

COMMITTEE ON THE PEACEFUL USES  
OF OUTER SPACE

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Use of space technology in the United Nations system

**Space Benefits for Africa: Contribution of the United Nations Family**

At its twenty-eighth session, in 2008, the United Nations Inter-Agency Meeting on Outer Space Activities agreed that a report on the benefits of space science and technology for sustainable development in Africa should be prepared by the Office for Outer Space Affairs of the Secretariat, in cooperation with the United Nations Economic Commission for Africa (ECA) and in consultation with other United Nations entities.

The draft report was endorsed by the Meeting at its twenty-ninth session in March 2009 and is submitted to the Committee for information under agenda item 13, “Use of space technology in the United Nations system”. The report will be presented to the third African Leadership Conference on Space Science and Technology for Sustainable Development, which will be held in Algiers, Algeria in November-December 2009. The report will also be submitted to session of the Commission on Sustainable Development in 2010.

The advance unedited version of the report “Space Benefits for Africa: Contribution of the United Nations Family” is contained in the annex.





## Annex

# SPACE BENEFITS FOR AFRICA: CONTRIBUTION OF THE UNITED NATIONS FAMILY

## Report of the United Nations Inter-Agency Meeting on Outer Space Activities\*

(Vienna, 4-6 March 2009)

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\* The present report was prepared by the Office for Outer Space Affairs in cooperation with the Economic Commission for Africa and consultation with members of the United Nations Inter-Agency Meeting on Outer Space Activities. The report was endorsed by the Inter-Agency Meeting on Outer Space Activities at its twenty-ninth session, held from 4 to 6 March 2009.



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## I. Introduction

1. The United Nations Inter-Agency Meeting on Outer Space Activities serves as the focal point for inter-agency coordination and cooperation in space-related activities.<sup>1</sup> The United Nations is actively involved in bringing space benefits to Africa. Over the last five years, twenty five United Nations entities have reported their space-related activities in Africa through the means of the annual United Nations Inter-Agency Meeting on Outer Space Activities. The space-related activities of the United Nations system typically focus on the following issues: the protection of the environment and management of natural resources; the use of space applications for human security, humanitarian assistance, development and welfare; enabling technologies for development, including information and communications technology and global navigation satellite systems; and capacity-building and education in space applications for sustainable development.

2. The report of the Secretary-General on the coordination of space-related activities within the United Nations system is reviewed by the Inter-Agency Meeting annually and plays an important role in fostering new inter-agency partnerships and promoting synergies.<sup>2</sup> It serves as a strategic tool for the United Nations to avoid duplication of effort in the use of space applications and space-related activities. The report is also a useful source of information on the activities of the United Nations entities in promoting through space technology sustainable development in the world, including in the African region.

3. At its twenty-eighth session, in 2008, the Inter-Agency Meeting agreed that a report on the benefits of space science and technology for sustainable development in Africa should be prepared by the Office for Outer Space Affairs of the Secretariat, in cooperation with the United Nations Economic Commission for Africa (ECA) and in consultation with other United Nations entities. The report aims to reach out to, and support the efforts of, African regional initiatives and conferences in promoting the use of space tools for sustainable development. Through the report, the Inter-Agency Meeting seeks to underline the importance of promoting cooperation and finding synergies, as well as contribute to regional cooperation in raising awareness among decision-makers and key stakeholders of the role of space science and technology in promoting the sustainable development of Africa.

4. The report was endorsed by the Meeting at its twenty-ninth session in March 2009 and would consequently be presented, in late 2009, to the third African Leadership Conference on Space Science and Technology for Sustainable Development.<sup>3</sup> The African Leadership Conference on Space Science and Technology for Sustainable Development is an important regional forum that aims to raise awareness among African leaders of the importance of space science and technology; provide a regular forum for the exchange of information among African countries; and enhance intra-African cooperation in the development and

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<sup>1</sup> Further information on the Inter-Agency Meeting can be found at: <http://www.uncosa.unvienna.org/uncosa/en/iamos/index.html>.

<sup>2</sup> Further information as well as the reports of the Inter-Agency Meeting and of the Secretary-General on the coordination of space-related activities within the United Nations system can be found at: <http://www.uncosa.unvienna.org/>

<sup>3</sup> More information on the African Leadership Conference on Space Science and Technology for Sustainable Development, as well as the Proceedings of the last Conference, can be found at: <http://www.space.gov.za/conferences/alc2007/>.

application of space technology. The first Conference was held in Abuja, Nigeria, in 2005, the second was held in Pretoria, South Africa, in 2007, and the next Conference will be held in Algiers, Algeria in 2009.<sup>4</sup>

5. The space technologies, applications and initiatives identified for inclusion in the report are those that have a role in promoting sustainable development in Africa. In most cases, the outlined space applications, activities and initiatives are implemented in cooperation among various United Nations entities, which can be further strengthened through inter-agency cooperation. The report outlines a wide range of space benefits for the promotion of sustainable development in Africa and describes a number of important programmes and projects involving United Nations entities, which use space technology and applications to address various aspects of sustainable development for Africa.

6. The present report was prepared by the Office for Outer Space Affairs, in cooperation with the Economic Commission for Africa (ECA), on the basis of the reports of the Inter-Agency Meeting and of the Secretary-General on the coordination of space-related activities within the United Nations system, as well as the submissions from the following United Nations entities: the United Nations Office on Drugs and Crime (UNODC), the Department of Field Support (DFS), the Department of Peacekeeping Operations (DPKO), the Office of the United Nations High Commissioner for Refugees (UNHCR), and the International Telecommunication Union (ITU).

## **II. Space solutions for sustainable development in Africa: an Overview**

7. Since the United Nations Conference on Environment and Development in Rio (1992),<sup>5</sup> sustainable development has remained elusive for many African countries. Poverty is still a major challenge, as 41% of the Sub-Sahara African population (or roughly 300 million people) were living on one dollar a day or less in 2004. Multiple armed conflicts, insufficient access to education and widespread pandemics, such as HIV and malaria, have undermined Africa's efforts to achieve sustainable development. The region is also challenged by serious environmental threats, including desertification, deforestation and climate change.<sup>6</sup> Africa has therefore been a priority area for United Nations' activities, and the Johannesburg Plan of Implementation of the World Summit on Sustainable Development<sup>7</sup> referred to Africa's sustainable development as a cross-cutting issue.

