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Technical Advisory Mission

Bangladesh

19-23 June 2011

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(UN-SPIDER)

Report of the

Technical Advisory Mission

to

Bangladesh

19 – 23 June 2010

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- Masaru Arakida, Asian Disaster Reduction Centre (ADRC), Kobe, Japan
- Roy P.S., Centre for Space Science Technology Education in Asia and the Pacific (CSSTEAP), Dehradun, India
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The boundaries, names and designations used in this report do not imply official endorsement or acceptance by the United Nations.

TAM expert team with the officials from DMRD

This report has not been formally edited

Abbreviations

ADRC	Asian Disaster Reduction Centre
BBS	Bangladesh Bureau of Statistics
BMD	Bangladesh Metrological Department
BTRC	Bangladesh Telecommunication Regulatory Commission
CDMP	Comprehensive Disaster Management Program
CEGIS	Centre for Environmental and Geographic Information Services
CPP	Cyclone Preparedness Program
CSSTEAP	Centre for Space Science and Technology Education in Asia and the Pacific
DMB	Disaster Management Bureau
DMRD	Disaster Management & Relief Division
DRR	Directorate of Relief and Rehabilitation
FFWC	Flood Forecasting and Warning Centre
GIS	Geographical Information System
GPS	Global Positioning System
ISDR	International Strategy for Disaster Reduction
IWM	Institute of Water Modelling
LGED	Local Government Engineering Department
MOD	Ministry of Defence
MoFDM	Ministry of Food and Disaster Management
NDRCC	National Disaster Reduction Centre of China
OCHA	Office for Coordination of Humanitarian Affairs
SoB	Survey of Bangladesh
SPARRSO	Space Research and Remote Sensing Organization
SUPARCO	Pakistan Space and Upper Atmosphere Research Commission
TAM	Technical Advisory Mission
UNDP	United Nations Development Programme
UN-SPIDER	United Nations Platform for Space-based Information for Disaster Management and Emergency Response

About UN-SPIDER

In its resolution 61/110 of 14 December 2006 the United Nations General Assembly agreed to establish the **"United Nations Platform for Space-based Information for Disaster Management and Emergency Response - UN-SPIDER"** as a new United Nations programme, with the following mission statement: *"Ensure that all countries and international and regional organizations have access to and develop the capacity to use all types of space-based information to support the full disaster management cycle"*.

UN-SPIDER aims at providing **universal access** to all types of space-based information and services relevant to disaster management by being a **gateway** to space information for disaster management support; serving as a **bridge** to connect the disaster management and space communities; and being a **facilitator** of capacity-building and institutional strengthening.

Whereas there have been a number of initiatives in recent years that have contributed to making space technologies available for humanitarian and emergency response, UN-SPIDER is the first to focus on the need to ensure access to and use of such solutions during all phases of the disaster management cycle, including the risk reduction phase, which will significantly contribute to reducing the loss of lives and property.

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Executive Summary

Based on the invitation from the Government of the Republic of Bangladesh, through Disaster Management and Relief Division, the UN-SPIDER technical advisory mission to Bangladesh was carried out from 19 to 23 June 2011. The key objectives to visit Bangladesh were to assess national capacity and evaluate disaster and risk reduction activities, policies and plans with regard to the use of space-based technologies and to facilitate access of national institutions to space-based information to support full cycle of disaster management. The mission team comprised of 8 experts from the organizations representing UN-SPIDER, NDRCC, UNOCHA, ADRC, CSSTEAP, SUPARCO and APSCO.

The mission team held discussions with the key stakeholders within the Government and UN Offices. The mission team visited eleven key stakeholders namely Disaster Management Bureau (DMB), Directorate of Relief and Rehabilitation (DRR), Centre for Environmental and Geographic Information Services (CEGIS), Bangladesh Meteorological Department (BMD), Space Research and Remote Sensing Organisation (SPARSO), Comprehensive Disaster Management Programme (CDMP), Survey of Bangladesh (SOB), Cyclone Preparedness Programme (CPP), Institute of Water Management (IWM), Flood Forecasting and Warning Centre (FFWC), Bangladesh Telecommunication Regulatory Commission (BTRC) and Early Recovery Facility (ERF) of UNDP. The mission team was received by the heads and senior members of the organisations/departments and provided opportunity to have discussions at length.

On 21 June, UN-SPIDER, MoFDM and CDMP organised a one day workshop bringing together over 60 representatives from various government and UN agencies to discuss cross cutting issues related to use of geographic and space-based information for disaster risk reduction and emergency response. The workshop was inaugurated by His Excellency Minister of Food and Disaster Management. On last day, wrap-up meeting with key stakeholders was organized and outcomes of the TAM and follow-up actions were discussed. The wrap-up meeting ensured that observations and recommendations of the mission team are shared outcomes of all stakeholders as well.

The policy level issues and constraints were addressed in order to ensure that space technology becomes an integral part of disaster management, especially given the country's geographical location that makes it prone to frequent flooding and cyclones. Additionally, the team carried out an in-depth evaluation of the technical aspects (data, information management, institutional linkages, capacity in the country etc.) to ensure prescription of

relevant, appropriate and sustainable technological applications that would foster effective disaster management.

Following are the key recommendations of the report:

- Policy: Update National Plan for Disaster Management (NPDM) and Standing Orders on Disaster (SOD) to mention use of space-based information and technology into the disaster management framework for improved capabilities of risk management and emergency response.
- Coordination: Enhance coordination between organisations of MOD (technology providers) and MoFDM (technology users) thus ensure working level cooperation among DMB, DRR, SPARRSO and BMD with sole purpose of considering space based resources as a common resources for the purpose of disaster management and ensuring that space technology providers provide services directly to the end users.
- Awareness raising and capacity building: Frequent awareness raising programmes for decision makers to strengthen institutional preference to utilize the space based information to support the disaster management. In addition, capacity building at DM institution is required to develop interface between the technology provider organisations and DM institutions. For example, appropriate capacity in DMB will be able to leverage upon the services offered by SPARRSO, BMD and other organisations like CEGIS.
- Information management and sharing: Develop data and information sharing policies, standards and coordination mechanism for supporting DM at national level based on the notion that data is a national property and need to be shared openly, particularly in the event of disaster. To facilitate data sharing, the data catalogue and sharing platform should be created based on existing resources. Information product should cater precise requirement of the end users.
- Data access: Access to National Spatial Data Infrastructure (NSDI) templates, baseline data and operational disaster related databases to all stakeholders. The access should ensure timely availability of appropriate satellite data and geospatial data and strong data policy to conform with the data standards and formats.
- Emergency Communication: Provision of the satellite based emergency communication systems to be stationed in Bangladesh. Satellite Communication technology should be utilized to train CPP volunteers. Provision of standby assets like flyway terminals, satellite telephones, mobile terminals and back up power sources.

