UNITED NATIONS OFFICE FOR OUTER SPACE AFFAIRS

PROGRAMME ON SPACE APPLICATIONS

SPACE TECHNOLOGY AND DISASTER MANAGEMENT

A PLAN-OF-ACTION FOR AFRICA

THIS IS A DRAFT VERSION FOR DISCUSSION PLEASE SEND COMMENTS TO david.stevens@unvienna.org

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Space Technology and Disaster Management – A Plan-of-Action for Africa

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INTRODUCTION

Earth observation satellites contribute to providing significant and unique solutions in all disaster management areas: disaster mitigation, disaster preparedness, disaster relief and also disaster rehabilitation. Such solutions are already an integral part of disaster management activities in many developed and even developing countries. Even though national capabilities in the use of space technologies in developing countries are increasing at a significant rate there is still a definite need to support in a more direct way the transfer of these available technologies, while at the same time proposing methodological approaches that are indeed customised and appropriate to the specific needs of the country.

In the development of such methodological solutions all space-based technologies should be considered such as the use of earth observation satellites (including high-resolution imagery), global navigation satellite systems (GPS and GLONASS), and communication and meteorological satellites, while the use of geographic information systems (GIS) provides a structure for integrating the information, contributing to improved planning and decision-making.

The United Nations Office for Outer Space Affairs' (OOSA) approach to contributing to expanding the use of space-based technology for disaster management is to hold a total of 5 Regional Workshops on the Use of Space Technology for Disaster Management, bringing together practitioners and space agencies that have already developed space technology-based solutions and those responsible for dealing with disaster management and also with space technology in developing countries.

The Economic Commission for Africa, within its programme of *Harnessing Information for Development*, implements and supports activities aimed at assisting African Member States to improve the understanding and the use of space-based information technologies for decision-making in the various sectors of development. The Regional Workshop promoted contributes directly to the work ECA has been carrying out in Africa in this area, thus the importance of ECA's involvement not only in organising the workshop but also in the many activities that will result from this gathering of experts.

The Regional Workshop was held in Addis Ababa, from 1 – 5 July 2002 for the benefit of all African Countries. The workshop brought together 120 participants from 44 countries to discuss the potential benefits of using space technology to support disaster management activities in Africa, to determine the types of information and communications needed in managing specific disasters and the extent to which they could be met by space-based technologies, and most importantly to develop a regional plan of action that would coordinate the efforts of the various institutions interested in forming a cooperative network and that would lead in the near future to pilot projects that incorporate and test the use of space-based solutions for disaster management in the region.

The participants represented a wide area of expertise and institutional settings: University Researchers and Professors, Space Agencies, Space Technology Users, Civil Defence Experts, NGOs, UN Agencies and Private Industry.

A total of 58 presentations were made in 15 thematic sessions covering the wide range of current use of space technology for disaster management. Topics ranged from the discussion on the use of earth observation satellites, meteorological satellites, high-resolution satellites, global navigation satellite systems, communication satellites, and geographic information systems. There were also seven discussion sessions held which enabled the further discussion of the main topics that subsequently formed the framework of this Plan-of-Action.

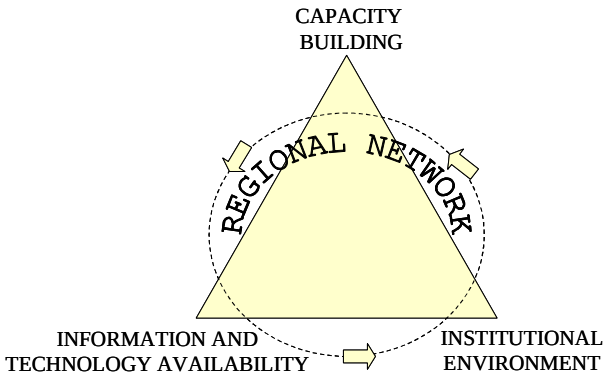
The list of participants and the presentations can be viewed at the following web site:
www.oosa.unvienna.org/SAP/stdm

APPROACH TO ESTABLISHING THE STRATEGY

The thematic and discussion sessions were structured around the 3 cornerstones of an effective plan-of-action: Information and Technology Availability, Institutional Environment, and Capacity Building. A Regional Network was proposed to provide the necessary coordination of the plan-of-action while at the same enabling the sharing of experience and expertise.

The various presentations given at the thematic sessions enabled the understanding of the various issues (conclusions and recommendations) of each cornerstone, whereas during the discussion sessions the participants focused on defining the *modus operandi* of the regional network.

