maps can be compiled, indicating which areas are potentially vulnerable. Information from satellites is often combined with other relevant data in geographical information systems (GIS) in order to carry out risk analysis and assessment. GIS can be used to model various hazard and risk scenarios for planning the future development of an area.

11. Meteorological satellites can monitor weather patterns, detect and track storms and monitor frosts and floods. Derived products are produced routinely several times per day, many of them focused on particular hazard events. Tracking sequences of tropical cyclone images from geostationary satellites as well as storm intensities and atmospheric winds derived from these images provide 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, has improved such forecasts.

12. Global navigation satellite systems (GNSS), such as the Global Positioning System (GPS) of the United States and the Global Navigation Satellite System (GLONASS) of the Russian Federation, provide accurate position, velocity and time information that is readily accessible at ground level to anyone with a receiver. The reduction in size and cost of receivers is contributing to widening the number of users that are now using such technological solutions to collect data to support risk reduction and emergency response activities.

13. Restoring communication in disaster stricken areas is usually the main priority when responding to an emergency. Additionally, there is 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 are geo-stationary satellites that enable the setting up of emergency communication channels and are being used increasingly by all those responding to an emergency. The Tampere Convention on the Provision of Telecommunication Resources for Disaster Mitigation and Relief Operations, which entered into force on 8 January 2005 following ratification by the thirtieth country, will contribute to the greater availability of telecommunication equipment for disaster mitigation and relief. The Tampere Convention is a legally binding international instrument aimed at helping relief workers bring telecommunication equipment across borders during and after an emergency with a minimum of difficulty.

Specific findings of the Action Team on Disaster Management

14. The study carried out by the Action Team on Disaster Management aimed at understanding the current existing constraints to maximizing the use of space-based technologies in the various phases of the disaster management cycle, mitigation, relief, prevention and reconstruction, leading to the following specific findings:

(a) Disasters such as floods, earthquakes, forest fires, oil spills, drought and volcanic eruptions affect large parts of the globe and coordinated international efforts are required to minimize their impacts. Disaster relief requires timely and updated geo-social databases and situational analysis for the various phases of the disaster;

(b) Space technology such as remote sensing and meteorological satellites as well as communications and navigation and positioning systems can play a vital role in supporting disaster management by providing accurate and timely information and communication support;

(c) The utilization of space assets in support of disaster management continues to lag significantly in most parts of the globe and remains a major challenge; however, there are several international efforts aimed at addressing the developmental needs and achieving effective utilization of space technology;

(d) A considerable gap, however, exists and is likely to remain in all areas of space technology applications to disaster management, including technical, operational, education/training and organizational areas, unless a global, integrated and coordinated approach is taken. In virtually all countries, there is a lack of understanding of the benefits of the use of space technologies in supporting risk reduction and disaster management activities, especially by disaster managers and civil protection agencies.

IV. Relevant operational and planned programmes and systems

15. The study of the ad hoc expert group identified several international initiatives that were contributing in a significant way to increasing the use of space-based technologies in support of disaster management activities. Those initiatives were either specific to a particular phase of the disaster cycle, specific to a type of disaster or specific to a geographical region.

16. An example of an initiative specific to a particular phase of the disaster cycle is the Charter on Cooperation to Achieve the Coordinated Use of Space Facilities in the Event of Natural or Technological Disasters (the International Charter "Space and Major Disasters"). At UNISPACE III, a proposal to create a charter that would provide a unified system of space data acquisition and delivery to those affected by natural or man-made disasters through authorized users was put forward by the European Space Agency (ESA) and the Centre national d'études spatiales (CNES) of France, who signed the Charter in June 2000, with the Canadian Space Agency signing the Charter shortly after. Additional members that have since joined are the United States (National Oceanic and Atmospheric Administration and United States Geological Survey), India (Indian Space Research Organization (ISRO)), Argentina (National Commission for Space Activities of Argentina (CONAE)) and Japan (Japan Aerospace Exploration Agency), and more recently the Disaster Monitoring Constellation (DMC). Each member agency of the Charter has committed resources to support the initiative, which is contributing to mitigating the effects of disasters on human life and property in countries around the world.

17. Until December 2005, the Charter had been activated over 90 times in response to landslides, oil spills, floods, a tsunami, volcanic eruptions, forest and bush fires, earthquakes, storms and hurricanes, including for the Indian Ocean tsunami, the recent earthquake in India and Pakistan and Hurricane Katrina in the United States. Specifically during the Indian Ocean tsunami, the Charter was activated a total of three times: firstly by India (through ISRO) for its own territory and by the French Civil Protection Agency for Sri Lanka and then by the Office for Outer Space Affairs for Indonesia and Thailand. Nearly 200 maps, using the satellite imagery provided, were produced within the first weeks and made available to emergency relief teams responding to the disaster.