1. Introduction

On 25-28 October 2010, the Fourth Asian Ministerial Conference on Disaster Risk Reduction through Climate Change Adaptation (4AMCDRR) was hosted by the Government of the Republic of Korea and the United Nations International Strategy for Disaster Reduction (UNISDR). Sixty-two ministers and officials from disaster management authorities from the Asia-Pacific region gathered and discussed the main theme of the conference, "Disaster Risk Reduction through Climate Change Adaptation". The delegation from the Government of Bangladesh led by Mr. Mohammad Abdul Wazed, Joint Secretary, Disaster Management & Relief Division (DMRD) of MoFDM participated in the conference and interacted with the UN-SPIDER about employing space technology to strengthen disaster management efforts in Bangladesh.

Following this conference, on 27 February 2011, the Government of Bangladesh through Disaster Management & Relief Division of the Ministry of Food and Disaster Management, invited UNOOSA to carry out the Technical Advisory Mission (TAM) in the framework of UN-SPIDER programme. The mission was carried out to evaluate the strengths and challenges related to the access and use of use of space technologies and space-based information for effective disaster management in Bangladesh. The overall objectives were to strengthen disaster risk management capabilities of Bangladesh by proposing recommendation to the government to improve their capacities to access and utilize the space-based information in cooperation with UN-SPIDER.

The team conducting the UN-SPIDER technical advisory mission to Bangladesh from 19 to 23 June 2011 included 8 experts from the following organisations:

- Shirish Ravan, UN-SPIDER, UNOOSA, Beijing
- Li Suju, UN-SPIDER, UNOOSA, Beijing
- Yang Siquan, NDRCC, Beijing
- Masaru Arakida, ADRC, Kobe
- Roy P.S., CSSTEAP, Dehradun
- Imran Iqbal, SUPARCO,
- John Marinos, UNOCHA ROAP, Bangkok
- Sampoch, APSCO

Thus, the team possessed a wide range of expertise and in-depth knowledge covering areas such as disaster management, climate change, geo-spatial technologies, current trends in space technologies, and issues in the developing countries in Asia related to the capacity building, information management, and disaster management planning and policies.

UN-SPIDER Technical Advisory Support

Technical Advisory Support (TAS) is one of the prime activities of the UN-SPIDER programme at the national level. It serves to identify the existing capacity to use space-based information, analyzing the institutional framework to support disaster management through space-based information and identifying the limitations. TAS attempts to enable the government to overcome current limitations regarding the use of space-based information for disaster management. It also deals with international cooperation and regional opportunities, networking with regional institutions, and setting up disaster management plans. It covers region-specific aspects such as trans-boundary issues, emergency response, risk assessment, GIS based disaster management systems, and disaster risk reduction.

Technical Advisory Support could range from a simple consultative phone call to full-fledged in situ technical support. It often materializes in any of the following three forms:

- Technical Advisory Missions involving experts from various space and disaster management agencies and countries under the umbrella of one mission.
- Technical advice to national institutions by means of meetings, teleconferences, video conferences etc.
- Facilitating direct cooperation between national institutions and satellite imagery providers

Technical Advisory Missions have to be requested by the respective national government. They typically generate:

- Reports with recommendations and follow up action
- Guidelines/policies on disaster management issues, emphasizing the use of space-based information in all stages of disaster management
- Facilitation for capacity building in collaboration with UN-SPIDER and partner organizations
- Partnership for developing emergency support mechanism

2. Objectives of the mission

During the preparation stage, the UN-SPIDER mission team interacted with the officials from DMRD to develop terms of references of the mission to define objectives of the mission. They included following:

- to assess national capacity and evaluate disaster and risk reduction activities, policies and plans with regard to the use of space-based technology;
- to assist in the definition of risk and disaster management plans and policies with regard to the use of space-based technology;
- to facilitate national institutions' access to space-based information to support disaster risk reduction and emergency response activities;
- to identify training needs and facilitate the implementation of capacity building activities; and
- to identify possible risk reduction and emergency response activities using space-based technology.

The mission team is confident that it gained sufficient insight into the disaster management situation and use of space-based technology in Bangladesh that informed the conclusions and recommendations presented in this report. The mission benefited from the excellent support of the local counterpart, the Disaster Management & Relief Division, Ministry of Food & Disaster Management.

It is expected that recommendations of this technical advisory mission will offer long-term support to the Government of Bangladesh through:

- linking national disaster management authorities with the geospatial community within the country/region;
- promoting data sharing (with focus on spatial data and space-based information) within institutions to benefit the disaster management community;
- contributing to the enhancement of disaster management plans and policies by mainstreaming the use of space-based information in all stages of disaster management;
- providing access to satellite-based information and solutions during emergency response;

- offering opportunities to strengthen participation in existing networks and communities of practice.

As is the case in many developing countries, it was apparent that the current use of space-based technology could benefit from an increased attention within the government, which in turn would contribute to ensuring a wider provision of relevant information for disaster risk reduction, strengthen early warning systems and monitor disaster's impact to provide effective emergency response. The mission aimed at improving this state by engaging the key stakeholders involved in providing the technology solutions and disaster managers. Based on interactions between the team of experts and officials of the Government of Bangladesh the following were the expectations from the mission:

- addressing space-based information in the national legislation to contribute to disaster risk reduction in the framework of Hyogo Framework of Action;
- strengthening early warning system through incorporation of appropriate space technology;
- creating bilateral and multi-lateral initiatives for capacity building ;
- defining mechanisms to bridge the disaster management community and providers of geospatial technology;
- establishing and strengthening networks between the Government and regional and global organisations;
- sharing experiences and best practices with other countries;
- advising on modern applications of earth observation technology, especially crowd sourcing, global datasets, international initiatives and tools for disaster management.