8. Space technology and its applications, such as Earth observation systems, meteorological satellites, communication satellites and global navigation systems,

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<sup>4</sup> More information on the African Leadership Conference on Space Science and Technology for Sustainable Development can be found at: <http://www.space.gov.za/conferences/alc2007/>.

<sup>5</sup> More information on United Nations Conference on Environment and Development (the Earth Summit) can be found at: [http://www.un.org/esa/dsd/resources/res\\_docukeyconf\\_eartsumm.shtml](http://www.un.org/esa/dsd/resources/res_docukeyconf_eartsumm.shtml)

<sup>6</sup> More information on the United Nations' promotion of sustainable development in Africa can be found at: [http://www.un.org/esa/dsd/susdevtopics/sdt\\_africa.shtml](http://www.un.org/esa/dsd/susdevtopics/sdt_africa.shtml)

<sup>7</sup> More information on United Nations Conference on Environment and Development (the Earth Summit) can be found at: <http://www.un.org/events/wssd/>

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lend strong support to the implementation of actions called for at the World Summit on Sustainable Development and make a significant contribution to the promotion of sustainable development in Africa. Space is benefiting Africa and its people in various ways. Space applications offer effective tools for connecting people around the world, monitoring and conducting assessments of the environment, managing the use of natural resources, managing natural disasters, and providing education and health services in remote areas.

9. Space applications are widely used in agriculture, an important yet fragile economic sector in many parts of Africa. Low soil fertility, scarce irrigation, poor rural infrastructure, insufficient rural finance and recurrent droughts are among the major challenges facing sub-Saharan African agriculture. African soils are diverse but characterized by limited fertility. Only 45 per cent of the lands is arable, 16 per cent has soil of high quality, and about 13 per cent has soil of medium quality.<sup>8</sup> In that regard, Earth observation technology enables quick response with timely information to predict and simulate the production expected during one agricultural season.

10. Space-technology also contributes to getting a better understanding of global weather and climate change. Satellite systems now monitor temperature, rainfall, cyclones, and vegetation cover even in areas where few or no weather stations or other means of scientific observation exist. Regional monitoring mechanism in Africa based on satellite-derived data allow early warning of drought and extreme weather events as well as predictions of rainfall amounts and locust invasions. Instruments installed in remote areas, where no telecommunication infrastructure exists, use satellite-based communication system to transmit data from anywhere to central processing hubs.

11. Due to the continuous rise of demand on natural resources, a rapidly growing population, processes of deforestation and desertification, the impact of climate change and resource mismanagement, access to natural resources is worsening in the region. Earth observation is the frequently used tool to monitor the environmental impact of human activities on a local scale and manage natural resources such as forests and water resources, which are crucial for the livelihood as well as economic development in Africa.

12. Space-based information systems play a significant role in risk reduction and disaster management on the African continent, which is heavily affected by meteorological disasters, such as droughts, floods, storms and cyclones. Natural and man-made disasters result in damage of ground-based infra-structures such as communication cables and access roads, thereby making space technology a vital option for disaster management. The potential benefits of space information in disaster management can be grouped into two primary phases: the “hot phase”, dealing with the emergency response which includes warning and crisis management, and the “cold phase,” which is the period preceding or following the disaster and which includes risk reduction and damage assessment.

13. To increase the use of space technology in disaster management, a number of global initiatives have been established to take advantage of space technology in

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<sup>8</sup> Report of the Secretary-General on Africa, E/CN.17/2008/8.

disaster management. Some of those include the activities of the International Charter on Space and Major Disaster<sup>9</sup>, the Committee on Earth Observation Satellites (CEOS)<sup>10</sup>, the Global Earth Observation System of Systems (GEOSS)<sup>11</sup>, the Disaster Monitoring Constellation International<sup>12</sup>, the Integrated Global Observing Strategy-Partnership<sup>13</sup> and the United Nation Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER)<sup>14</sup>.

14. Tele-epidemiology, a field heavily based on satellite imagery, allows identifying areas at risk of a disease outbreak, for example, by indicating the areas where climatic conditions are favourable for a rapid increase of malaria-transmitting mosquitoes. Satellites are also used to monitor air quality, which is linked to public health, environmental protection and compliance monitoring. Air pollution not only poses a health hazard, but also has a harmful impact on precipitation.

15. Space-related applications are also increasingly employed in transportation services, which is another essential field that contributes to the achievement of sustainable development in Africa. Access to transport allows mobility, promotes commerce and fosters education and health. In many African countries, transport access rates and network quality are low. In order to fill the transportation gap, many African countries have reformed the management of their infrastructure, including the utilization of global navigation satellites, which are used for precise determination of position in space and in time. Although initially designed as navigation tools, global navigation satellite systems have developed into a multidisciplinary tools for navigation geodesy, surveying and cartography, agriculture, atmospheric science and disaster management.

### **III. Space-related activities of United Nations entities in Africa**

#### **Human security**

16. The United Nations uses satellite and aerial imagery for the development of large-scale maps to support the movements, operations and planning of peacekeeping troops and to improve staff security and emergency preparedness in the field. Maps, often derived from satellite imagery, also inform the deliberations of the Security Council on the ongoing emergencies in different parts of the world.

17. Peacekeeping operations are usually deployed in areas devoid of up-to-date geospatial information. The United Nations therefore established GIS units in eleven United Nations peacekeeping missions, as well as a GIS centre to support the field units at its Brindisi Logistics Base. Those units integrate information from various sources with digital maps of the theatre of peacekeeping operations, which allows peacekeeping missions to enhance their operational readiness and

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<sup>9</sup> Further information on the International Charter “Space and Major Disasters” can be found at: <http://www.disasterscharter.org>.

<sup>10</sup> Further information on the Committee on Earth Observation Satellites can be found at: <http://www.ceos.org/>.

<sup>11</sup> Further information on the Global Earth Observation System of Systems can be found at: <http://www.earthobservations.org>.

<sup>12</sup> Further information on the Disasters Monitoring Constellation International can be found at: <http://www.dmcii.com/>.

<sup>13</sup> Further information on the Integrated Global Observing Strategy Partnership can be found at: <http://www.igospartners.org/>.

<sup>14</sup> Further information on the United Nations Space-based Information for Disaster Management can be found at: <http://www.unoosa.org/oosa/unspider/index.html>.

