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Committee on the Peaceful Uses of Outer Space

Report on the United Nations/Algeria/European Space Agency International Seminar on the Use of Space Technology for Disaster Management: Prevention and Management of Natural Disasters

(Algiers, 22-26 May 2005)

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 and transfer of knowledge and skills in developing countries and countries with economies in transition.

2. At its forty-seventh session, in 2004, the Committee on the Peaceful Uses of Outer Space endorsed the programme of workshops, training courses, symposiums and conferences planned for 2005.[2] Subsequently, the General Assembly, in its resolution 59/116 of 10 December 2004, endorsed the activities of the United Nations Programme on Space Applications for 2005.

3. The United Nations/Algeria/European Space Agency International Seminar on the Use of Space Technology for Disaster Management: Prevention and Management of Natural Disasters was held in Algiers from 22 to 26 May 2005. Organized by the Office for Outer Space Affairs of the Secretariat and the Algerian Space Agency (ASAL), the Seminar was co-sponsored by the European Space Agency (ESA) and the Islamic Educational, Scientific and Cultural Organization and hosted by ASAL. The Seminar built upon the work carried out by the Office for Outer Space Affairs, in the framework of the United Nations Programme on Space Applications, on the use of space technology in disaster management, strengthening the work that is already being carried out in Africa in this field.

4. From 1994 to 2003, there were more than 300 natural disasters on average each year, affecting an average of 104 countries and killing over 50,000 people. Those disasters affected nearly 260 million people and caused damage amounting to an annual average of $55 billion. In 2004, the tsunami in the Indian Ocean caused a jump in the statistics, contributing to increasing the total of people killed in 2004 to 241,400 and the staggering cost of 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 tsunami of 2004 highlighted once again the need for integration of disaster planning into development programmes, including the building of local capacity for disaster preparedness and response.

5. The World Conference on Disaster Reduction, held in Kobe-Hyogo, Japan, from 18 to 22 January 2005, recognized the contribution of space technology to disaster reduction and emphasized the need to routinely incorporate space-based services into support risk reduction. The Conference was the largest gathering ever of the disaster community, with a total of 4,000 participants in the plenary activities and thematic sessions and around 40,000 in the public segment. A list of commitments is set out in the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters,[3] which will contribute

substantially to reducing the loss of lives and the damage to the social, economic and environmental assets of communities and countries. Specifically with regard to space technology, the final documents recognized the contribution of space technology to risk reduction over the past 10 years and also 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 observation, to support disaster risk reduction.

6. Between 2000 and 2004, the Office for Outer Space Affairs organized a series of regional workshops on the use of space technology for disaster management, bringing the results of the regional workshops to a final international workshop, held in Munich, Germany, from 18 to 22 October 2004, at which a total of 170 participants from 51 countries discussed a global strategy to help developing countries gain access to and be able to use space technology for disaster management, "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 global navigation satellite systems played an important role in risk reduction and disaster management and put forward 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. At the global level, participants recognized the importance of and urgent need for a coordination entity to act as a "one-stop shop" for knowledge- and information-sharing (best practices) and also as a platform for fostering alliances.

7. On 20 October 2004, the General Assembly adopted resolution 59/2, following its five-year review of the implementation of the recommendations of UNISPACE III, which included a proposal by the Committee on the Peaceful Uses of Outer Space for a study to be conducted on the possibility of creating an international entity to provide for coordination and the means of optimizing the effectiveness of space-based services for use in disaster management. That study is currently being prepared by an ad hoc expert group, with experts provided by interested Member States and relevant international organizations. Once concluded, it will provide a design for a coordinating mechanism, which, once in place, will contribute to helping developing countries have access to and incorporate space-based technology solutions for risk reduction and disaster management.

8. At the regional level, Algeria's ALSAT-1 satellite, which was launched as part of the Disaster Monitoring Constellation (DMC), has been providing additional opportunities for disaster management in North Africa. The Seminar was an opportunity to build upon the expertise acquired by Algeria for the benefit of the whole region, in particular the potential of ALSAT-1 to support disaster management activities in the region.

9. The objective of the Seminar was to increase the awareness of national and regional users of the potential of space technology for preventing and managing natural disasters, thus contributing to the incorporation of space-based technology solutions into disaster reduction and management activities in the region. The Seminar was structured so that participants would learn how space technologies were being used in the management of natural disasters and how they could

incorporate such solutions into disaster management activities in their own countries. In particular, the Seminar was intended to provide participants with an understanding of how space technology could help solve disaster management challenges and how such solutions were already making a difference. A major objective was to help space technology institutions and civil protection agencies in the region to work together to improve the use of space technology in disaster management.