3. Mission activities at a glance

The mission team spent 5 days in Bangladesh from 19 to 23 June 2011. Prior to the mission, UN-SPIDER had in-depth interactions with the governmental counterpart, Disaster Management and Relief Division (DMRD), to develop technical aspects of the advisory mission. The DMRD conducted several coordination meetings with their stakeholders to plan discussion sessions with expert team and set the right momentum prior to start of the TAM. The country profile compiled by the DMRD provided insight into the framework and efforts related to the disaster management in the country and the current status of using space-based information for risk and disaster management.

The TAM team visited totally 11 key stakeholder agencies to have detailed discussions about their role in disaster management and their views about use of space technology usage in their day to day work. One day workshop was organized on third day of the TAM with participation of over fifty participants from key stakeholder agencies. On the last day, the TAM team briefed outcomes of the TAM to the key officials in a wrap-up meeting chaired by the Deputy Secretary of MoFDM. The core team of TAM had long discussion session at the end of each day to reflect upon their observations and findings of the day.

The activities by day are as follows:

Day1: 19 June, 2011, Sunday

Visit to the host organization (DMRD) and meeting with the Joint Secretary of DMRD: The Joint Secretary provided an overview of the disaster situation, institutional framework and coordination, best practices and the status of using space-based information for disaster management. The relevant issues concerning the TAM, including the expectations, were discussed.

Visit to Disaster Management Bureau (DMB) and meeting with Director General of DMB: The DG provided overview on role of DMB on reducing the vulnerabilities and the projects undertaken in this regard. The early warning efforts were highlighted.

Visit to the Center for Environment and Geographic Information Services (CEGIS) and meeting with Executive Director of CEGIS: The executive director presented a brief on the projects implemented by CEGIS that provided critical inputs to the disaster reduction efforts. He also highlighted the nation-wide geo-database developed by

CEGIS and demonstrated capabilities of CEGIS to undertake studies to support disaster reduction efforts by employing GIS and remote sensing technologies.

Visit to Directorate of Relief and Rehabilitation (DRR) and meeting Director General of DRR: The presentation from DG explained the organization contexts, focus areas, operational programs and the challenges.

Day2: 20 June, 2011, Monday

Visit to Bangladesh Meteorological Department (BMD) and meeting with Director: The constraints related to the technical manpower, observations systems and space technology resources were discussed. There is urgent need to close gap between technology organizations and decision makers by generating awareness at higher level in the Government. The team also visited the infrastructure of BMD.

Visit to Space Research and Remote Sensing Organisation (SPARRSO) and meeting with the Chairman: SPARRSO is an official government agency to deal with space related matters. SPARRSO presented information the existing infrastructure such as ground receiving stations and explained their role in providing space-based solutions for disaster management.

Visit to the office of Comprehensive Disaster Management Programme (CDMP): The detailed activities of the programme were presented. The activity related to the Disaster Management Information Platform captured attention of TAM experts. The programme has attempted to use GIS and plans to use space-based information. The programme is appropriately placed to demonstrate full capabilities of space technology in disaster management in Bangladesh.

Visit to the Survey of Bangladesh (SoB): The Surveyor General of SoB explained ongoing efforts of SoB to update topographical maps using recently acquired aerial photograph for entire Bangladesh. A role of SoB in setting up National Spatial Data Infrastructure (NSDI) was discussed in detail. `

Day3: 21 June,2011, Tuesday

Technical workshop on use of space technology for disaster risk reduction: The workshop was attended by over 50 persons from the Government, non-government, Academia and UN organisations involved in disaster management and potential users of geospatial technologies. The workshop was inaugurated by the Hon'ble

Minister of MoFDM, Dr. Mohammad Abdur Razzak and chaired by Chairman, SPARRSO. The SPARRSO and UN-SPIDER delivered keynote presentations which were followed by the speeches by the Additional Secretary of DMRD and Honourable Minister of MoFDM. DMRD, BMD, CEGIS, CDMP and FFWC & IWM gave technical presentations to present national scenario. The presentations from TAM experts (NDRCC, UNOCHA, CSSTEAP and ADRC) covered the best practices, information management needs, technological advances and regional/international initiatives. The second half of the workshop was an interactive session to get inputs from participants on the issues related to strengthening use of geospatial technologies in disaster management. The workshop was not only effective in generating awareness, but participants also provided valuable inputs on how the application of space technologies can be strengthened in disaster management in Bangladesh.

Day4: 22 June,2011, Wednesday

Visit to Cyclone Preparedness Program (CPP) office: The CPP background, organization structure and ongoing activities were presented. The early warning equipment were also demonstrated to the TAM members.

Meeting with the Chairman of Bangladesh Telecom Regulatory Commission (BTRC): The discussion was focussed on the plans of BTRC for emergency telecommunication considering experiences during the past disasters.

Visit to IWM & FFWC office: The IWM demonstrated the flood forecast and risk assessment models and products. A flood scenario modelling was also demonstrated as one of the research outcomes of IWM.

Visited Early Recovery Facility (ERF) of UNDP to get appraisal of the programme.

Day5: 23 June,2011, Thursday

Wrap up meeting with the all stakeholders to present outcomes of the TAM: The meeting was chaired by Secretary-of DMRD. The meeting was attended by over 20 senior representatives from the key stakeholder departments including the CDMP, BMD, DRR, DMB and SPARRSO. The outcomes of the TAM were presented and follow up activities were discussed. All the stakeholders had consensus on urgent action of improving coordination between different agencies to enhance the capability of using space based information for disaster management in Bangladesh.

4. Observations of Mission team

4.1 Disasters and disaster risk in Bangladesh

Bangladesh is a disaster-prone country. It is located at the fragile deltaic flood-plain in South Asia formed by the Ganges, the Brahmaputra and the Meghna rivers, surrounded by India, Myanmar and Bay of Bengal. More than 310 rivers(57 Trans boundary rivers) and tributaries have made the country a land of rivers. About 80% of its total areas is floodplains. There are around 165 million (up to 2010, Population Reference Bureau) people in Bangladesh within its 147,570 sq.km territory, which makes the population density of about 1100 per km^2 . The major and frequently occurred natural hazards are flood, tropical cyclone, storm surge, tornado, river bank erosion, drought, earthquake, arsenic and fire.