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capabilities. Satellite images and data are crucial in planning and operations to support terrain and situational awareness, thematic and analytical mapping for military and police deployments, mine action, and underground water resource investigation, as well as movements of internally displaced persons and refugees.

18. The Cartographic Section of the United Nations provides support to the United Nations in various special projects, such as assistance and advice on delimitation of international boundaries (with intensive use of satellite imagery as well), project management of GIS units within peacekeeping missions and the GIS centre in Brindisi, Italy, which prepares topographic base mapping. The United Nations International Boundary Evidence project, in collaboration with WHO, aims at creating and maintaining a geo-database of international boundaries.

19. The Department of Peacekeeping Operations (DPKO) and the Office for the Coordination of Humanitarian Affairs (OCHA) has established the Sudan Inter-agency Mapping group, which functions in cooperation with local authorities to promote and facilitate the sharing of standardized geospatial information and satellite imagery to enable all members to develop compatible and reliable products to assist in their operations.<sup>15</sup>

20. Since 2004, OCHA leveraged on multiple occasions the resources made available through the geographic information support team,<sup>16</sup> bilateral agreements with major companies and other mechanisms to service the geospatial data requirements of the humanitarian community, especially by channelling satellite imagery obtained from the government of the United States during major disasters and related response.

21. The Office of the United Nations High Commissioner for Refugees (UNHCR) uses satellite imagery, GPS receivers, existing maps and refugee registration data to develop a geographic information system. Camp mapping has been implemented for Tanzania, Chad, Kenya, Namibia, Sudan, Sierra Leone and Liberia. Refugee camp mapping on the Kenya and Somalia border (Dadaab) is planned in order to assess the impact of refugee camps on environment and changes in environmental conditions of the refugees. In the context of collaborative platforms for inter-agency activities in regions with limited Internet access, it is crucial to improve access to global navigation systems in remote areas and establish long-term partnerships for remote sensing data re-use and for customised interpretation of high-resolution imagery.

22. UNGIWG supports the development of the Second Administrative Level Boundaries (SALB) data set project, which also provides up-to-date contact

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<sup>15</sup> The members of the Sudan Inter-agency Mapping (SIM) group include the United Nations Mission in the Sudan, the Office for the Coordination of Humanitarian Affairs, the United Nations Mine Action Service, the United Nations Joint Logistics Centre, UNDP, the United Nations Children's Fund, WHO, WFP, the Humanitarian Information Centre for Darfur, the European Union Satellite Centre, the Sudan Central Bureau of Statistics and the New Sudan Centre for Statistics and Evaluation. Further information on the work of this group can be found at: <http://www.unsudanig.org/sim/>.

<sup>16</sup> GIST membership consists of United Nations agencies with humanitarian operations, including DPKO, FAO, UNHCR, WFP and WHO, United States agencies, representatives of donor countries, non-governmental organizations and academic institutions, with the Office for the Coordination of Humanitarian Affairs providing secretariat services. Further information on the work of this initiative can be found at: <https://gist.itos.uga.edu/index.asp>.

information for national mapping agencies in collaboration with other United Nations partners, such as ECA and several regional and global initiatives.<sup>17</sup> UNGIWG members have worked to define and gradually implement a United Nations Spatial Data Infrastructure project, which aims primarily at improving the ability of the United Nations system to deliver as one in bringing space benefits for sustainable development. The project will be instrumental in creating the geospatial standard environment and data framework needed for a more efficient United Nations and will first focus on improving Africa data availability, access to relevant and shared satellite imagery, in order to respond better to the challenges faced by the African continent in the context of recent developments related to the climate change and food security.

**BOX1: COSPAS-SARSAT**

COSPAS-SARSAT is an international satellite-based search and rescue distress alert detection and information distribution system. In the framework of COSPAS-SARSAT, five African countries (Algeria, Madagascar, South Africa, Nigeria and Tunisia) currently provide location-related space-based search and rescue services, particularly for people and transportation systems in danger, for example air crashes, shipwrecks and motor accidents. The search and rescue activities operate on a worldwide basis by providing accurate, timely, and reliable alert and location data to the international community on a non-discriminatory basis. (<http://www.cospas-sarsat.org/>)

**Food security and agriculture**

23. Space technology and applications play a crucial role in promoting agriculture and addressing food security. Farming relies on weather forecasts derived from monitoring satellites. Crop irrigation depends on rainfall and evaporation measurements from satellites. Satellite imagery informs risk assessment of pest and disease threats to crop, while mapping crops from space helps forecasting agricultural yield. Effective use of existing Earth observation information therefore provides tools that enhance the collection, storage, analysis and dissemination of food security information. Remote sensing data, in combination with data gathered in the field, is essential for carrying out comprehensive studies on food security and vulnerability.

24. United Nations entities and programmes, such as the Food and Agriculture Organization of the United Nations (FAO), the United Nations Environment Programme (UNEP) and the World Food Programme (WFP), collaborate with various governmental and non-governmental entities to strengthen information systems to manage food security. WFP and FAO have carried out various initiatives in the framework of the Global Monitoring for Food Security project of the European Space Agency (ESA) in the area of food security in Africa through

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<sup>17</sup> Further information the Second Administrative Level Boundaries data set project can be found at: <http://www.unsalb.org/index.php>

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agricultural meteorology. Three pilot countries - Ethiopia, the Sudan and Uganda – were selected as pilot cases, where a new methodology for estimating cultivated area, using radar data at the beginning of the cultivation season, will be applied.

25. In 2006, WFP, FAO and Global Monitoring for Food Security of ESA installed the GeoNetwork spatial information environment for the Southern African Development Community, the Regional Centre for Mapping of Resources for Development and the Regional Training Centre for Agrometeorology and Operational Hydrology. Following the set-up of the spatial information environment in six WFP regional bureaux and several countries, including Ethiopia and the Sudan, WFP developed the concept of setting up mapping task forces, composed of geographic information system (GIS) practitioners, at the country level, which complemented the mandate of each agency or local institution by sharing knowledge, data and capacity in order to ensure a better understanding of a country's situation.

26. The use of integrated space technology applications for monitoring climate change impact on agricultural development and food security was a subject of a regional workshop, organized by the Office for Outer Space Affairs, the government of Kenya and ESA, held in Nairobi, Kenya, in December 2008. The workshop addressed the prediction, monitoring and early warning of climate-related disasters and environmental hazards, and improvement of regional food security such as sustainable agricultural development, land use and land cover change.