The Figure below shows the relationship between the main components of the Plan-of-Action and the Regional Network.



Information and Technology Availability - Information is derived from data, whereas knowledge is information used within a specific context. Data availability refers to not only having access to the data needed but also refers to receiving the data when it is needed and in a format it can be used. The discussions held at the workshop, and which involved all participants, were centred on the types of data needs, the present availability of data for Africa and finally the difficulties of distributing the data.

There are a number of available technologies: Remote sensing technologies (satellite and photography) which provide data for terrain, land cover, etc, LIDAR devices which are being used to create elevation data for natural landscape features and buildings, ground surveying tools which produce maps for boundaries, and other landscape

elements, governmental censuses and surveys which provide socio-economic data for defined spatial units, global navigation satellite systems which offer a means to obtain positional information for stationary or moving phenomena, wireless telecommunications developments which facilitate inter-personal contacts during disasters., wireless technologies, which provide a means for data logging in the field, and finally Internet products and services for access to and dissemination of data, information and knowledge.

Institutional Environment - Institutional environment refers not only to the existence of institutions that are involved in disaster management or that already have competence in the use of space-based solutions but also refers to the current national and regional policies with regard to disaster management. In this area consideration must be given to existing initiatives in place that will support or contribute to the development of activities that use space-based technologies.

One important aspect when analysing the institutional environment are the communication channels already in place and the strength of the networks and partnerships. Dealing with disasters is a multi-disciplinary activity which involves all sectors of society.

Capacity Building - This final cornerstone of the strategy refers to increasing the current available capabilities of the region through training, institutional strengthening and available funding.

Human resources can be considered the single most important resource to have available during a crisis. The training of enough experts is something that does not happen overnight.

Regional Network – Resources are limited and mechanisms must be put in place to build synergies among institutions, enabling the sharing of expertise and results. As a starting point to a better integration of efforts, at the workshop it was proposed that the institutions define a list of hazards that are concerns in Africa and then indicate their interest in participating or even coordinating activities in each hazard area.

THE ISSUES RAISED AT THE WORKSHOP: RECOMMENDATIONS AND CONCLUSIONS

After 58 presentations and many hours of discussions many valuable points were put forward for further consideration. Each session had a Rapporteur, many of which summarised the relevant points presented. The main points put forward during the workshop were the following:

Information and Technology Availability

The availability and use of spatial data is part of and impacts every aspect of society and should be made available to people who need them, when they need them, and in a form that they can use to make decisions with minimal pre-processing.

Data is usually considered the starting point of any strategy. Even though we all agree that there is an urgent need to update the base map data in many African countries, particularly in those countries that have lost relevant portions of their data infrastructure due to recent disturbances, one must point out that today there are options for accessing free and low-cost data which should be considered. Also archived data should be catalogued and made widely available. Whereas in the beginning of the information technology revolution data was always considered the bottleneck to implementing successful systems, today data is widely available and in many cases for free.

Access to data will be greatly facilitated through the implementation and strengthening of National Spatial Data Infrastructures which will contribute to guaranteeing that all the data will be made available and easily accessible. At the same time it is recommended that all spatial data holdings be publicised through ECA's clearinghouse node (The Standard-Based Geoinformation System Project). This of course determines the need to establish and use metadata standards.

There is a need to increase data sharing. Data sharing can be fostered by federated and distributed databases. An important recommendation is to make sure when acquiring spatial data or compiling a spatial database that all the needs of the present users and also the potential users are being considered.

On the other hand when there is the need to have quick access to remote sensing data, this in most cases will be a very slow process if not an impossible one due to the slow Internet connections presently available throughout the region.

One must always stress that information is only useful when it reaches the end user. The RANET (Radio and Internet) Project is a successful example of how communication satellites can be used to inform the end user, solving the problem of the 'Last Mile Connectivity'. Further information on this project can be obtained at www.ranetproject.net

Even though current data is possible to obtain the same cannot always be said for benchmark/reference data, which is needed as historical data when carrying out impact and/or vulnerability studies.

Also pointed out at the workshop was the need to develop data requirements for each hazard scenario and make these scenarios available to the Regional Network. These data requirements must include considerations for both spatial and temporal characteristics of the data needed.

The last recommendation and perhaps one of the most important ones made at the workshop is to take advantage of initiatives already in place that make spatial data available free of charge to be used for disaster response such as the initiative known as the International Charter Space and Major Disasters which presently involves 5 major space agencies (NOAA, ESA, CNES, CSA and ISRO). Further information can be found on their website: www.disasterscharter.org.