Floods: Floods are annual phenomena, with the most severe occurring during the months of July and August. Regular river floods affect 20% of the country, increasing up to 68% in extreme years. The flash floods, rain floods, monsoon floods and coastal floods are four types of flooding occur in Bangladesh.

Cyclones and storm surges: Tropical cyclones from the Bay of Bengal accompanied by storm surges are one of the major disasters in Bangladesh. The country is one of the worst sufferers of all cyclonic casualties in the world. The cyclone usually cause high number of casualties which is due to the fact that cyclones are always associated with storm surges. The surge height in excess of 9m are commonly experienced.

Tornado: Tornado usually occurred during two transitional periods between southwest and northeast monsoons over the Indian sub-continent, which referred to as pre-monsoon (March to May) and post-monsoon (October to November). The tornadoes usually cause lots of havoc and destruction and is difficult to forecast the location and occurrence.

River bank erosion: River bank erosion is one of the major hazards in Bangladesh due to high river density and morphologically dynamic nature. It's usually an ongoing disaster with devastating calamities and dramatic consequences in the lives of people affected. During 1973 to 2004, the bank erosion along Padma river and Jamuna River were 29,390 hectares and 87,790 hectares respectively, which caused severe destruction of housing and infrastructures.

Earthquake: Bangladesh and the north-eastern Indian states are considered seismically active regions. The record of approximately 150 years shows that Bangladesh and the surrounding regions experienced seven major earthquakes.

Table: Bangladesh Natural Disasters from 1980 - 2010

No of events	234
No of people killed	191,836
Average killed per year	6,188
No of people affected	323,480,264
Average affected per year	10,434,847
Economic Damage (US$ X 1,000)	17,072,500
Economic Damage per year (US$ X 1,000)	550,726

Source: http://www.preventionweb.net/english/countries/statistics/?cid=14

Table: Natural Disaster Occurrence Reported

Year	Disaster	Death
1970	Cyclone	300,000
1988	Flood	2,373
1988	Cyclone	5,704
1991	Cyclone	138,868
1996	Tornado	545
1997	Cyclone	550
1998	Flood	918
2004	Flood	747
2007	Flood	1,071
2007	Cyclone(SIDR)	3,406
2009	Cyclone	190

Source: http://www.preventionweb.net/english/countries/statistics/?cid=14

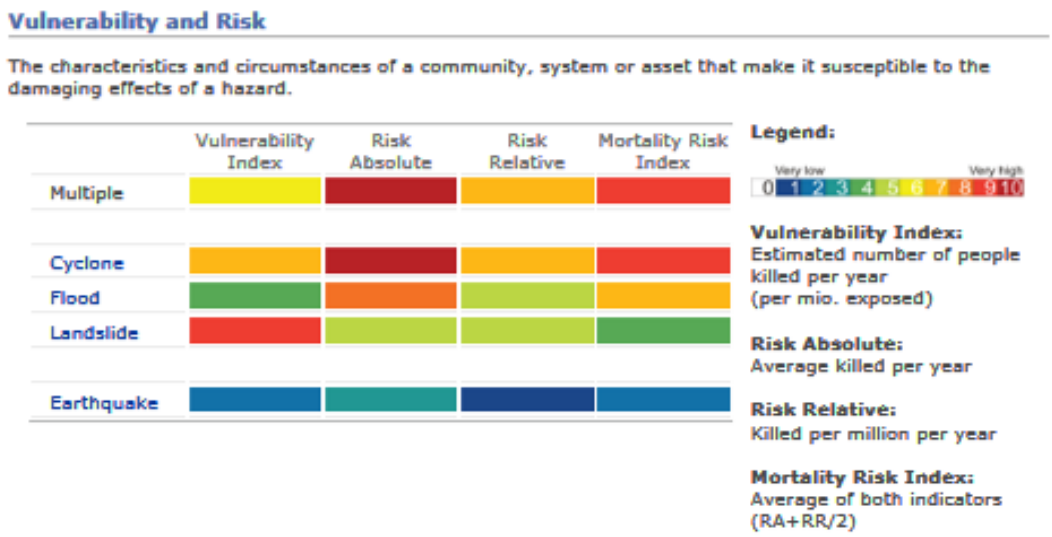
Drought: There are three types of drought in Bangladesh , namely permanent drought, seasonal drought and unpredictable drought. Due to inadequate and uneven rainfall, Bangladesh faces unpredictable drought hazard in the dry monsoon. Drought affects

seasonal crops, fruit bearing tree, forestry and the environment as a whole. In the past droughts have typically affected about 47% area of the country and 53% of the populations.

Arsenic contamination, salinity intrusion, tsunami, fire, infrastructure collapse and landslide are other hazards faced by Bangladesh.

Disaster Risk and Climate Change: The natural factors such as geographical location, land characteristics, multiplicity of rivers and the monsoon climate render Bangladesh highly vulnerable to natural hazards. Additionally, although some social indicators have achieved substantial improvements, there are 40% of the population still live below the poverty line and near two thirds of Bangladeshis are employed in the agriculture sector. According to the 2009 Global Assessment Report on Disaster Risk Reduction, Bangladesh is facing high disaster risk. The mortality risk index for multiple disasters and cyclone are all 10, which is the highest index.

Figure: Vulnerability and risk of Bangladesh



Source: http://www.preventionweb.net/english/countries/statistics/risk.php?cid=14

Bangladesh is currently ranked as the most climate vulnerable country in the world according to the Fourth Assessment Report of UN Intergovernmental Panel on Climate Change (IPCC). The production of rice and wheat might drop in Bangladesh by 8 percent and 32 percent respectively by 2050. Impacts of climate change are visible in Bangladesh in the form of temperature extremes, erratic rainfall and increased number of intensified floods, cyclones, droughts, prevalence of rough weather in the Bay. As the