**BOX2: REGIONAL TRAINING CENTRE FOR  
AGROMETEOROLOGY AND OPERATIONAL HYDROLOGY**

UNEP, United Nations Development Programme (UNDP), United Nations Institute for Training and Research (UNITAR), FAO, United Nations Educational, Scientific and Cultural Organization (UNESCO) and World Meteorological Organization (WMO) are supporting the Regional Training Centre for Agrometeorology and Operational Hydrology (AGHRYMET), an institution of the Permanent Inter-State Committee for Drought Control in the Sahel. AGHRYMET works to increase agricultural production in the member countries of the Permanent Inter-State Committee and to improve management of natural resources in the Sahel region by, among other things, producing and disseminating information and providing training in the field of agricultural ecology. (<http://www.agrhymet.ne>)

**Health and sanitation**

27. Through the use of satellite communications, it becomes possible to provide high-quality and cost-efficient health services and medical care to people in areas with non-existent or underdeveloped healthcare infrastructure, in particular in rural areas.<sup>18</sup>

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<sup>18</sup> *Space for Sustainable Development: Contribution of the Committee on the Peaceful Uses of Outer Space to the work of the Commission on Sustainable Development for the thematic cluster 2008-2009*, UNOOSA, A/AC.105/892.

28. Diseases like malaria afflict millions of people each year, especially in Africa. Geospatial science and technology is used by United Nations entities to contribute to the international efforts in monitoring, evaluation and response management, as well as in understanding and characterizing the various environmental-climatic factors, which are known to perpetuate or exacerbate such disease, including temperature, precipitation, moisture, vegetation and land cover types. The World Health Organization (WHO) and WMO share the data from the monitoring of rainfall, temperature, humidity and flooding during the rainy season with the Southern Africa Malaria Control Programme and assist in early detection of and response to malaria epidemics.

29. WHO uses global positioning system (GPS) devices to collect data on the location of households and/or health facilities in various countries. In the context of the malaria control programme conducted in Botswana, Malawi, Mozambique, Namibia, Swaziland, Zambia and Zimbabwe, the location of both types of infrastructure are identified and integrated in GIS to monitor and map the spatial distribution of a number of malaria and other health indicators by household or health facility, which allow a better understanding of the malaria situation in countries and assists in cross-border malaria control. WHO also uses global navigation technology in the context of the Service Availability Mapping initiative<sup>19</sup> to assess and monitor the availability and coverage of health services.

30. In Zambia, a project initiated by WHO, the Research on Equity and Community Health Trust of Malawi and the Southern African Network on Equity in Health<sup>20</sup> has now developed into a capacity-building exercise aimed at addressing the needs in terms of geographic information and GIS capacities to support HIV/AIDS monitoring, evaluation and response. A total of 17 local and international institutions, including WHO and ECA, are now part of a working group that has been created in order to fill the existing gaps. A similar process is also under way in Malawi.<sup>21</sup>

31. The Telemedicine Task Force released a report entitled “eHealth for Sub-Saharan Africa: Opportunities for Enhancing the Contribution of ICT to Improve Health Services” in July 2007.<sup>22</sup> The recommendations from the report were accepted by the European Commission with a view to implementing two pilot projects, “Medical e-content via satellite for the African health work force” and “Satellite-based tele-consultation service for rural areas”, the results of which will form the basis for long-term actions to support the gradual development of an e-health network covering sub-Saharan Africa.

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<sup>19</sup> Further information on the Service Availability Mapping (SAM) initiative can be found at: <http://www.who.int/healthinfo/systems/serviceavailabilitymapping/en/index.html>.

<sup>20</sup> Further information on this project can be found at: [http://www.unsalb.org/SDI/ZMB/GIS\\_HIV\\_ZMB.htm](http://www.unsalb.org/SDI/ZMB/GIS_HIV_ZMB.htm)

<sup>21</sup> Further information on the Malawi project may be found at: [http://www.unsalb.org/SDI/MWI/GIS\\_HIV\\_AIDS\\_MWI.htm](http://www.unsalb.org/SDI/MWI/GIS_HIV_AIDS_MWI.htm)

<sup>22</sup> The Telemedicine Task Force comprises representatives of the European Commission, ESA, WHO, the African Union Commission, the New Partnership for Africa’s Development, the African Development Bank, the Central African Economic and Monetary Area, the Organization of Coordination for the Control of Endemic Diseases in Central Africa, the East African Community, the Economic Community of West African States, and the secretariat of the African, Caribbean and Pacific Group of States. Further information on this initiative can be found at: [http://www.esa.int/esaTE/SEM2UREFWOE\\_index\\_0.html](http://www.esa.int/esaTE/SEM2UREFWOE_index_0.html).

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32. A regional workshop on using space technologies for tele-health to benefit Africa was organized by the Office for Outer Space Affairs in partnership with WHO, ESA, Centre National d'Études Spatiales and the government of Burkina Faso, and was held in Ouagadougou, Burkina Faso, in May 2008. The workshop aimed to raise awareness of the benefits of using space technologies in tele-health, exchange information on the current status of tele-health practices in the Africa region and discuss issues, concerns and approaches in developing tele-health for the region.

**BOX3: AFRICA HEALTH INFOWAY**

The Africa Health Infoway initiative, led by WHO in close partnership with ECA, International Telecommunication Union (ITU), and the African Union Commission, aims to strengthen health information management at the district level in Africa. It covers 53 African countries and is focused on district-level health data collection and processing, as well as on evidence-based decision-making in health. Satellite-based communication and long-distance wireless connectivity are among space-based applications planned for launch in the countries. (<http://www.who.int/africahealthinfoway/en>)

**Protecting and managing the national resource base**

33. Climate change impact is one of the most challenging issues threatening Africa today. ECA aims to use geospatial technology to determine relevant indicators for the evaluation of climate change impact, assess magnitude and level of risk of vulnerable zones, and map African vulnerability. Satellites provide a global view of the dynamic processes on the land, in the oceans and in the atmosphere of our planet. The satellite imagery compiled over many years is a vital resource that allows the detection and monitoring of environmental changes. Satellites provide the “hard evidence” to enforce environmental legislation and serve as a powerful tool to communicate environmental issues to the wider segments of the global society.<sup>23</sup>