10. The present report was prepared for submission to the Committee on the Peaceful Uses of Outer Space at its forty-ninth session and to its Scientific and Technical Subcommittee at its forty-third session, in 2006.

B. Programme

11. The opening ceremony of the Seminar included addresses by the Minister for Higher Education and Scientific Research of Algeria, the Director-General of ASAL and representatives of ESA and the Office for Outer Space Affairs.

12. The Seminar consisted of a keynote presentation session, 10 presentation sessions and 3 discussion sessions. The keynote presentations were made by representatives of the Directorate-General for Civil Protection of Algeria, ESA and the University of Peradeniya, Sri Lanka. There were five presentation sessions on the following hazards: geo-hazard risks; forest and bush fires; floods; drought, desertification and land degradation; and entomological risks. Five further presentation sessions focused on cutting edge solutions for disaster management; global initiatives such as DMC and 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 work of the United Nations in space technology and disaster management; the role of the private sector in space technology and disaster management; and ways to increase the use of space technology for management of natural disasters in Africa. A total of 46 presentations were made and comprehensive discussion sessions were held at the conclusion of each presentation session.

13. Three discussion sessions on improving coordination between civil protection agencies and space technology institutions in North Africa were designed to help participants develop plans concerning how civil protection agencies and space technology institutions in each country of the region could work together to better manage natural disasters, through the incorporation of space-based services and information.

14. The Seminar was conducted in Arabic, English and French, with the use of simultaneous interpretation.

C. Attendance and financial support

15. Decision makers and technical personnel from developing and developed countries attended the Seminar. Specifically, representatives of space technology institutions and civil protection agencies from each country in the North Africa

region were invited in order to develop plans to improve coordination for the management of natural disasters.

16. A total of 128 participants from the following Member States attended the Seminar: Algeria, Argentina, Australia, Brazil, Canada, China, Côte d'Ivoire, Egypt, France, Germany, Italy, Kenya, Libyan Arab Jamahiriya, Mauritania, Morocco, Niger, Nigeria, Norway, Spain, Sri Lanka, Sudan, Switzerland, Syrian Arab Republic, Tunisia, Turkey and United Kingdom of Great Britain and Northern Ireland. Palestine was also represented.

17. Representatives of the following regional and international organizations participated in the Seminar: Office for Outer Space Affairs, United Nations Development Programme, World Food Programme (WFP), African Centre of Meteorological Applications for Development, African Regional Centre for Space Science and Technology Education—in French Language, affiliated to the United Nations, Arab League Educational, Scientific and Cultural Organization, ESA, Islamic Educational, Scientific and Cultural Organization, Regional Centre for Mapping of Resources for Development, Regional Training Centre for Agrometeorology and Operational Hydrology and Their Applications, and Sahara and Sahel Observatory.

18. Together with ESA, ASAL and the Islamic Educational, Scientific and Cultural Organization, the Office for Outer Space Affairs provided funding support to a total of 25 participants, of whom 3 were female participants.

II. Summary of presentations

19. The presentation sessions provided participants with the opportunity to learn how space technology could be used to manage natural disasters, with success stories demonstrated and potential applications explained. The presentation sessions stimulated discussion on how space technology could best be applied to disaster management in the Northern Africa region. The presentations that were made at the Seminar are available on the ASAL website (www.asal-dz.org).

20. The keynote presentations provided a framework of understanding for the presentations and discussions that were to follow, as well as an overview of current best practice in the use of space technology for disaster management. In particular, the use of remote sensing for the prevention and management of natural disasters in Algeria was presented by the Directorate-General for Civil Protection of Algeria. International cooperation in disaster management, including the contribution of ESA, was described. Participants were provided with a case study of the Sri Lankan experience in relation to the tsunami in the Indian Ocean in 2004.

21. The first presentation session included five presentations on geo-hazard risks. Participants were provided with an overview of northern Algerian seismicity, including the use of the Global Positioning System (GPS) and satellite imagery from Landsat, SPOT-5, Envisat, QuickBird and Ikonos for updating seismological maps. The objectives and results of the Detection of Electromagnetic Emissions Transmitted from Earthquake Regions (DEMETER) programme, a scientific research project designed to study the relationship between seismic activity and ionospheric disturbances, were also reviewed. The achievements and plans of the

Integrated Global Observing Strategy (IGOS) were presented. An IGOS GeoHazards Theme report, published in 2004, provided a strategic view of the development of the geophysical hazards community and proposed the establishment of the IGOS GeoHazards Bureau to support the implementation of the IGOS GeoHazards Theme and also act as a repository for information on geophysical hazards. The use of interferometric synthetic aperture radar (SAR) analysis and GPS techniques for seismic hazard assessment in north Algeria was demonstrated.