Institutional Environment

Many of the workshop participants stressed that not all countries in the region have institutions that have competence in the use of space-based technologies and there are many countries that do not have a centralised disaster management coordination.

Thus a first step toward strengthening the institutional aspects is to help establish in these countries National Disaster Management Centres that will promote an integrated and co-coordinated system of disaster management, with a special emphasis on prevention and mitigation, by national, provincial and municipal organs of state, pertinent institutions (including NGOs and Universities), other role players involved in disaster management and communities.

Also, to promote an integrated approach to dealing with disasters, specific Working Groups for each type of hazard should be formed at the various levels of government.

When defining activities there is a need to focus on vulnerability; specifically the focus should be on preparedness and prevention and less on emergency response.

In Africa there are many examples of successful regional co-ordination. This was demonstrated by the various examples given at the workshop. This is important, even more so for a region like Africa, because regional co-ordination leads to improvements in the access to satellite data and also in reductions in the cost of data acquisition.

Even so many participants stressed that there was room for improvement especially in the case of disasters that cross international borders such as international boundary rivers that occasionally flood. This indicates the need for strengthening inter-governmental coordination.

Also it was correctly put forward the need to build upon the existing regional networks such as SAFNet and SAWIN[1], strengthening initiatives that have already determined the best *modus operandi* and using the existing channels of communication.

Finally, as always has been the case when proposing alternative approaches to dealing with everyday issues, there is a need to continuously demonstrate the cost-benefit of using remotely sensed data and other space-based technology solutions to decision makers, many of which still have not understood the benefits.

Capacity Building

Capacity building should be aimed at increasing the capability of organisations and individuals to effectively use geospatial information for disaster preparedness, response, and recovery. Technology in general has a role to expand access to information, while geographic information systems technology (realized as databases and software toolboxes) can improve access to information for planning, spatial logistics (for example, evacuation routes) and other purposes, build capacity for understanding, predicting, and problem-solving, in the geospatial domain, and facilitate citizen contributions to disaster awareness and preparedness.

Training should be channelled through the existing regional training centres: the African Centre for Space Sciences and Technology in Morocco, the African Regional Centre for Space Sciences and Technology in Nigeria, the Regional Centre for Mapping of Resources for Development (RCMRD) in Kenya and the Regional Centre for Training in Aerospace Surveys (RECTAS) in Nigeria.

Methodological approaches developed should take into consideration not only using the available satellite data but also combining such information with traditional knowledge which is important for understanding and predicting human behaviour. Local knowledge transmitted in beliefs, taboos, and tales has greatly helped to preserve the environment through generations and should be at the centre stage when developing methodological solutions.

Disaster Prevention and Mitigation requires as a first step, efficient and functional Wide Area Monitoring Information Systems that provide accurate near–real-time information, from multiple sources, that can be easily integrated to produce appropriate products that are easily and freely accessible to all relevant role players.

Partnerships across institutions have to be created so as to maximise the benefit of implementing such systems. Increase networking with space agencies, taking advantage of the CEOS[2] forum, in particular the existing work carried out by the Disaster Management Support Group.

Funding is a major concern. Effort should be made to involve the bilateral and multilateral development agencies, such as USAID and the African Development Bank. UNOOSA has developed a database of funding institutions that could be contacted for funding support.

Implementing the Regional Network

It was proposed at the workshop that the course-of-action to contributing to consolidating the use of space technology for disaster management in Africa should be through the creation of a Regional Network that would

[1] SAFNet is the Southern Africa Fire Network which is part of the Global Observation of Forestry Cover; SAWIN is the Southern African Water Information Network.

[2] CEOS – Committee on Earth Observation Satellites

support the coordination of the efforts of the various institutions interested in forming such a cooperative network and also lead to the definition in the near future of pilot projects that incorporate and test the use of space-based solutions for disaster management.

In the course of carrying out its activities the Regional Network should take into consideration the conclusions and recommendations put forward at the workshop and which have been discussed in the previous sections.

The Regional Network should recognise work already on going, specially the work being developed that already has local commitment. The Network would work primarily using internet and fax, providing information to all interested institutions on the current activities being proposed and/or carried out, and fostering possible partnerships among the different initiatives and interests. Once partnerships have been defined, a further step would be to define pilot projects that these institutions could jointly become involved in. To define the responsibilities of each institution terms of reference of each pilot project should be developed.