34. Many entities of the United Nations system, including UNEP, UNDP, FAO, UNESCO, WHO, the secretariats of the United Nations Framework Convention on Climate Change, the United Nations Convention to Combat Desertification in those Countries Experiencing Drought and/or Desertification, particularly in Africa, and the Convention on Biological Diversity, are involved in the Millennium Ecosystem Assessment, a project that helps meet ecosystem assessment needs by, inter alia, providing tools for planning management, filling data gaps with additional remote sensing information, and assisting in building individual and institutional capacity to undertake integrated ecosystem assessments and to act on their findings.<sup>24</sup>

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<sup>23</sup> *Space Science and Technology for Sustainable Development*, booklet of the National Working Group on Space Science and Technology of South Africa. ([http://www.space.gov.za/downloads/Space\\_Brochure\\_2004.pdf](http://www.space.gov.za/downloads/Space_Brochure_2004.pdf))

<sup>24</sup> Further information on the Millennium Ecosystem Assessment can be found at: <http://www.millenniumassessment.org/en/index.aspx>.

35. Satellite based techniques have proved to be a key source of information for water resources management at local, national and regional scales. ECA uses geospatial technology to address concerns about spatial patterns of water resources (quantity, quality, and balance between multiple uses), surface water body monitoring, seasonal hydrological characteristics assessment, and flood forecasting.

36. The Division of Water Sciences of UNESCO developed a regional strategy for the implementation of national projects in Africa as part of the UNESCO/ESA Earth Observation for Integrated Water Resources Management in Africa/Space Hydrology International Partnership (TIGER/SHIP) project, which is based on the recommendations of the World Summit on Sustainable Development and aimed at building national capacities in water resource management.<sup>25</sup> Other UNESCO initiatives and programmes contributing to the goals of the World Summit on Sustainable Development and, in particular, to the New Partnership for Africa's Development (NEPAD), include the system-wide World Water Assessment Programme; the cross-cutting project on the application of remote sensing for integrated management of ecosystems and water resources in Africa; the open initiative on the use of space technology for the monitoring of World Heritage sites; and the Intergovernmental Oceanographic Commission's Regional Ocean Observing and Forecasting System for Africa.<sup>26</sup>

37. FAO's African Water Resources Database was set up under the guidance of the FAO Inland Water Resources and Aquaculture Service in collaboration with the Land and Water Development Division and the Environment and Natural Resources Service. The database is a GIS-based analytical platform that allows users to visualize and analyse the complex hydrological and ecological relationships within specific river reaches, larger-scale river basins or entire mega-basins.<sup>27</sup>

38. Under the Technical Cooperation Programme of WMO,<sup>28</sup> a number of data collection platforms were replaced or installed in 2004 to collect meteorological and hydrological data via the geostationary meteorological satellites (Meteosat satellites) in Africa. In 47 African countries, satellite receiving ground equipment was replaced to enable them to receive data and products from the Meteosat second-generation satellites.

39. UNEP has issued a number of publications on sustainable development in Africa. Among them is the 2008 publication entitled "Africa: Atlas of Our Changing Environment",<sup>29</sup> which describes environmental change at more than 100 locations spread across every country in Africa. More specific issues in the field of environmental change in Africa are addressed in UNEP's publications "Africa's

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<sup>25</sup> Further information on the Earth Observation for Integrated Water Resources Management in Africa/Space Hydrology International Partnership (TIGER/SHIP) project can be found at: <http://www.tiger.esa.int/>.

<sup>26</sup> Further information on the World Water Assessment Programme can be found <http://www.unesco.org/water/wwap/publications/index.shtml>.

<sup>27</sup> Further information on the FAO's African Water Resources Database can be found at: <http://www.fao.org/fishery/collection/awrd/en>.

<sup>28</sup> Further information on the Technical Cooperation Programme of WMO can be found at: [http://www.wmo.int/pages/prog/tco/index\\_en.html](http://www.wmo.int/pages/prog/tco/index_en.html).

<sup>29</sup> Further information on these two publications of UNEP can be found at: <http://www.unep.org/dewa/africa/AfricaAtlas/> and [http://www.unep.org/publications/search/pub\\_details\\_s.asp?ID=3993](http://www.unep.org/publications/search/pub_details_s.asp?ID=3993).

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Lakes: Atlas of Our Changing Environment”,<sup>30</sup> which presents an overview of the location of the lake resources of Africa and human impact on them. UNEP/GRID-Sioux Falls (United States) also studied rapid environmental changes in Lake Chad in West Africa, highlighted in a publication entitled “Analysing environmental trends using satellite data: selected cases”.<sup>31</sup> Analysing the changes, by examining satellite data over various periods, provided scientific evidence and an early warning of the potential long-term consequences of development decisions.

40. UNEP, ECA and WFP assist the African Ministerial Conference on the Environment in preparing the Africa Environment Outlook report, which highlights the potential of the region’s natural resource base to support the development agenda of the New Partnership for Africa’s Development.<sup>32</sup>

41. The United Nations Institute for Training and Research (UNITAR) Operational Satellite Applications Programme continues its participation in the process, initiated in Lisbon, in 2007, leading to a Global Monitoring for Environment and Security programme for Africa.<sup>33</sup> In 2008, UNITAR Operational Satellite Applications Programme aimed to complete its research partnerships in the area of integrated applications combining Earth observation with telecommunications and navigation systems.

**BOX4: AFRICA ENVIRONMENTAL INFORMATION NETWORK**

UNEP coordinates the technical implementation of the Africa Environment Information Network in response to the request from the African Ministerial Conference on the Environment. The Network focuses on developing an infrastructure and support mechanism for collating and storing geospatial and bibliographic data, harnessing professional skills and expertise to analyse and generate policy-oriented information and using information and communication technologies to communicate that information to decision makers at various levels.

(<http://www.unep.org/dewa/africa/aeoprocess/aein/aein.asp>)

**Land Use and Management**

42. Land use and management are important factors for development in rural areas. Accurate land-use data at the right spatial resolution is a primary source of information for decision makers. Remote-sensing products have wide coverage and are therefore used to produce land-use and land-cover maps as the first step in various applications. Among other things, those data are used to establish rural land

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<sup>30</sup> Further information on this UNEP publication can be found at: <http://na.unep.net/AfricaLakes/>.