18. The activation of the Charter by the United Nations a total of 22 times has been made possible because the Office for Outer Space Affairs was accepted as a

Cooperating Body to the Charter in March 2003, a mechanism through which the United Nations system can request imagery from Charter members by faxing in requests for imagery to support emergency disaster response situations. Since the United Nations joined the Charter, nearly 80 per cent of the activations have been in response to disasters in developing countries and nearly 50 per cent have been initiated by the United Nations, clearly demonstrating the important role of the Organization in helping developing countries have access to ongoing international initiatives.

19. The Charter has made Earth observation data available to emergency relief teams, but an analysis of the impact of the data provided has shown the need for a full range of end-to-end services, including data processing and interpretation and not only satellite imagery. Several initiatives are filling that gap, such as the United Nations Organization Satellite (UNOSAT), RESPOND and the facility for the Center for Satellite Based Crisis Information (ZKI) of the German Aerospace Center (DLR).

20. UNOSAT is a United Nations operational programme 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 of UNOSAT in the area of disaster management is to facilitate physical planning and programme implementation by local authorities, project managers and field personnel working in emergency response and risk prevention. UNOSAT is a service-oriented project that has since 2002 provided Earth observation and GIS services to the humanitarian community. It is spearheaded by the United Nations Institute for Training and Research and implemented by the United Nations Office for Project Services.

21. RESPOND is an alliance of European and international organizations working with the humanitarian community to improve access to maps, satellite imagery and geographical information. RESPOND works during all phases of the disaster cycle where geographical information helps deploy humanitarian and development aid, paving the way for a set of sustainable services. It has been set up to identify the space-based information that is regularly used by humanitarian agencies when anticipating or responding to disasters. In addition to base mapping and satellite-derived information, RESPOND is also committed to supporting training, providing support services and infrastructure, forecasting and alert services, thus covering a large part of the disaster management cycle. The services are intended to respond to slow-onset disasters such as famine and desertification, as well as to sudden emergencies such as tsunamis, earthquakes and floods.

22. ZKI is a service of the German Remote Sensing Data Center (DFD) of DLR. It is responsible for providing rapid acquisition, processing and analysis of satellite data and the provision of satellite-based information products on natural and environmental disasters, for humanitarian relief activities, as well as in the context of civil security. The analyses are tailored to meet the specific requirements of national and international political bodies as well as those of humanitarian relief organizations.

A. Other international initiatives

23. The Integrated Global Observing Strategy Partnership (IGOS-P) is an international partnership, established in June 1998, which brings together a number of international organizations concerned with the observational component of global environmental issues, from a research point of view as well as from an operational perspective. The IGOS GeoHazards Theme is a combined initiative of three IGOS members, UNESCO, the Committee on Earth Observation Satellites (CEOS) and the International Council for Science. It intends to respond to the scientific and operational information needs related to the prediction and monitoring of geophysical hazards, namely earthquakes, volcanoes and ground instabilities. The main goal of the initiative is to investigate and develop an integrated observational strategy that would greatly enhance the operational and research capabilities of end-user agencies involved in mitigation of geohazards at the local, national and regional levels.

24. One recent effort that is seeking comprehensive coordination and political commitment to guarantee the wide incorporation and use of space-based technology products and solutions is the 10-year implementation plan for a Global Earth Observation System of Systems (GEOSS) put forward by the intergovernmental Group on Earth Observations (GEO). The plan summarizes the steps that should be taken over the next decade by a growing community of nations and intergovernmental, international and regional organizations to put GEOSS in place. GEOSS will contribute to the establishment of the capacity to continuously monitor the state of the Earth, increased understanding of dynamic Earth processes, enhanced prediction of the Earth system and further implementation of international environmental treaty obligations. The plan includes consideration of the need for coordination of a wide range of space-, air-, land- and ocean-based environmental monitoring platforms, resources and networks—at present often operating independently.

25. The 10-year implementation plan recognizes 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 will bring a more timely dissemination of information through better coordinated systems for hazard monitoring, prediction, risk assessment, early warning, mitigation and response at the local, national, regional and global levels.