Teams would work on a 'best efforts' basis. Each institution would be responsible for its own expense. If additional funding support is needed for satellite imagery and/or hardware/software the team could contact the interested space agencies and/or the bilateral and multilateral development institutions.

The definition of the proposed Regional Network was conducted in a two-step approach. During the first phase institutions defined hazard topics that should be considered as separate areas. Thus the 18 hazard areas listed below were identified.

- Coastal and Marine Systems (Coastal Erosion)
- Desertification and Deforestation
- Earthquakes / Tsunamis
- Epidemiological and Entomological Risk
- Fires
- Floods
- Drought
- Food Security
- Cyclones
- Land Degradation
- Landslides
- Oil Spills
- Plagues
- Pollution
- Refugees
- Transportation Accidents
- Volcano
- Windstorms - Extreme Climate Conditions

The second step of the approach consisted of all institutions demonstrating their interest to participate or even take a coordinating role in each hazard area. A total of 87 institutions demonstrated their interest by showing a 'soft' commitment to participating in one or more hazard areas.

It was agreed as a follow-up to this 'soft' commitment that UNOOSA and ECA would send a letter to each of the 87 institutions presenting the background of this network and inviting each one to formally participate in the interested areas (either as participant or coordinator). A Letter would also be sent to the Government informing of the establishment of the network and the various demonstrated interests. Finally letters will also be sent to space related institutions from the international community. Once pilot projects have been defined letters will also be sent to funding institutions to secure their participation.

FINAL THOUGHTS

As the world witnesses an interminable succession of disasters – floods, storms, earthquakes, landslides, volcanic eruptions and wildfires - the topic is becoming a growing concern. The number of people that are at risk has been growing steadily by 70 to 80 million per year [1]. Decisions not made today and actions not taken tomorrow will directly impact these populations that are or will be at risk.

Space-based technology has a real contribution to make to help tackle all areas of disaster management and steps should be taken today to ensure the gradual use of what is currently available. Perhaps the establishment of the Regional Network in Addis Ababa has been the easiest step of this long journey, albeit the most important one.

It is now up to the 87 institutions that have demonstrated their interest in getting involved, plus all the other institutions that will be given the opportunity to join, to take advantage of these cutting-edge technologies and come up with and implement the solutions to the pressing disaster threats that are everyday reality in Africa.

ACKNOWLEDGMENTS

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Table 1: Space Technology and Disaster Management – Regional Network for Africa

INSTITUTION	Earthquakes / Tsunamis	Floods	Drought	Coastal and Marine Systems (Coastal Erosion)	Epidemiological and Entomological Risk	Desertification and Deforestation	Oil Spills	Food Security	Cyclones	Land Degradation	Fires	Plagues	Windstorms - Extreme Climate Conditions	Pollution	Refugees	Volcano	Landslides	Transportation Accidents
EASTERN AFRICA																		
ALRMP (Kenya)		P	C		P					C	P							
Dept of Surveying - University of Nairobi (Kenya)			P		P					C				C	P			
Dept. of Geology - University of Nairobi (Kenya)	C	P								P						C	C	
Dept. of Meteorology - University of Nairobi (Kenya)		P	P			P		P	P	P			P	C	P			
DIMARSI (Sudan)		P	C			P		C	P	P					C	P		
Disaster Management Dept. (Tanzania)	P	P	P								P				C	P	P	C
DMC (Rwanda)		P	P													P		
DOM (Uganda)		P	P					P		C								
EMA (Ethiopia)		C	P		P	C		C		C	C			P	C		P	
HAC (Sudan)		P	P		P	C		P	P		P				P			
JKUAT (Kenya)						C		C		P								
Meteorological (Kenya)		C	C					P	P									
NDOC (Kenya)	P																	
NEMC (Tanzania)		P	P	**C**		P	C	P		P				C				
NMSA (Ethiopia)		P	P			P		P	P		P		P	P				
TDHD (Kenya)	P	P	P			P								P	P	P		
UCLAS (Tanzania)			P	P				P		C								C
USIU – Nairobi (Kenya)			P					P		C				P	P			
NORTHERN AFRICA																		
CDA (Egypt)	P	P	P	P	P	P	P											
CNTS (Algeria)		P	C	P		C	P											
CRTS (Morocco)	P	P	P			P	P											
NARSS (Egypt)	P	P	P	C	C	P	C											
SOUTHERN AFRICA																		
ARC/ISCW (South Africa)		P	C	P	P	P		C		C	P		P	C			C	
DOC/ISSA (South Africa)		P	P	P		P	C			P	P							
Met (Zambia)		P	P		P	P		P	P	P	P		P	P			P	
NDMC (South Africa)		P	P	C	C	C	P	P	C	P	P		C	P			P	
SAC (South Africa)		C	P	P		P	P	P	P	P	P		P	P	P	P	P	
SAFNET (Botswana)											C		P	P				
SG (Malawi)		P	P	P		P		P	P	P	P			P			P	
UCM- GIS Centre (Mozambique)		P	P	P	P			P	P	P	P			P				
WESTERN AFRICA																		
ABE (Bénin)		P																
ACEI (Ivory Coast)		P	P	P	P	P				C	P			P	C			
BNETD (Ivory Coast))		P	P	P	P	P				P	P		P					
CENAGREF (Bénin)											P							
CENATEL (Bénin)			P								P							
CERSGIS (Ghana)		P	P	P		P								P				
CNRA (Ivory Coast)			P			P				P								
CNTIG (Ivory Coast)		P	P	P		P					P							
CSE (Senegal)		P	P	P	P	P					P							
DFRN (Benin)			P			P					P							
DPC (Mauritania)		P	P	P		P					P		C					
DPT GEO - Université Burkina Faso (Burkina Faso)			P			P				P								
ENSP (Cameroon)		P		P										P				
EPA (Ghana)		P	P	P		P								C				