<sup>31</sup> Further information on this UNEP publication can be found at:

[http://www.unep.org/publications/search/pub\\_details\\_s.asp?ID=3570](http://www.unep.org/publications/search/pub_details_s.asp?ID=3570).

<sup>32</sup> Further information on the Africa Environment Outlook report can be found at:

<http://www.grida.no/publications/other/aeo/?src=/aeo/>

<sup>33</sup> Further information on the Global Monitoring for Environment and Security programme for Africa can be found at:

<http://www.gmes.info/>.

registers that also help to identify the capabilities and limitations of those land areas.<sup>34</sup>

43. The generation of land-use products using Earth surface classification methods reaps many benefits from the use of specific absorption rate images. Low-resolution satellite data, for example, moderate resolution imaging spectrometer data, advanced very high resolution radiometer data and ancillary data (such as data on precipitation and temperature, climatic maps, land-use maps, topographic and soil maps, life zone maps, vegetation maps and the historical record of droughts) are useful to predict land surface changes and to make recommendations for appropriate and effective interventions for sustainable land management. Satellite imagery can be used to make an inventory of previous landslides and to collect data on relevant parameters concerning, among other things, soil, geology, slope, geomorphology, land use, hydrology and faults. The selection of the most adequate high-resolution satellite data is essential in extracting land surface information.<sup>35</sup>

44. Land degradation affects more than one billion hectares in Africa, which corresponds to a loss of more than nine billion United States dollars per annum across the continent. ECA uses geospatial technology to highlight and assess the trends, effects, and existing interrelationships between various causal factors that contribute to land degradation processes.

45. The United Nations Office on Drugs and Crime (UNODC) and the Government of Morocco have collaborated since 2003 in conducting the surveys of the country's cannabis cultivation and production of cannabis resin. The surveys aim to measure the evolution of the cannabis cultivation in Morocco, define the geographical boundaries of the crop, determine the production of cannabis and of its resin (hashish), analyze the cannabis producers' revenues, and collect socio-economic parameters. The information collected with the help of space technology is essential for the sustainable development of regions, where illicit crops continue to provide a major reliable and profitable source of livelihood. Policy makers can use that information to design alternative development strategies for the region.

46. UNODC will continue monitoring cultivation and production of cannabis in Morocco. The challenge is to explore new sensors that can differentiate crops with adequate spectral and spatial resolutions, with sufficient revisiting time and lower costs, and to find necessary resources to carry out a global survey on cannabis, including in Africa.

47. Launched by the United Nations, the Global Land Cover Network is a global collaborative project to develop a fully harmonized approach to making reliable and comparable baseline land-cover data accessible at the local, national and international levels, especially for the user community in developing countries. Regional collaborative networks have already been established for sub-regions in Africa, the Americas, the Middle East, South-East Asia and Central Asia.<sup>36</sup>

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<sup>34</sup> *Space for Sustainable Development: Contribution of the Committee on the Peaceful Uses of Outer Space to the work of the Commission on Sustainable Development for the thematic cluster 2008-2009*, UNOOSA, A/AC.105/892.

<sup>35</sup> *Space for Sustainable Development: Contribution of the Committee on the Peaceful Uses of Outer Space to the work of the Commission on Sustainable Development for the thematic cluster 2008-2009*, UNOOSA, A/AC.105/892.

<sup>36</sup> Further information on the Global Land Cover Network can be found at: [http://www.glcnet.org/index\\_en.jsp](http://www.glcnet.org/index_en.jsp).

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**BOX5: AFRICOVER**

The entities of the United Nations have been involved in the Africover project, which is part of the Global Land Cover Network and aims to establish a digital geo-referenced database on land cover and a geographic referential (a type of reference map that includes place names, roads and water distribution). Africover is based on Landsat TM and ancillary data for ten African countries - Burundi, the Democratic Republic of the Congo, Egypt, Eritrea, Kenya, Rwanda, Somalia, Sudan, United Republic of Tanzania and Uganda. (<http://www.africover.org>)

**Infrastructure, transport and energy**

48. Infrastructure, transport and energy are important elements in achieving sustainable development. Many African countries face recurring and deepening energy shortages, which are partly linked with the lack of rigorous assessments of energy potential in the continent. ECA uses geospatial technology to map energy potentials in Africa (biofuel production, wind energy, solar exposure, etc.) and assist in planning energy supply and demand. ECA carries out the activities to assist Member States to develop and utilize their geo-information resources (production, management and distribution of geospatial data and products) and promote policies, standards and enabling legal frameworks for spatial information-based decisions. ECA activities cover the following: policies and coordination (assign custodianship responsibilities as appropriate); data (building fundamental, core datasets, thematic data); capacity-building and retention (critical mass of skilled persons); standards and interoperability (common geodetic framework, metadata standard); e-Services (development of online applications and streamlined electronic delivery of products and services to achieve more informed decisions.

49. Under the project “GPS Africa”, the Office for Outer Space Affairs contributes to the deployment of a GPS receiver network in Africa to enable the participation of developing nations in the studies of the Sun and Earth system in the framework of the International Heliophysical Year 2007. The network included the International Heliophysical Year instrument array from International Geodesy System (IGS), Analyse Multidisciplinaire de la Mousson Africaine (AMMA), Scintillation Network Decision Aid (SCINDA) and the African Receivers for Equatorial Electrodynamics Studies (AGREES).

50. The African continent is directly involved in the global navigation satellite systems through the African Reference Frame (AFREF) project,<sup>37</sup> a geodetic project aimed to unify the coordinate reference frames of Africa and which serves as the basis for the national three-dimensional reference networks fully consistent and homogeneous with the International Terrestrial Reference Frame. AFREF is based on current satellite positioning technologies, and forms the geodetic infrastructure for multinational projects requiring precise geo-referencing (e.g. three-dimensional

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<sup>37</sup> Further information on AFREF can be found at: <http://geoinfo.uneca.org/afref/>.

and time dependent positioning, geodynamics, precise navigation, and geoinformation). Like other continental geodetic reference frames, it will be part of the global geodetic infrastructure and is implemented in close cooperation with the international partners with expertise and interest in geodetic reference frames, notably the International Association of Geodesy (IAG), the International Committee on Global Navigation Satellite Systems (ICG) and the Office for Outer Space Affairs. When fully implemented, it will become key to infrastructure, planning and development projects and will include a network of continuous, permanent GPS stations, to which users anywhere in Africa would have free access.