22. The importance of using satellite imagery in the prevention and management of forest fires in Algeria was outlined, along with some examples of deforestation between 1992 and 2000. The need for coordination between space technology institutions and civil protection agencies in early warning and emergency management was emphasized, as was the need for rapid access to satellite resources, coupled with field visits and accessibility of data on the Internet. The significance of Sentinel Fire Mapping in the development of real-time forest and bush fire monitoring in Australia, especially in early warning and emergency monitoring based on satellite data, was presented. It was emphasized that fire mapping needed to be developed rapidly, that a model and platform for national fire mapping and monitoring should be developed, that satellite data should be integrated into a geographical information system (GIS) and that the system should have the potential for modelling fire spread. The system and mechanism for monitoring vegetation fires in Brazil was presented, where fires were detected using Moderate Resolution Imaging Spectroradiometer (MODIS) satellite data in a GIS environment, coupled with recent statistics on fires. The use of various satellites and sensors for various burn areas was discussed, including the differences between requirements for analysis of forest fire risk in different regions of Africa. Hotspot information was derived from fire temperature, fire intensity and burning area. Overall, the presentation session demonstrated the importance of strong relationships between the firefighting coordination body and the fire detection agencies.

23. The use of space technology in the prevention and management of floods in Algeria was presented. The need to integrate remote sensing data into hydrological systems was emphasized, coupled with the use of cartography, field monitoring and modelling, which were all essential for the implementation of an early warning system. The implementation of a flood prevention strategy and plan of intervention was presented, as also the continuous improvement of space-based techniques in the management and prevention of floods in China. Satellite tools had contributed to a better understanding and estimation of rainfall as input into the model for flood alarm systems in China. The use of a geo-referenced database for Nouakchott, utilizing GIS, was demonstrated. Through the use of satellite imagery and modelling, a study of the suitability for development of urban zones was carried out. In general, the emphasis of the session was on the need for early warning systems that were based on geographical analysis and understanding of the mechanisms of floods. In particular, it was recommended that high-resolution satellite images be used to distinguish between floods caused by natural phenomena and those resulting from anthropogenic factors. It was recommended that training programmes be held on the use of space technology in flood management.

24. The presentations on drought, desertification and land degradation demonstrated the importance of space-based tools in monitoring and managing

natural disasters and highlighted current best practice in using Earth observation tools in preventing and managing desertification. The first presentation focused on the use of space techniques in oases and the Saharan environment and the characterization of physical, biological and socio-economic parameters. The importance of collaboration and cooperation between multidisciplinary institutions—such as space technology, meteorology and social sciences—to produce an integrated information system as input to decision-making was emphasized. The contribution of remote sensing to flood management in Algeria was described, as was the use of space techniques to locate underground water resources in drought-prone areas and to produce a desertification sensitivity map of Morocco. The use of space technology to monitor predatory insects to ensure food security in the Sahel region was outlined. Space-based techniques were particularly useful in observing insect swarms in remote and inaccessible desert zones. ALSAT-1 imagery had been used to monitor fragile ecosystems in mountainous regions and deforestation in Algeria, as well as to update desertification maps.

25. The Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES) programme in West Africa aimed to achieve early warning, fast intervention and operational research on locust swarms, by utilizing high-resolution satellite images from MODIS and field data using eLocust2 software and RAMSES software specific to locusts. In Algeria, prediction of locust plagues was based on ground- and satellite-based meteorological and vegetation data from SPOT and ALSAT-1. The eLocust system, an experimental project to be implemented in several countries, consisted of mobile instruments for field data collection, access to communication satellites able to transmit short messages in real time and cheaply and a platform with capacity to use several satellites and distribute data in various forms to several users. The system would consider climatic conditions, vegetation, locusts and pesticides. The locust control analysis system was based on the use of GIS combined with ground-based meteorological data, locust information from the field and satellite images supplied by ALSAT-1. The experimental model made possible the production of maps for analysis of plague history.