26. Similarly, the Global Monitoring for Environment and Security (GMES) is a joint initiative of the European Commission and ESA, designed to establish a European capacity for the provision and use of operational information for global monitoring of the environment and security. The overall aim of GMES is 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 high-quality data, information and knowledge, by means of 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 the European capacity for GMES should be in place and operating.

27. WMO, recognizing that it has the global infrastructure needed to develop and deliver products and services that are critical for the development of international, regional and national natural disaster risk management and response strategies, recently established its Natural Disaster Prevention and Mitigation Programme. The infrastructure of WMO to support such an initiative comes from its scientific and technical programmes and its network of regional specialized meteorological centres, world meteorological centres and the national meteorological and hydrological services. The Programme will contribute to the development of an organization-wide coordinated framework, which will enhance the contribution of WMO to risk reduction and disaster management, ensuring that fully integrated products and services are provided at the national, regional and international levels to guide decisions for the prevention of, preparation for, response to and recovery from the impacts of disasters.

28. The ad hoc expert group also identified examples of non-governmental organizations that provided valuable support for international emergency response and humanitarian relief such as MapAction and Global Map Aid. MapAction is an international charity based in the United Kingdom of Great Britain and Northern Ireland that specializes in the mapping of disaster areas using satellite images and supplying those maps to humanitarian aid organizations and other relief agencies. Global MapAid was formed with the aim of supplying specialist maps to humanitarian relief decision makers, predominantly for slow-onset disasters such as famine, but also when necessary for rapid-onset disasters such as floods.

29. Similarly, the private sector also contributes significantly, providing valuable support to emergency response. During the Indian Ocean tsunami disaster, several companies operating commercial high-resolution satellites made imagery available to interested organizations. A coordinating entity such as the proposed disaster management international space coordination organization (DMISCO) would contribute to bringing together such private companies and the disaster response teams that could benefit from their contribution.

B. Building space-based systems specifically to support disaster management

30. To date, disaster management activities have been taking advantage of existing technologies and assets that are already in space in order to support multiple types of user and multiple types of application. However, specific space missions are now being designed and launched to support disaster-type users and activities.

31. DLR has tested an experimental sensor, the Bi-spectral InfraRed Detection (BIRD), which is useful for monitoring fires and land surface. Since October 2001, BIRD has been conducting worldwide thermal anomaly observations providing high-resolution/sub-pixel data products of selected wild land fires and volcanic activity, and its data collection includes various worldwide high-temperature events archived at DLR. The experience gained with this sensor will guide the development of future systems to be developed by ESA.

32. DMC is the first Earth observation constellation, which, once fully implemented, will consist of five to seven low-cost small satellites providing daily images for applications including global disaster monitoring. It is being

implemented through the cooperation of an international consortium in which each partner runs an independent small satellite mission that services national needs and also makes the imagery available to the global community. By sharing space and ground assets, the members of the DMC consortium offer the unique benefit of access to a seamless global monitoring service. Currently, the following countries have already launched a satellite as part of DMC: Algeria, China, Nigeria, Turkey and United Kingdom.

33. There are other constellations of satellites being planned, such as the ORFEO programme with two high-resolution PLEIADES optical systems implemented by CNES, combined with four Constellation of Small Satellites for Mediterranean Basin Observation (COSMO-SkyMed) implemented by the Italian Space Agency (ASI). Each of the four COSMO-SkyMed satellites will be equipped with a synthetic aperture radar (SAR) instrument, capable of operating in all weather conditions at high resolution and of providing information in real time for the management of floods, droughts, landslides, volcanic/seismic events, forest fires, industrial hazards and water pollution.

C. Initiatives that contribute to capacity-building

34. Capacity-building and strengthening of institutional arrangements at all levels is key to increasing the ability of organizations and individuals to effectively use space-based services for disaster preparedness, response and recovery.

35. An important example of capacity-building in developing countries is the programme to establish regional centres for space science and technology education at existing research and higher education institutions in each region covered by the United Nations regional economic commissions, being carried out by the Office for Outer Space Affairs within the framework of the United Nations Programme on Space Applications. Each centre offers high-quality education, research and applications programmes, opportunities and hands-on experience to the participants in the following four areas: remote sensing and GIS; satellite meteorology and global climate; satellite communications; and space and atmospheric sciences.

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

37. The Preparation for Use of Meteosat Second Generation in Africa (PUMA) project was initiated by the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), together with its African user community in 1996. The successful launch of the new Meteosat Second Generation (MSG) weather satellite brings significant benefits to the meteorological services of 41 African countries and 4 countries bordering the Indian Ocean. The PUMA project has contributed to strengthening the network of national meteorological services of African countries and four regional centres with equipment, training and application support to obtain and use data from the satellite for a multitude of purposes. Furthermore, EUMETSAT has initiated the African Monitoring of the Environment for Sustainable Development, which builds upon the PUMA project, aimed at

developing new applications using satellite technologies and other ancillary data in Africa in support of sustainable development.