51. Through the AFREF project, ECA works to develop a unified geodetic reference frame for Africa, so that maps and other geo information products can be represented on the same datum. ECA also collaborates with the African Union to prepare a transport infrastructure master plan for Africa. The main objective of the programme of activities is to produce an optimum, integrated all-mode transport infrastructure master plan for Africa. Producing such a master plan requires access to data on all existing and planned networks and corridors of development, including railways, airports, roads, ports, harbours and waterways, and related social economic information. Those transport components need to be depicted in their correct spatial locations and cross-referenced with one another in order to perform a full analysis of all relevant factors. Since there is currently no database containing those necessary data sets, another major objective of the project is to create a database (using remote-sensing and global positioning system techniques) in a geographic information system in order to support the proper planning, design, operation and maintenance of infrastructure facilities.

52. In line with ECA's support for regional priorities defined by NEPAD, several regional geospatial databases are developed to support regional initiatives. The Development in Africa geospatial database covers all existing and planned infrastructure facilities in Africa, including all networks and development corridors for transport infrastructure, as well as power plants and power systems interconnection networks for the power sector. The Agricultural Commodity Value-Chain Database and Interface is an inventory of available data and information resources conducted through an extensive survey involving international and regional partners. The creation of the primary databases on ecological and crop production zones, optimum processing locations, markets and infrastructure is ongoing.

53. The United Nations Geographic Information Working Group (UNGIWG),<sup>38</sup> an informal inter-agency coordination body comprising over 33 United Nations departments, programmes and specialized agencies, continues its efforts to improve through cooperative approaches access to geospatial data on African countries, including transportation infrastructure data. UNGIWG works closely with various private companies and data providers to obtain direct access to geographic data captured through the use of satellite imagery and user-contributed content. Licensing arrangements for that purpose are being negotiated to enable access and

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<sup>38</sup> Further information on the United Nations Geographic Information Working Group can be found at: <http://www.ungiwg.org/unsdi.htm>

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use of such valuable and up-to-date geospatial base data for improved infrastructure mapping.

**BOX6: CONNECT AFRICA**

Connect Africa, launched at a Summit of leaders in Kigali, Rwanda, in October 2007, is a global multi-stakeholder partnership to mobilize the human, financial and technical resources required to bridge major gaps in ICT infrastructure across the region, with the aim of supporting affordable connectivity and applications and services to stimulate economic growth, employment and development throughout Africa. The Connect Africa Summit was organized by ITU, the African Union, the World Bank Group and the United Nations Global Alliance for ICT and Development, in partnership with the African Development Bank, the African Telecommunication Union, ECA and the Global Digital Solidarity Fund. (<http://www.itu.int/ITU-D/connect/africa/2007>)

**Disaster management and emergency response**

54. When disasters strike, different types of satellites are employed to alleviate the suffering of people on the ground. Remote sensing satellites provide the imagery that allows mapping of the extent of the disaster and its impact, resulting in maps which are used to prioritize relief needs and to enable relief workers to locate and reach the victims. Communications satellites are essential for information flow and for relief coordination, when the disaster damages or destroys the ground communications infrastructure. When the disaster renders existing maps ineffective or if it strikes in remote, poorly mapped areas, navigation satellites allow relief workers to establish their location, collect damage assessment data and update existing maps as needed.

55. The International Strategy for Disaster Reduction (ISDR) aims at building disaster resilient communities by promoting increased awareness of the importance of disaster reduction as an integral component of sustainable development in order to reduce human, social, economic and environmental losses caused by disasters. To facilitate disaster risk reduction in Africa, ISDR has established its regional outreach office, ISDR Africa, in Nairobi in 2002, which aims to advance the disaster risk reduction process in Africa in partnership with major stakeholders in the region. With the support from ISDR Africa, NEPAD, Africa Union Commission, African Development Bank, UNDP and UNEP have developed the Africa Regional Strategy for Disaster Risk Reduction to facilitate integration of that Strategy into development programmes of Member States and international organizations.<sup>39</sup>

56. In December 2006, the United Nations General Assembly established, in its resolution 61/110, the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) as a programme to provide universal access to all types of space-based information and services

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<sup>39</sup> Further information on the Africa Regional Strategy for Disaster Risk Reduction can be found at: <http://www.unisdr.org/>.

relevant to disaster management. UN-SPIDER is implemented by the Office for Outer Space Affairs and is mandated to ensure that all countries and international and regional organisations have access to and develop the capacity to use all types of space-based information to support the full disaster management cycle. Several member states, including Algeria, Nigeria and South Africa have already offered to support UN-SPIDER's work with regional support offices, hosted by institutions in those countries. This will promote regional expertise within Africa and foster regional networks to support disaster risk management.

57. In the context of UN-SPIDER, the Office for Outer Space Affairs has supported several awareness raising and networking events in African countries, including those in Ghana, Morocco and Nigeria, and provides technical support to include the use of space-based information into national plans and policy. In 2008, a technical advisory mission was conducted in Burkina Faso to assess the current use of space-based information for disaster management. The expert team provided recommendations on how to improve access to and use of space-base information. A similar mission to Namibia in 2009, followed by a training, helped to improve the use of satellite imagery for flood early warning in the countries flood-prone northern provinces.

58. UNITAR Operational Satellite Applications Programme continues to develop and disseminate satellite-based services and products for humanitarian relief and disaster prevention.

59. ECA continues to focus on the identification of multi-hazard or composite risk hot spots and develop vulnerability mapping and disaster monitoring applications to better understand human and environmental impacts. In Africa, nearly all of the Charter activations were made possible due to the close cooperation among several United Nations entities. The Office for Outer Space Affairs and ECA work closely to ensure that the Charter and other similar opportunities are accessible to all African countries.