26. Five presentations were made on cutting-edge solutions for disaster management. The use of satellite imagery to create a database of vegetation types, forest degradation and urban development was demonstrated. The potential of the Envisat for disaster management was outlined, specifically the determination of relief to produce a digital elevation model, sea-level temperature, a vegetation index, atmosphere chemistry, the atmospheric concentration of gases and so on. Radar interferometry techniques were presented as a useful method of measuring ground subsidence in oil fields, urban zones and mines, especially in arid regions. Participants learned about the use of interferometric SAR in seismic risk management in the Mediterranean Sea, as well as GPS techniques for determining active faults. The implementation of a geodesic network in north Algeria to monitor tectonic plate deformation using GPS stations was discussed.

27. Four presentations were made on global initiatives such as DMC and the International Charter “Space and Major Disasters”. Participants learned about DMC, which already had four satellites in orbit, owned by Algeria, Nigeria, Turkey and the United Kingdom, with the fifth and sixth satellites already planned. The use of Nigeria Sat-1 for natural risks was presented. The contribution of ALSAT-1 in the framework of DMC for major risks was presented. The Algerian space programme,

including two additional satellites for Earth observation and telecommunications, was presented. The use of space-based solutions, in particular the International Charter "Space and Major Disasters", for earthquake hazard evaluation in Turkey was described.

28. Three presentations were made on the work of the United Nations in the field of space technology and disaster management. A presentation was made on the fundamental role of capacity-building in space technology in the management and prevention of natural disasters. Participants were informed about the regional centres for space science and technology education, affiliated to the United Nations, in particular the African Regional Centre for Space Science and Technology Education—in French Language, located in Morocco. Those centres provided regular postgraduate training in topics such as remote sensing, GIS, telecommunications, satellite meteorology and global climate. The work of the Office for Outer Space Affairs in improving disaster management was presented. As well as an overview of the work of the Office, emphasis was placed on its role as a cooperating body to the International Charter "Space and Major Disasters", through which other United Nations entities could gain access to satellite data from the Charter in the event of a major disaster. As a cooperating body to the Charter, the Office had been operating a hotline that enabled entities of the United Nations system to gain access to satellite imagery from the Charter free of charge for disaster management purposes. Since July 2003, the Charter had been activated 19 times by the Office on behalf of United Nations bodies. WFP presented its work on the use of space-based technologies to support humanitarian response to food insecurity in Africa. Its emergency response and preparedness framework consisted of comprehensive food security and vulnerability analysis; a food security monitoring system; early warning and contingency planning; emergency food security assessment; and response planning. Tasks included spatial analysis of vulnerability patterns, monthly food security early warning bulletins, seasonal reports and agro-meteorological monitoring, which required various types of Earth observation data. In particular, a vulnerability analysis mapping spatial information environment had been developed in order to improve storage and sharing of spatial data for food security and to support quick map production through dynamic map services. It was emphasized that a multi-agency framework for emergency response and preparedness strategy was much needed.

29. Four presentations were made on the role of the private sector in improving the use of space technology in the prevention and management of natural disasters in the region. A presentation was made on European Space Imaging tools for disaster response. Meteosat, IRS-P6 Resourcesat-1 and Ikonos were described as having provided high-resolution satellite imagery in response to disasters such as forest fires in Portugal, floods in southern France, an industrial explosion in Algeria and an earthquake in Morocco. The roles of observation, meteorological and telecommunication satellites in the various stages of disaster management were explained. The integration of all information obtained from the field, modelling and satellite data into a GIS was highlighted. The European Aeronautic Defence and Space Company Astrium presented its work on the major initiative on Global Monitoring for Environment and Security (GMES) of the European Union and ESA, which is designed to deliver a global monitoring capability to European Governments and user communities by 2008.

30. Four presentations were made during the final presentation session, which focused on increasing the use of space technology in Africa. In order to convince decision makers of the advantages of using space technology, it was necessary to coordinate and strengthen the use of existing space technology infrastructure at the national and regional levels. In general, incorporation of space-based solutions reduced the cost and time of map production and improved natural resource management and monitoring of land degradation. The Regional Centre for Mapping of Resources for Development used space technology for food security and environmental monitoring; flood modelling and prediction; modelling and prediction of diseases such as Rift Valley fever and HIV/AIDS; land degradation mapping and monitoring; and monitoring urban sprawl. The Centre also conducted training in the use of modern geo-informatic technologies in those areas. For space technology to become operational in resource mapping and assessment, there was a need for aggressive and sustained awareness-raising among decision makers; creation of awareness of availability of Landsat archive data free of charge as well as other low-resolution satellite data through the Internet; building of capacity at the national level; development of a variety of space technology applications; and support for national and regional initiatives.