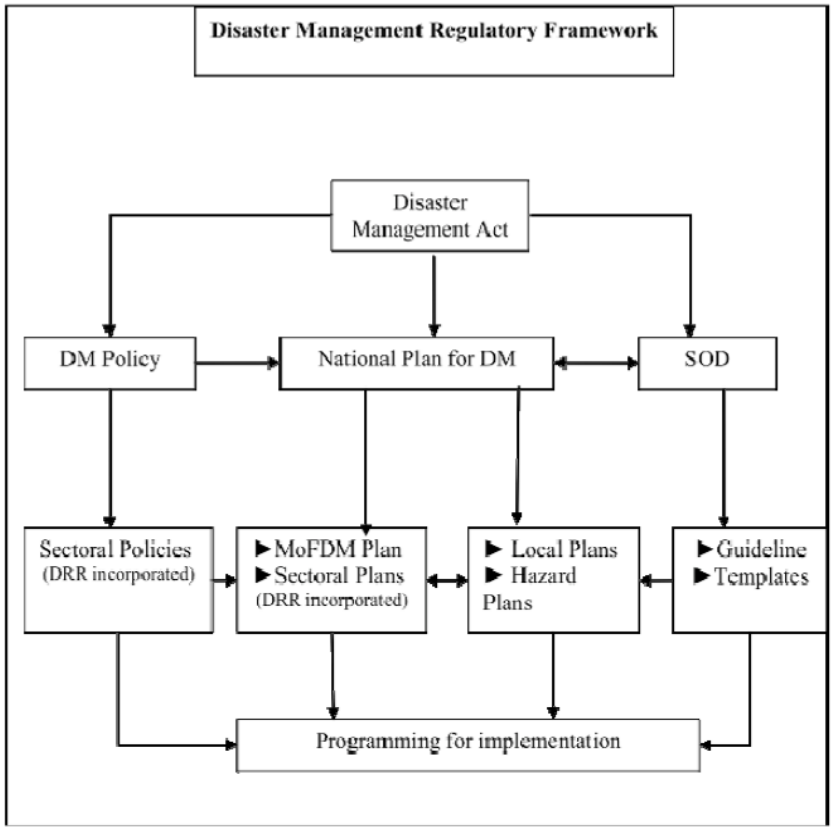
climate change progresses, it will have negative impact in Bangladesh which may result in the increased disaster risk (Global Assessment Report, 2011).

Weather factors that contribute to disasters

Natural hazards by themselves do not cause disasters – it is the combination of an exposed, vulnerable and ill prepared population or community with a hazard event that results in a disaster. Climate change will, therefore, affect disaster risks in two ways, firstly through the likely increase in weather and climate hazards, and secondly through increase in the vulnerability of communities to natural hazards, particularly through ecosystem degradation, reductions in water and food availability, and changes to livelihoods. Climate change will add yet another stress to those of environmental degradation and rapid unplanned urban growth, further reducing communities' abilities to cope with even the existing levels of weather hazards.

4.2 Disaster risk management and emergency response effort in Bangladesh

4.2.1 Policy and plan



Disaster Management Regulatory Framework

Standing Orders on Disaster (SOD): The Government of Bangladesh has paid more attention and endeavoured great efforts on policy and plan for effective disaster risk management. The first SOD has been in effect since 1997. Considering the adverse impact of climate change and the recommendation of the World Conference on Disaster Reduction 2005, also as a signatory of Hyogo Framework for Action, in 2010, the SOD was revised and published. The new edited SOD follows a comprehensive approach emphasizing risk reduction as well as emergency responses relating to all hazard and all sectors, which means that, is has to be followed not only during disasters, but also at normal times.

The national level and local level policy and coordination, the roles and responsibilities of all ministries, divisions, departments and government owned cooperation, the responsibilities of field level officials and local representatives and organizations have been clearly spelled out with clarity in the SOD, which entrusts the concerned officials with specific responsibilities regarding disaster management at all levels.

The National Plan for Disaster Management (NPDM) 2010-2015: The NPDM 2010-2015 developed in 2010 by MoFDM, which is an outcome of the national and international commitments for addressing the disaster risks comprehensively. The key focus of the Plan is to establish institutional accountability in preparing and implementing disaster management plans at different levels of the country. The NPDM incorporates Disaster Risk Reduction and Hazard Specific Multi-Sectoral Plans to create effective mechanism for reducing risk and achieving sustainable development.

The scope of the plan is to cover disaster threat analysis, vulnerability identification, investigations of disaster reduction measures, responsibilities assignment, funding provision, cost management and system for coordination. Both the natural and human induced hazards have been included in the plan, defining role of the government, non-government organizations and private sectors.

The Disaster Management Act: The Act, which is in final draft,~~ct,~~ if enacted, creates the legislative framework under which disaster risk reduction and emergency response management is undertaken in Bangladesh.

The National Disaster Management Policy: The policy, due to be formulated and adopted, defines the national policy, describes the strategic policy framework and national principles of on disaster risk reduction and emergency response management in Bangladesh.