INSTITUTION	Earthquakes / Tsunamis	Floods	Drought	Coastal and Marine Systems (Coastal Erosion)	Epidemiological and Entomological Risk	Desertification and Deforestation	Oil Spills	Food Security	Cyclones	Land Degradation	Fires	Plagues	Windstorms - Extreme Climate Conditions	Pollution	Refugees	Volcano	Landslides	Transportation Accidents
IMPM (Cameroon)					P													
INC (Cameroon)																	P	
INRA (Benin)			P								C							
IP (Senegal)					P													
IRAD (Cameroon)								P									P	
IRGM/CRH (Cameroon)		C	P	C		P	P			P				P		C	C	
IUT (Cameroon)		P		P														
LTA/IST/UCAD (Senegal)		C	P	P	P		P									P		
Ministry of Environment (Nigeria)		P	P	P	P	P	P									P		
Ministry of Rural Development (Mauritania)			P					P			P							
Ministry of Water Resources (Nigeria)		P		P												P		
NASRDA (Nigeria)		P	P	P	P	P	P						P			P		
NEMA (Nigeria)		C	P	C		P	C						P					
NNPC and DPR (Nigeria)							C											
OCEAC (Cameroon)					P													
SIGET_A (Burkina Faso)		P	C		C	P		C		C	P							
SODEFOR (Cote d'Ivoire)			P			C												
UDS (Cameroon)																	P	
UIGIS Lab (Nigeria)		P	P	P	P	P	P						P					
REGIONAL INSTITUTIONS																		
AGRHYMET		C	C	P		C		C		C	C	C		P				
DMCN (Eastern Africa)		C	C	P	P	P	P		C		P		C	C			P	P
NBA (Niger Basin Authority)		P	P															
Oakar Services Ltd. (Kenya)																		
RCMRD (Eastern Africa)		P	P		P	C		C		C	P			P	P		P	
RECTAS						P				P								
SADC		C	C	P	C	C	P	C	C	C	C							
OTHER INSTITUTIONS																		
Aerospace Geomatics Ltd (Germany/Nigeria)		P	P			P	P			P								
Avanti Communications (UK)	P	P		P			P		P		P				P			
CNES (France)	P	P	P													P		
Cranfield University (UK)		P	P			P		P		P	P							
CRPSM - Univ. of Rome (Italy)	P	C	C	C		C	P		P	P	C		P	P		P	P	
DLR (Germany)		P	P							P								
Global FireMonitoring Centre (GFMC)											C							
International Water Management Institute (Sri Lanka)		P	P			P		P		P								
RadarSat (Canada)		P																
Scot (France)		P	P			P		P		P								
Surrey Space Centre (UK)		P	P			P												
The Open University - Dept Earth Sciences (UK)		P	P							P								
University of Jena (Germany)		P	P							P								
Vienna University of Technology (Austria)		P	P															
UN AGENCIES																		
DMC (Rwanda)																		
DPKO																		
UNHCR								P		P					C			

Institution offering to Participate =	P
Institution offering to take on a Coordinating Role =	C