V. Identified actions that would support the further use of space technology for risk reduction and disaster management

38. The ad hoc expert group noted that there existed a significant number of ongoing or planned, space-related initiatives that can support different phases of disaster management (i.e. risk reduction, prevention, mitigation, early warning, relief and rehabilitation). Those initiatives include GEO, the International Charter "Space and Major Disasters", IGOS-P, GMES and the WMO Disaster Prevention and Mitigation Programme. There are also initiatives such as UNOSAT, RESPOND, MapAction and Global Map Aid implemented by non-governmental organizations and private companies that provide value-added products for disaster management. The ad hoc expert group concluded that gaps existed in the awareness of the disaster management community of those resources, in knowledge of how to access them and in the capacity to use them.

39. The study conducted by the Action Team on Disaster Management highlighted the gaps and constraints in the current system, most of which could be addressed effectively through the application of space technology. The disaster management community, consisting of civil protection agencies, governmental and non-governmental organizations and scientific organizations, has diverse requirements for information with appropriate temporal and spatial scales, that is, information should be delivered when needed and with the appropriate detail to be useful. It is essential to map out those requirements and to adopt a unified approach and a unified, coherent voice to meet them in a reliable and timely manner. A coordinated and global approach using space assets needs to be developed to address the gaps identified. The gap that exists between the user communities and the space application providers needs to be bridged in order to ensure effective delivery of services in a usable format. Additionally, the large volume of information available from space systems in terms of archived data is currently not organized and is thus difficult to access. Finally, the lack of awareness among the disaster management community of the potentials of space systems to provide vital contributions in areas such as risk assessment, hazard zonation, damage assessment and emergency communications is a further constraint.

40. It is clear that there are many international mechanisms already in place to address specific aspects of the disaster cycle, coupled with activities to better coordinate space assets at the global level, with a high degree of broadly convergent political and institutional support for further action. At the same time, because of technical developments, more satellites and derived services will be increasingly available to provide information and products to users working in disaster management. However, such activities are driven by different mandates, often with a focus on specific disaster phases or types of crisis. Consequently, there is no single, global coordination mechanism to implement an integrated disaster monitoring system that makes maximum use of available space technologies and services as called for in the Vienna Declaration. To establish such a system would

require the commitment of significant resources in the near and long term. It would also require the willing collaboration and partnership of many varied agencies. Fortunately, large parts of such a potential partnership already exist, underpinned by growing technical and institutional capability, but not in any formally coordinated fashion. Integrating those activities presents a major challenge.

A. Recommendations of the Action Team on Disaster Management

41. In order to implement a global integrated disaster management system, the Action Team made the following three recommendations in its final report:

(a) *Recommendation 1*. An international space coordination body for disaster management, provisionally identified as DMISCO, should be established. Such a body would have the mandate to provide the necessary means to optimize the efficiency of services for disaster management. It would ensure affordable, comprehensive and universal space-based delivery by fully utilizing existing and planned space and ground assets and infrastructures, and with the full participation of organizations and mechanisms currently in place. The proposed body would act as a focal point for global space efforts in support of disaster management;

(b) *Recommendation 2*. A fund should be established as a sustainable resource used for applying space technologies in support of disaster management and for capacity-building. The primary contributors to the fund should be development and relief organizations and those who would be the main beneficiaries of disaster reduction;

(c) *Recommendation 3*. Member States should be encouraged to allocate a portion of their disaster management resources/funds to using space technologies and to identify points of contact (national focal points) in order to focus their internal disaster management activities and to liaise with external efforts.

B. The Munich Vision

42. At the same time the Action Team on Disaster Management was carrying out its work, the Office for Outer Space Affairs was organizing a series of regional workshops on the use of space technology for disaster management between 2000 and 2004, bringing the results of the regional workshops to a final international workshop, which was held in Munich, Germany, in October 2004. At that meeting, a total of 170 participants from 51 States discussed a global strategy that would contribute to helping developing countries gain access to and be able to use space technology for disaster management, a strategy put forward as the Munich Vision: a Global Strategy for Improved Risk Reduction and Disaster Management Using Space Technology (A/AC.105/837, annex). 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, and put forward a number of recognitions and recommendations in the areas of capacity development and knowledge-building; data access, data availability and information extraction; enhancing awareness; and national, regional and global coordination. At the global level, participants recognized the importance of and urgent need for the coordination entity being

proposed by the Action Team, which was envisioned by the workshop participants as a "one-stop shop" for knowledge- and information-sharing (best practices) and also as a platform for fostering alliances.