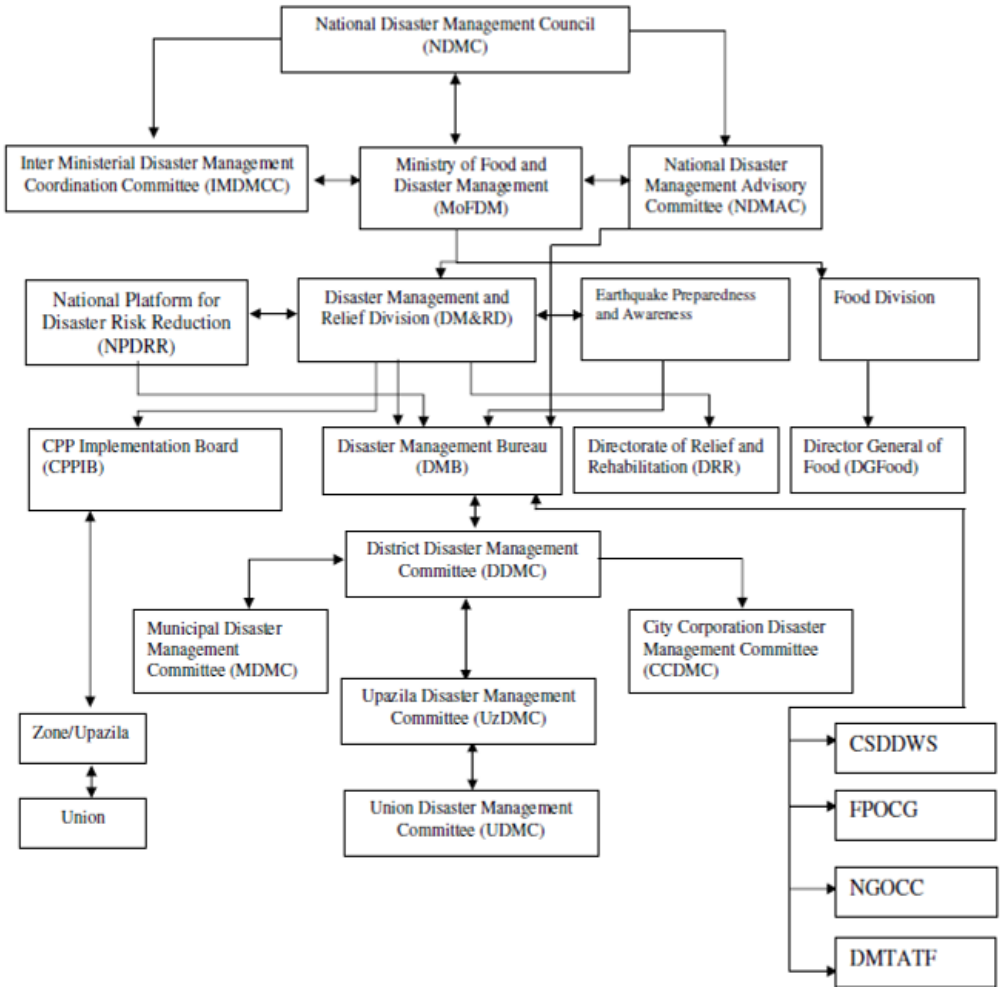
4.2.2 Institutional context

At the national level, the policy guidance and coordination mechanism include:

- National Disaster Management Council (NDMC)
- Inter-Ministerial Disaster Management Coordination Committee (IMDMCC)
- National Disaster Management Advisory Committee (NDMAC)
- National Platform for Disaster Risk Reduction (NPDRR)
- National Disaster Response Coordination Centre (NDRCC)
- Earthquake Preparedness and Awareness Committee (EPAC)
- Cyclone Preparedness Program Implementation Board (CPPIB)
- Cyclone Preparedness Programme Policy Committee
- Disaster Management Training and Public Awareness Building Task Force (DMTATF)
- Focal Point Operation Coordination Group of Disaster Management (FPOCG)
- NGO Coordination Committee on Disaster Management (NGOCG)
- Committee for Speedy Dissemination of Disaster Related Warning/Signals (CSDDWS)

At sub-national level, the coordination mechanism include:

- District Disaster Management Committee (DDMC)
- Upazila Disaster Management committee (UzDMC)
- Union Disaster Management Committee (UDMC)
- City Corporation Disaster Management Committee (CCDMC)
- Municipal Disaster Management Committee (MDMC)



The ministry of Food and Disaster management (MoFDM) is the focal point of the Government of the People's Republic of Bangladesh. The mission of MoFDM is to bring a paradigm shift in disaster management from conventional response and relief to a more comprehensive risk reduction culture and to promote food security as an important factor in ensuring the resilience of the community to hazards. Other organisations cooperate with MoFDM to provide relevant inputs and implement decisions under the directives and national level policy guidelines of Prime Minister's Office. The following organizations support MoFDM directly or indirectly through their mandates related with information:

- Ministry of Home Affairs is responsible for disaster rescue, security, relief operations and related disaster information management.
- Ministry of Defense is responsible for risk assessment of defense issues and associated with disasters and disaster early warning information dissemination.

- Ministry of Water Resources is responsible for risk reduction affairs of the water related disasters, especially flood disaster.
- Ministry of Agriculture is responsible for determination of disaster loss and planning of agricultural rehabilitation
- Ministry of Health and Family Welfare is responsible for providing curative and preventive health service to the people during disaster.
- Ministry of Environment and Forest plays special role in disaster management and climate change risk reduction, especially in normal period and rehabilitation stage.
- Ministry of Information responsible for alerting people facing emergency and awareness creating by mass media.
- Ministry of Posts and Telecommunications is responsible for telecommunication infrastructures and facilities.
- Survey of Bangladesh is responsible for national surveying and mapping.
- NGOs, civil society organisations, UN agencies and private sector support the Government to manage disasters.

National Disaster Management Council (NDMC): At the apex level, the NDMC is established to provide policy guidance towards disaster risk reduction and emergency response management in Bangladesh. The council is multi-sectoral and inter-disciplinary in nature. The NDMC consists of 33 members that includes the ministers or secretaries from the related ministries, chaired by the Prime Minister. The NDMC meets at least once a year. Decisions of the council meetings will be implemented by the IMDMCC

Inter-Ministerial Disaster Management Coordination Committee (IMDMCC): The IMDMCC acts on the decisions taken by the NDMC. The IMDMCC is chaired by the Minister of MoFDM. It facilitates policy making, planning, programming and implementing measures relating to disaster risk reduction and emergency response management in Bangladesh.

4.3 Status of use of geographic and space-based information in the Institutions involved in disaster risk reduction and emergency response

4.3.1 Ministry of Food and disaster Management

Role in Disaster Management

MoFDM is the focal point of the Government for disaster-related issues. MoFDM has sound disaster risk reduction and emergency response organizational structure. The agencies, including DMRD, DMB, DRR and CPP under the ministry have their specific responsibilities and roles related with disaster risk reduction and emergency response. The coordination rate of MoFDM is as below:

- avoid duplication
- ensure effective participation in disaster management by all stakeholders
- fill up the gaps and maximize the synergy impact
- promote transparency and accountability
- promote predictable leadership during disaster emergency
- optimize resource allocation and effective utilization

The Disaster Management Relief Division (DMRD): The DMRD has been given the mandate to carry out task for disaster risk reduction and emergency response related issues. The Secretary of the DMRD controls the activities of all officials engaged in emergency relief work. The division provides information to NDMC and IMDMCC to assist them in taking decisions.

Disaster Management Bureau (DMB): The DMB was created in 1993 to assist the DMRD with all necessary information during normal time, alert and warning stage, disaster stage and recovery stage and advise the government on all matters relating to disaster management.

Disaster Relief and Rehabilitation (DRR): The DRR is responsible for carrying out the activities related to disaster relief, rehabilitation schemes, infrastructure and shelter construction, and also focus on relief material management and supply.