**BOX7: THE INTERNATIONAL CHARTER “SPACE AND MAJOR DISASTERS”**

The International Charter “Space and Major Disasters” is an international mechanism through which United Nations entities can request and receive various satellite images, free of cost, to support their disaster response activities in the field. Since its inception in 2000, over 180 activations have been carried out, including 20 of them covering African regions. The Office for Outer Space Affairs acts as a cooperating body of the Charter for the United Nations. (<http://www.disasterscharter.org>)

#### **IV. Outlook for the future**

60. Space science and technology support numerous aspects of the world's sustainable development and provide indispensable tools to achieve better natural

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resources management, assess the interactions between the environment and society, and provide valuable information for humanitarian and peace-keeping operations. Satellites are essential to the sustainable development of Africa: they are crucial in communication, medicine and education; they are used to determine position in space and in time, thus being invaluable for navigation on land, sea and air; and they are vital in Earth observation and remote sensing, in particular in such areas as environmental monitoring, mapping, urban planning, weather prediction, disaster management and relief.

61. As space technology plays an indispensable role in the development of Africa, a growing number of African countries focus on the implementation of national space programmes with a strong developmental emphasis. Significant progress has been made by the region in developing indigenous space-related capabilities. For example, the African space assets dedicated to remote-sensing include those of Algeria (AlSat-1 and AlSat-2), Egypt (EgyptSat-1), Nigeria (NigeriaSat-1 and NigeriaSat-2), and South Africa (Sunsat-1 and Sumbandila). Both Egypt and Nigeria operate communication satellites (NileSat-1, NileSat-2 and NigComSat-1), which contribute to the African integration to the global communication connection. Numerous countries in Africa established national space agencies and coordinating institutions to promote space science and technology. A growing number of space-faring and space-using countries outside Africa have recognized the importance of the African impetus and provided support and assistance to those undertakings.

62. In its efforts to take full advantage of the benefits from space technology, Africa faces various challenges, which are conditioned by three factors. Institutional factors involve the need for more intra- and inter-state coordination and synergies. Technical elements relate to the strengthening of appropriate infrastructure, developing operational environments, setting up archiving and processing facilities, harmonizing spatial data management with common fundamental datasets and geodetic reference. And human factors include the urgency to build critical mass of skilled human resources, which is an essential pre-condition and booster to making progress in space science and technology. There is a need to leverage on the space-related advances so far and develop strategic guidance by raising awareness and making geospatial and space-derived information available to decision-makers and the public at large in a user-friendly format.

63. Building national and regional capacity in space science and technology, as well as space law, is crucial for the African efforts to overcome the above-mentioned challenges. In that context, United Nations-affiliated African Regional Centres for Space Science and Technology Education, located in Morocco and Nigeria, make a valuable contribution to capacity-building in space science and technology and offer programmes in space and atmospheric science, satellite communications, satellite meteorology and global climate, remote sensing and the geographic information system. Two further model curricula are being developed in the area of global navigation satellite systems and space law. The Regional Centres, in cooperation with the Office for Outer Space Affairs, are working to become centres of excellence and regional hubs for bringing socio-economic benefits to all Member States in Africa in terms of education and training, research and policy-making, and application of space science and technology, as well as space law. In addition to the United Nations-affiliated Regional Centres, two regional training

centres in satellite meteorology are operated by WMO in Kenya and the Niger as part of the organization's space-related training activities.

64. Since many of Africa's developmental challenges transcend national boundaries, the collective impact of those national space programmes could be greatly enhanced through regional cooperation and coordination. Regional cooperation and partnerships among African Member States and international entities are essential to promote the use of space science and technology in achieving internationally agreed sustainable development goals and in benefiting from space technology. Strengthened inter-regional and intra-regional cooperation would help African countries develop capacity to utilize space applications for sustainable development.

65. The African Resource Management (ARM) system is a regional initiative that aims to make space more accessible to the final user and is underpinned by four pillars. The first is the ARM satellite constellation, launched by Algeria, Kenya, Nigeria and South Africa, which aims at developing a constellation of satellites for mutual benefit and cooperation in the areas of agriculture, climate, environment, land use, border monitoring, disaster monitoring, water management and health. The second is the ARM application infrastructure that represents a number of applications that can be deployed by each of the African countries supporting one of three priority economic areas: 1) food security, agriculture and coastal zone areas; 2) environmental monitoring, conservation and tourism; and 3) government planning and security. The third is the ARM information services that relate to information products, which are generated by the application infrastructure and need to be distributed to users, and to the user support provided to interpret and use the information. The final pillar is the ARM public awareness that supports the long-term success of using space for the benefit of Africa by ensuring that space stays relevant to daily lives of people.

66. United Nations entities will leverage on existing opportunities and work closely with disaster management agencies in Africa to address the increasing number of natural and man-made disasters. The network of UN-SPIDER Regional Support Offices, currently implemented in Algeria, Nigeria and South Africa, will play a major role in supporting African countries to access and use space-based information. UNOOSA and ISDR will coordinate in the area of risk reduction, and UNOOSA and OCHA in the area of emergency and humanitarian response.

67. In the framework of delivering as one, the United Nations is actively involved in bringing space benefits to Africa, focusing on the following issues: the protection of the environment and management of natural resources; the use of space applications for human security, humanitarian assistance, development and welfare; enabling technologies for development, including information and communications technology and global navigation satellite systems; and capacity-building and education in space applications for sustainable development. The report of the Secretary-General on the coordination of space-related activities within the United Nations system plays an important role in fostering new inter-agency partnerships and promoting synergies and serves as a strategic tool for the United Nations to avoid duplication of effort in the use of space applications and space-related activities. The Inter-Agency Meeting seeks to underline the importance of promoting

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cooperation and finding synergies, as well as contribute to regional efforts including in the African continent in raising awareness among decision-makers and key stakeholders of the role of space science and technology in promoting sustainable development.

68. This report aims to reach out to, and support the efforts of, the African Leadership Conference to raise awareness among African leaders of the importance of space science and technology; provide a regular forum for the exchange of information among African countries; and enhance intra-African cooperation in the development and application of space technology.

69. The Africa Leadership Conference can benefit from establishing strong links with other regional space-related initiatives, such as Asia-Pacific Regional Space Agency Forum (APRSAF), Asia-Pacific Space Cooperation Organization (APSCO), and the Space Conference of the Americas, which have already developed implementation mechanisms. The African Leadership Conference has reached out to the United Nations Committee on the Peaceful Uses of Outer Space with a view to promoting its role in shaping and strengthening the African region's involvement in the global space community. Enhanced regional cooperation should leverage on the opportunities provided by inter-governmental fora, such as the Committee on the Peaceful Uses of Outer Space, because it would not only lead to increased collective outcome but could also strengthen intra- and inter-regional cooperation.

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