III. Observations and recommendations

A. General observations

31. Three discussion sessions were organized, with participants divided into groups according to geographical region. The discussion sessions were structured to help civil protection agencies and space technology institutions develop plans to work together to incorporate the use of space technology into operational disaster management activities. Three groups were set up: Libyan Arab Jamahiriya and Sudan; Algeria, Morocco and Tunisia; and Mauritania and Niger. Participants from the remaining countries joined the group of most interest and relevance to them. During the first discussion session, participants identified the main types of disaster in their region and the institutions responsible and the current uses of space technology for disaster management. The second discussion session was designed to help countries define the main activities to focus on and draw up an initial list of activities to be carried out in their countries. During the third discussion session, the three groups presented the results of their discussions and together defined a regional strategy, stressing the need for closer cooperation between national civil protection institutions and space technology institutions.

32. Participants emphasized the need to strengthen national capacity in the area of integration and the use of space technologies in the prevention and management of natural risks, specifically through targeted training, appropriate for the regional context, taking advantage of existing regional structures and specialized centres of excellence. It was stressed that the countries present from sub-Saharan Africa had neither national strategies for space technology nor national institutions responsible for space technology. The need to raise the awareness of decision makers was identified as a possible focus area. Cooperation with the Intergovernmental Authority on Development as a regional institution was recommended.

33. During the Seminar, the executive secretariat of the International Charter "Space and Major Disasters" announced that discussions on the membership of DMC had commenced and that, once they had been concluded, the civil protection agencies of Algeria, Nigeria and Turkey would become authorized users of the Charter. For those countries not yet members of the Charter, two channels existed for accessing it: countries could use bilateral or multilateral agreements among civil protection agencies, or the Charter could be accessed through the Office for Outer Space Affairs via the resident representative or United Nations presence in each country. The Charter aimed at providing assistance to emergency and rescue organizations in a pragmatic manner. For other phases of risk management, frameworks such as the "Respond" initiative of GMES were being developed and would increasingly be made available to developing countries.

B. Recommendations

34. Participants identified the need for a regional task force that would bring together civil protection and space technology institutions of North Africa and would contribute to the following activities that are important to the region as a whole: (a) provision of support in the implementation of regional early warning and monitoring systems that incorporated the use of space technologies for the reduction of risks in the areas of floods, forest fires, drought, desertification and locust peril; (b) provision of support in the integration of the use of space technologies in the development of regional seismic risk charts; (c) provision of support in the development of regional vulnerability analysis maps, specifically with a focus on desertification, in conjunction with current ongoing initiatives; (d) provision of support in the implementation of local pilot projects focusing on incorporating solutions based on space technology to deal with hazards relevant to the region; (e) provision of support in the incorporation of space technology solutions into the development of a regional locust biotope map; and (f) provision of support in the implementation of a regional network for permanent observation using global navigation satellite systems (GNSS).

35. Participants also called for capacity-building at the national level for the integration of space technology into prevention and management of natural disasters, in particular through training based on existing regional and national structures and specialized centres.

36. Participants proposed the implementation of a regional task force for the North African region for coordination between civil protection agencies and space technology institutions, as initially proposed at the United Nations/European Space Agency/Sudan Regional Workshop on the Use of Space Technology for Natural Resource Management, Environmental Monitoring and Disaster Management, held in Khartoum from 4 to 8 April 2004, and welcomed the offer by ASAL to take on a coordinating role for this regional task force and also the offers by the Directorate-General for Civil Protection of Algeria, the Remote Sensing Authority of the Sudan and the Royal Centre for Remote Sensing of Morocco, to co-chair the effort together with ASAL.

C. Role of the Office for Outer Space Affairs

37. The role of the Office for Outer Space Affairs in carrying out the recommendations of the Seminar is to build upon the potential of the regional task force as a coordination mechanism to support the various proposed regional needs that were identified. The Office would contribute to maintaining the list of institutional focal points, bringing into the task force relevant institutions from other regions and linking and synergizing the work of the task force 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 (GEOSS), GMES and the International Charter "Space and Major Disasters". The Office would also work closely with the Remote Sensing Authority of the Sudan to organize the proposed follow-up seminar in 2006. Additionally, the Office would work to harness existing opportunities that would further support the use of space technology for disaster management in the region, in particular in Chad, Mali, Mauritania and the Niger.

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-ninth session, Supplement No. 20* (A/59/20), para. 71.

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