Cyclone Preparedness Programme (CPP): The main activities of CPP, a joint venture program of Govt. of Bangladesh and Bangladesh Red Cresent Society, including disseminating cyclone warning signals to local residents, assisting people in taking shelter, rescuing victims affected by a cyclone and providing first aid to people injured by a cyclone. The CPP has set an example by establishing a dedicated network of volunteers (over 48,000) and effectiveness during emergencies, especially cyclone.

Data/Information Sharing

The above organisations collect disaster loss information to mobilise governmental support for disaster management. The rapid information collection includes approximate loss and damage and emergency requirement which should be sent within one hour of occurrence of the disaster. Subsequently, detailed information on disaster loss and damage assessment is collected. The information is collected by local government using basic data sheets and sent to DMRD and DMB.

Currently, there is no provision outlined in SOD to use space based information for rapid assessment, which also reflect in practice as space based information does not contribute enough to the rapid assessment despite presence of centres of excellence such as SPARRSO and CEGIS. The officials of the ministry are aware of the supportive function of space based information and are considering to use it for disaster management. National Plan for Disaster Management (NPDM) 2010-2015 defines use of the space-based technology and GIS for hazard assessment mapping.

Constraints and challenges

Although, the space based information is used as the reference information for disaster risk management and emergency response, it has not entered in the decision making process. The obvious reason is that it is not fully considered in the SOD and

NPDM. Consistent efforts of awareness generation and capacity building is the prime need for decision makers. Additionally, emphasis should be given to develop capacity of DMB and DRR to be able to use expertise and the services offered by the organisations such as SPARRSO and CEGIS.

4.3.2 Ministry of Defence

Role in Disaster Management

The Ministry of Defence is responsible for providing effective support to civil authorities with regards to dissemination of warning signals, evacuation, rescue and rehabilitation operations as and when required. However, it is the Arms Forces Division under Prime Minister's Office who undertakes utilization of Armed Forces in aid of the civil authorities when required based coordination with MoFDM. BMD, SPARRSO and SoB are the three information providing agencies for disaster management under the Ministry of Defence.

Bangladesh Meteorological Department (BMD) is responsible for weather condition monitoring and forecast. It contributes to disaster management by providing early warning for cyclones and has established information dissemination mechanism. The BMD has established dedicated communication link with Indian Ocean Tsunami Warning System in order to facilitate early warning on tsunami.

Bangladesh Space Research and Remote Sensing Organization (SPARRSO) is responsible for supplying satellite data and analyzed product for various purposes including disaster management. Satellite data on cloud formations in the region is

received hourly and any impending disaster like depression, cyclone, floods etc. are reported to the Government and also to BMD, BWDB, BAF and other relevant agencies.

Survey of Bangladesh (SoB) is the national surveying and mapping agency under the Ministry of Defence of Bangladesh. SoB has pivotal role in setting up National Spatial Data Infrastructure (NSDI) and providing basemaps and special mapping products relevant to disaster risk management.

Data/Information Sharing

The imagery of four meteorological satellites namely MTSAT, NOAA, METEOSAT and INSAT could be received and used by BMD for weather monitoring and early warning. The RADAR systems are also used integrated with satellite image. The weather forecast information, special weather bulletins, warning information and alert signals were disseminated and publicized to all concerns.

The SPARRSO receives images from six satellites (NOAA, FY-2C, Aqua/Terra, MTSAT and METOP) with its three ground receiving stations. SPARRSO maintains data archive of the images procured for specific applications which includes high resolution optical and microwave satellite. Recently, Sentinel Asia has approached SPARRSO to install WINDS receiving station to receive images during emergencies. The SPARRSO is responsible for analyzing and supplying space based information, images and products to BMD, DMB and other concerned agencies. A geo-database with twenty thematic layers for planning, management and decision making in different sectors is available with SPARRSO.

The Survey of Bangladesh (SoB) is in the process of updating 1:50,000 scale maps and generating 1:25,000 scale maps based on the aerial photographs. In addition to paper maps, SOB plans to supply digital formats of maps to the end users. The updated maps will cover the places of interest for disaster management such as shelter for evacuation during cyclones. The requirements of main stakeholders, including DMB, are considered by sharing the information contents of these topographic maps.

Constraints and challenges

The access to moderate and high resolution satellite data is one of the main challenge in using space based information for disaster management. At present the ground stations at SPARRSO mainly receives data from low resolution meteorological satellites. The bilateral agreements need to be in place to receive such data from neighbouring countries.

Another challenge is that existing capacity of the staff in the skills related to image processing is not adequate to explore full potential of the space based resources. The advance training on image processing, including microwave data processing, is need of the time.

One of the key constraint is lack of appropriate policy and mechanism to implement the policy for sharing the space based information in timely manner between the organisations governed by different Ministries. The channel for information exchange between the organisations governed by the Ministry of Defence and the Ministry of Food and Disaster Management is not direct which causes huge delays in information sharing.

Regarding the baseline and thematic data availability in digital form, SoB implied that it will take longer time to make such products available due to technical problem. The geo-databases developed by CEGIS, CDMP and SPARRSO are available with respective organisations. However, there is need of coordination mechanism the avoid duplication of strenuous efforts involved in digitization and offer mutual benefits by promoting data sharing.

4.3.3 Ministry of Water Resource

Role in Disaster Management

The Ministry of Water Resources is the apex body of the Government of the People's Republic of Bangladesh for development and management of the whole water resources of the country. Flood Forecast Warning Centre (FFWC) and Centre for Environmental and Geographic Information Services (CEGIS) are the centres of this Ministry visited by TAM team. Prime duties of these centres in relation to disaster management are as follows:

- Undertake water related disaster risk assessment and activities to reduce the potential loss in high risk areas.
- Monitoring water level of all major river system and provide flood forecast and early warning information to all concerns.
- Undertake loss and damage assessment of water related disaster and manage the reconstruction and rehabilitation of the destroyed infrastructure.

FFWC

FFWC was founded in 1972 under Bangladesh Water Development Board (BWDB) of the ministry and performs the duties of flood risk assessment, flood prone area identification, flood forecasting, early warning and alert information dissemination.

CEGIS

CEGIS was established in 2002 as a public trust in 2002 by the government of Bangladesh and has been functioning under the aegis of the Ministry of Water Resources and a Board of Trustees. The Centre supports management of natural resources for sustainable socio-economic development using integrated

environmental analysis, geographic information systems, remote sensing, and information technology.