VI. Key functions and potential benefits of the proposed coordinating entity

43. After reviewing the work of the Action Team, the ad hoc expert group agreed that the establishment of an entity to provide for coordination and the means of realistically optimizing the effectiveness of space-based services for use in disaster management would greatly contribute to helping Member States gain access to and use space-based services to support risk reduction and disaster management activities, contributing to bridging the gap between ongoing and planned programmes and systems and the user community. The expert group agreed that the international space coordination body recommended by the Action Team, the proposed DMISCO, would provide such a coordinating mechanism.

44. The proposed coordinating entity would contribute to harnessing existing opportunities and provide support to a coherent, integrated disaster response and management community. It would promote improved communication throughout and between the disaster management and space communities, making possible a truly multi-hazard, multi-phase approach, and would foster alliances and the transfer of knowledge and information between the respective actors, in particular from developed to developing countries. The experts considered it important to build on the disaster-related activities and outputs of key international efforts, including GMES, the International Charter "Space and Major Disasters", GEO, IGOS, the work of CEOS, the International Strategy for Disaster Reduction and the United Nations system as a whole, to generate the global cooperation required. Funding would also be more likely to become available if the programme envisaged was not too onerous or demanding on existing national or agency budgets.

A. Focus of the proposed coordinating entity

45. Based on the identified gaps and the possible benefits, the ad hoc expert group identified the following main aspects that were taken into consideration when defining the shape of the coordinating entity being proposed: (a) the proposed DMISCO should be seen as a "one-stop shop" for information and as a platform for fostering alliances; (b) it should be user-driven, that is, the disaster community should be centrally involved and the work should be carried out to the benefit of the user community; (c) the proposed entity should contribute to bridging the gap between the disaster management and space communities, creating a forum where both can meet; (d) it should make optimal use of the existing resources of space agencies; (e) it should focus on existing gaps that are limiting the use of space technology in risk reduction and disaster management; (f) its implementation should be incremental and not phased, that is, the entity should be able to fulfil its responsibilities from the beginning; (g) it should have informational, coordination and operational functions; and (h) it should fit in with existing global initiatives,

identifying synergies and building upon common opportunities, and should also contribute to the coordination of such initiatives.

46. The key aspect that the experts emphasized was that the proposed DMISCO had to be identified as a platform for fostering alliances of international initiatives and mechanisms (space technology and disaster management). The initial emphasis of its activities and services should lie in coordination and interaction with relevant national authorities, scientific institutions, organizations implementing and/or providing space-based solutions, humanitarian, environmental and civil protection actors and the space community. The experts also further defined the key informational, coordination and operational functions of the proposed entity.

47. Informational functions to be carried out by the proposed DMISCO should include: (a) a web-based information service covering all activities and initiatives relevant to the space technology and disaster management community, including information on case studies and best practices; (b) information on access to existing archive data for risk reduction and disaster management activities and maintaining an archive with data that could be immediately available; (c) public awareness; and (d) outreach activities.

48. Coordination functions should include: (a) contribution to bringing together entities of the United Nations system, international and regional agencies and national-level institutions, aimed at bridging the gap between the end user and space communities; (b) contribution to bringing together and harmonizing existing and future initiatives (such as the International Charter "Space and Major Disasters", RESPOND, the proposed GMES service centres and GEO); (c) establishment of and work with communities of practice (Internet-based forums); (d) contribution to the refinement of user requirements and best practices (customization) and building cumulative experience; (e) negotiation of data policies on behalf of users (acquisition, use, pricing and archiving); (f) facilitation of capacity-building, including definition of suggested curriculum; and (g) contribution, at the request of the relevant national institutions, to the definition of disaster management planning and policies with regard to the use of space-based technologies.

49. Operational functions should include: (a) contribution to the implementation of risk reduction and emergency response activities and projects identified in conjunction with national focal points; (b) development of risk information at the national level by disaster theme; (c) linking risk assessment to economic development strategies for poverty alleviation; (d) development of regional/subregional assessments of vulnerability; and (e) contribution to the implementation of international programmes or initiatives.

50. The entry point to the proposed DMISCO to provide operational support would be a request from a national focal point. The responsibility of the proposed entity would be: (a) to help define the activity/project in conjunction with the NFP, to identify possible partners and to help identify sources of funding. The entity would implement the project primarily through external partners; and (b) to contribute to the implementation of mandates of international initiatives, such as the International Charter "Space and Major Disasters" and GEOSS, specifically in the area of risk reduction and disaster mitigation.

B. Possible benefits from the proposed coordinating entity

51. The overall benefit from the proposed DMISCO would be building up the abilities of Member States in the use of space-based services to support the management of disaster events in an effective manner, besides providing a coordinating agency for sharing experience and initiating collaborative efforts. The benefits that can accrue from such a coordinated programme developed around the capabilities of space technology are manifold. One of the unique advantages is that it permits a multi-hazard approach to tackle disasters in terms of hazard zonation, risk assessment, monitoring and appropriate relief planning. Space data has proved its potential to provide vital information inputs to all phases of the disaster cycle, covering preparedness, mitigation, response and reconstruction.

52. The proposed entity could also help achieve universal access to space data, spreading the benefits across the globe and supporting the development of standards for delivery of space-based data and services. One of the key benefits expected from the implementation of the entity is the bridging of gaps between the space service providers and the disaster management community, through appropriate capacity- and awareness-building measures.

53. On the basis of the constraints identified by the members of the Action Team on Disaster Management, the ad hoc expert group agreed that DMISCO would contribute significantly to the areas listed below.

C. Capacity development and knowledge-building

54. As the disaster management user community has limited understanding of the potential of space-based technologies for disaster management, DMISCO would work closely with the space technology community in helping it reach out to understand its specific needs and to develop end-to-end solutions based on space technology and meeting the requirements of the user community. Furthermore, it would help the space technology community gain an understanding of the operational mechanisms, the interactions within the community and the interdependence among players at the local, provincial and national levels.

55. DMISCO would work closely with both the disaster management user community and the space technology community, helping identify all relevant players, which in turn would help interested national institutions work together in developing and implementing joint cooperative projects involving international, regional and national institutions. That in turn would lead to the sharing of expertise and the development of suitable solutions for the country and the region. Space technologists should have the responsibility of reaching out and bringing together all relevant players to take advantage of and build upon available space-based technologies to support disaster management, and DMISCO would provide support to the space technology community in that endeavour.

56. Although there are institutional capabilities within each region, there is a lack of consolidation of such capacity at the national and regional levels. There is also an urgent need to compile such information on existing and planned operational space systems that can support disaster reduction and management efforts. DMISCO would work together with each national focal point to compile a list of national

capabilities, including a list of recognized institutions in the field of space technologies.

57. There is a continuous need to educate people at the technical, institutional and decision-making levels on space capabilities and the need for continuous development of national and regional expertise. The proposed DMISCO would provide support to the carrying out of long- and short-term training and education programmes at the regional centres for space science and technology education affiliated to the United Nations, and also through other academic and thematic centres of excellence worldwide. Such programmes should include in the training curriculum-specific case studies of relevance to the respective countries.

D. Data access, data availability and information extraction

58. Since there are limited mechanisms in place to make data rapidly available at all decision levels during disaster response (even when data is available it is not always in a user-friendly format), the proposed entity would contribute to the consolidation of national spatial databases and specific thematic databases to support disaster management activities, including by contributing to the definition of the content and standards of such regional and national data sets, taking into account existing international data standards so as to facilitate the sharing of data.

59. The experts recommended that a web portal be set up, where users can acquire information on existing data, existing networks of excellence and opportunities for support. Such a web portal would be developed based on the conceptual design put forward by the subgroup on the Earth observation data website of the ad hoc expert group.

60. The proposed DMISCO should also be concerned with the general high cost of remotely sensed data, which is limiting its use, especially in developing countries, and also with the fact that there are limited mechanisms in place to facilitate the sharing of data obtained from satellites. Additionally, every effort should be made by the entity to publicize and disseminate free and low-cost data. Furthermore, the experts recommended that the entity work closely with satellite operators to reduce the cost of imagery to be used for disaster management activities, especially in developing countries.

61. The proposed body would work together with interested institutions in the development of standards for information extraction from remotely sensed data and disaster mapping procedures. Such standardization will foster better understanding and acceptance of space-based information by civil protection and disaster relief communities.

E. Enhancing awareness

62. Each country should be encouraged to evaluate the potential impact of the various types of disaster within its borders and assess the likely benefits to be gained from increased use of solutions based on space technologies. A concerted and sustained effort should be made to create awareness among decision makers on

the potentials of space technology so as to obtain appropriate political support for space-based solutions on a sustained basis.

63. The proposed DMISCO should ensure that lessons learned from the application of space-based technologies for the mitigation of hazards are disseminated to the public and that any awareness-raising initiative begins with school children and also involves the scientific community and the media. Furthermore, raising awareness is a continuous process and the entity should work with institutions within each country that use space technology to ensure that they take on responsibility for periodic activities that contribute to raising awareness such as promoting World Space Week (held from 4 to 10 October annually), focusing on the use of space technologies and how such technologies could contribute to sustainable regional development and disaster management.

F. Potential beneficiaries

64. The direct beneficiaries from such a coordination effort will be primarily the disaster management community, in particular those responsible for either responding to an event or for mitigating the effect of predictable disasters, space technology institutions interested in providing support to the disaster management community, non-governmental organizations involved in providing support and all academic and scientific institutions involved in monitoring events, providing capacity-building and carrying out research in best practices in the use of space technology for disaster management. Space-based information with its spatial contents is also useful at the community level to empower the community for better preparedness.

65. Additional beneficiaries will be private space technology companies interested in providing support or in understanding which products they produce are needed to support disaster events, and insurance companies interested in supporting best practices to reduce community and personal risks.

66. Ultimately it will be the population at large that will benefit from the coordination effort and all contributions invested in the proposed entity will contribute to the saving of lives and property.

VII. Organizational scope and nature of the proposed coordinating entity and its relationship with existing and planned international organizations and initiatives

67. The ad hoc expert group concluded that a coordination entity such as that proposed above could be established either as a programme within the United Nations system, included as a mandate, or as an inter-governmental organization outside the United Nations, but linked to the work of a specific United Nations entity. Furthermore, the proposed DMISCO could be either located physically within the premises of the United Nations, such as at the Office for Outer Space Affairs in Vienna, or hosted by a Member State.

68. An in-depth review of the advantages and disadvantages of each of the options by the ad hoc expert group demonstrated that, in order to expedite the establishment

of the proposed entity, it should initially be implemented as a United Nations programme under the leadership of the Office for Outer Space Affairs, either located in Vienna or hosted by a Member State that offers to provide facilities and partial operational support. Its final status would be determined at a later time by its stakeholders.

69. The coordinating entity should carry out its work for the benefit of all Member States of the United Nations, working closely with the designated national focal points and also with relevant intergovernmental, international and regional organizations.

70. To carry out the functions outlined above, the experts concluded that the proposed coordinating entity should have a staff of 10, which should include a coordinator, an assistant coordinator, two space applications experts, one external relations officer, one disaster management expert, one information management expert and three administrative support staff.

71. In order to be available on a round-the-clock basis, the proposed DMISCO would implement a call centre (with telephone, fax and Internet communication options), which could be contacted by the national focal points and those interested in learning how to access and use space-based services for disaster management. All the Professional staff would carry out the on-duty operator functions of the call centre on a rotating basis. The call centre would guarantee the ability of the entity to fulfil its role as the first entry point for institutions that need support in accessing and/or using space-based services for risk reduction and disaster management activities.

72. To provide support to the activities of the proposed DMISCO, the experts recommended the creation of an advisory board and a support forum.

A. Advisory board

73. The advisory board would be responsible for working closely with the coordinator, reviewing the proposed plan of work for each biennium, assessing if the necessary resources were in place and providing recommendations to the coordinator on the various aspects of the work to be carried out.

74. The advisory board would consist of experts nominated by Member States, specialized agencies of the United Nations and intergovernmental and non-governmental organizations having permanent observer status with the Committee on the Peaceful Uses of Outer Space. It would meet annually to prepare an evaluation of the work carried out by the entity, an assessment of the work for each biennium and recommendations on future steps, and would submit its report to the Committee.

B. Support forum

75. The support forum would bring together representatives of private satellite operators, relevant international and regional initiatives (such as GEO, the International Charter, the Asian Disaster Reduction Centre, Intelsat and Inmarsat), aiming at providing expert advice to the work carried out by the entity and also

enabling the coordination of activities of the various initiatives, thus contributing to avoiding the duplication of work.

76. The advisory board would submit annually to the Committee on the Peaceful Uses of Outer Space suggestions of institutions to be invited to take part in the support forum.

C. Reporting to the Committee on the Peaceful Uses of Outer Space

77. The coordinator would be responsible for submitting to the Committee on the Peaceful Uses of Outer Space an annual report on the activities of the coordinating entity as well as the workplan for each biennium.

D. Relationship of the proposed coordination entity with existing and planned international organizations and initiatives

78. The proposed DMISCO should be seen as the first step in obtaining information on how to access and use space-based services for risk reduction and disaster management. Information will also include relevant international, regional and even national initiatives. Furthermore, it would take on a coordination role, as needed, bringing such relevant initiatives together, ensuring that identified gaps are taken over by interested institutions and contributing, through sharing of information, to ensuring that identified bottlenecks are dealt with and that duplication of efforts is avoided.

79. The proposed DMISCO would work closely with national focal points in the identification of viable activities to carry out, contributing to defining the scope of each activity and resources needed, also helping identify possible partnerships and sources of funding. It would act as a facilitator of activities, only becoming responsible for the joint implementation of the activity with the respective national focal point if no partner is identified from among existing international and regional initiatives and opportunities.

80. In accordance with recommendation 2 of the Action Team on Disaster Management, a fund would be established to be available as a sustainable resource to support the implementation of the activities identified jointly by the national focal points and the proposed DMISCO.

81. Specifically, with regard to major international initiatives such as the International Charter and GEO, the proposed DMISCO should contribute directly to the implementation of their proposed mandates. With regard to the International Charter, it would take on the role of cooperating body currently carried out by the Office for Outer Space Affairs and would continue to promote access to and use of the Charter in developing countries.

82. With regard to GEO, the proposed DMISCO would contribute to the 10-year plan of GEOSS by helping facilitate more timely dissemination of available data and information through better coordinated systems for hazard monitoring, prediction, risk assessment, early warning, mitigation and response at the local, national, regional and global levels. Having a coordinating entity in place such as the proposed entity working closely with GEO, would guarantee that the

information to be disseminated indeed reached the correct end user and was used in the most effective way, while the user needs reached GEOSS.

83. The proposed DMISCO would work together with other initiatives within the United Nations system, ensuring the optimization of efforts and non-duplication of activities, in particular with regard to the work carried out by UNOSAT and WMO.

VIII. Mobilization of resources and implementation plan

84. The experts estimated, based on the initial list of functions and organizational scope identified above, that the implementation of the proposed DMISCO would require an annual operational budget of approximately $1.3 million, which would cover personnel (staff of 10), facilities (operation and maintenance) and operational costs. The total amount of cash contributions would vary depending on whether a Member State offered to host the entity and provided the facilities and part of the staff and whether in-kind contributions were made available, including secondment of experts by interested institutions or Member States. Whether the proposed DMISCO is hosted by a Member State or located within the Office for Outer Space Affairs, the United Nations contribution to it should be utilized to cover the cost of three staff members (two Professional and one General Service staff).

85. It is thus expected that the resources for the core of the work to be carried out would come from the United Nations (3 staff); contributions in cash from Member States (for facilities, operational costs and staff); a membership fee, either fixed or based on use of the services of the proposed DMISCO; contributions in kind (such as facilities provided by a hosting Member State) and secondments of experts. Additionally, funds would be needed to support the implementation of projects identified in conjunction with national focal points and would be defined and secured on a case-by-case basis.

86. The experts agreed on the following plan of implementation:

(a) The present study is being submitted to the Scientific and Technical Subcommittee at its forty-third session, in 2006, for its review and recommendation to the Committee on the Peaceful Uses of Outer Space;

(b) The ad hoc expert group will meet during the forty-third session of the Scientific and Technical Subcommittee to complete the details of the implementation plan, including a list of secured commitments; to define the activities to be carried out by the ad hoc expert group in 2006; to define further the relationship with existing and planned international organizations and initiatives; and to propose a strategy to be carried out to secure the necessary funding in order for the proposed DMISCO to begin its activities in 2007;

(c) The section of the study that refers to the Earth Observation Data Website being developed under the leadership of Romania and the section on case studies being developed under the leadership of the Czech Republic and Iran (Islamic Republic of), will continue to be developed by the ad hoc expert group and, once finalized, will be made available as a supplementary report;

(d) After submission to the Scientific and Technical Subcommittee at its forty-third session, the report will be revised to include the recommendations made

by the Subcommittee and then submitted to the Committee on the Peaceful Uses of Outer Space at its forty-ninth session, for its review and recommendation to the General Assembly at its sixty-first session;

(e) It is planned that the proposed entity will be operational on 1 January 2007.

Notes

[1] See *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.00.1.3).

[2] A/CONF.206/6 and Corr.1, chap. I, resolution 2.