Data/Information Sharing

BMD shares the satellite imagery and meteorological data with FFWC. FFWC analyses this data in combination with water level data from field observation to produce flood forecast maps, situation reports on flood levels and flood inundation map. Those outputs are distributed to decision makers and the response community.

The CEGIS have established geo-database covering entire Bangladesh including integrated coastal database and climate change database. The geo-database integrated with space based information has been effectively used for drought monitoring, erosion prediction, vulnerability assessment and resources planning by CEGIS.

Constraints and challenges

Due to self governance nature of CEGIS, sharing of geo-database and mapping products are on cost recovery basis which calls for financial provisions by the potential users in case they want to avail services from CEGIS. On the contrary, CEGIS does not have free access to the national data resources such as satellite data received and archived by SPARRSO. The challenge is to formulate policies for effective cooperation mechanism between these centres of excellence in the areas of remote sensing and geo-informatics.

4.3.4 Bangladesh Telecommunication Regulatory Commission (BTRC)

Role in Disaster Management

Vision of BTRC is to facilitate affordable telecommunication services of acceptable quality for all regardless of their location.

Data/Information Sharing

Some of the specific aspects of BTRC involvement with disaster management stakeholders are as follows:

- Establish networks with all the mobile phone companies for speedy dissemination of early warning information to community
- Assist MoFDM and BMD in establishing an effective early warning system
- Ensure distribution of warning signals to pre-determined centres quickly via mobile and establish wireless link with all inhabited islands.

Constraints and challenges

BTRC is aware of the need to plan emergency communications systems in cooperation with DMB based on the past experiences during cyclones when all existing communication systems were out of order for several days.

4.3.5 Comprehensive Disaster Management Programme (CDMP)

In Bangladesh, UN and other agencies provide great support to Bangladesh government through a joint program implementation. One of the key programme is CDMP supported by multiple donor agencies namely AusAid, DFID, European Union, Norwegian Embassy, SIDA and UNDP. The programme is jointly implemented by the UNDP and DMRD, MoFDM, Government of Bangladesh. The programme has already entered the Phase II (2010 to 2014).

Role in Disaster Management

CDMP aims to reduce Bangladesh's vulnerability to adverse natural and anthropogenic hazards and extreme events, including the devastating potential impacts of climate change. The six outcomes of CDMP II (from 2010 to 2014) is institution strengthening in comprehensive risk reduction, rural risk reduction, urban risk reduction, improved disaster preparedness & response, disaster-proofing of development funding, and community level adaptation to climate risk. CDMP II aims to institutionalise the adoption of risk reduction approaches, not just in its host Ministry of Food and Disaster Management, but more broadly across thirteen key ministries and agencies.

Data/Information Sharing

The approach of CDMP is to incubate the programme within CDMP before the programme enters in the Government departments for full scale implementation. The uses space based information and GIS for disaster preparedness and risk assessment. A platform for information sharing is established for risk assessment which includes a component of geo database. Some of the information systems that make use of geospatial technologies are - infrastructure inventory database, earthquake micro zonation mapping, disaster incident database, cyclone shelter database etc. CDMP has strong technical capacity to support 3S (RS, GIS, GPS) product development.

Constraints and challenges

The main challenge is to ensure that best practices and tools incubated by CDMP gets acceptance by DMB and other stakeholders. The systems developed at CDMP face constraints due to non-availability of baseline data, access to satellite images and weak linkages between GIS and disaster related databases. The best practices of CDMP will be successful if smooth flow of information in the current bureaucratic set up is ensured.

5. Assessment by the mission team

An assessment by mission team are summarised in the table below:

Strengths	Opportunities
✓ Institutional framework and structure is well established ✓ Excellent capacity to use space technology exists in BMD, SPARSO, CEGIS, SOB, FFWC, IWM etc. ✓ Cyclone prediction: Proven and effective example of employing space based information ✓ Geospatial databases exist ✓ Operational data on disaster risk is available ✓ Key decision makers are well aware of potential of space based information	➢ Space-based information and products (specially earth observation) are in incubation stage. They are ready for up scaling for operational use for disaster risk management ➢ Satellite images are yet to be used effectively during emergency response and damage assessment ➢ No provision of Emergency communication system ➢ Early warning (flood and cyclone predictions) can be further strengthened by providing better access to the space based information and related Technologies

An elaborated discussion is provided below.

5.1 Disaster Risk management framework

5.1.1 DM efforts equally focus on disaster risk reduction and Emergency Response

The disaster risk management structure is well established in Bangladesh, which covers entire disaster management cycle. There are comprehensive plans to focus on risk reduction activities, early warning stage and emergency response. The disaster management framework also considers the disaster risk reduction as one of the measure for climate adaptation. The management structure at national level covers all the stakeholder ministries to establish national mechanism for policy guidance and coordination. At local level, the coordination is taken care by involving local governance bodies such as city corporation, district, Upazilla etc.

The SOD, which reflects the vision of the government, clearly outlines the role and responsibilities of the ministries, divisions, agencies, organizations, committees, public representatives and citizens to cope with any natural disaster.

The National Plan for Disaster Management describes expected outcomes and action agenda for 2010-2015, with provides direction and perspectives to address disaster management in comprehensive manner. SOD and National Plan for Disaster Management guarantee the sustainability of disaster management efforts in Bangladesh.

5.1.2 Integrated approach towards disaster management

Disasters like flood, often triggered by cyclones in Bangladesh, are often aggravated by environmental degradation. The links between environment and disaster risk are two-fold. Environmental degradation accentuates disaster risk on the one hand, while on the other, disasters damage the environment thus increasing people's vulnerability to future disasters. It is, therefore, argued that a DRR approach that integrates concerns about the environment would have both environmental and disaster risk reduction benefits.

Fig 2. Integrated approach toward disaster management

Likewise, climate change adaptation inter-links with disaster risk reduction . These two issues have had two distinct histories, but are increasingly beginning to merge. One cannot adapt to climate change without disaster risk reduction. Disaster risk reduction provides insight into how to adapt to incremental change, while disaster preparedness is better strengthened when informed by the long term challenges of climate change and environmental degradation.

HFA review for 2011 clearly mentions that National Disaster Management Council (NDMC) outlined disaster and climate risk reduction tasks for the ministries, agencies, committees, civil society, organizations, non-government organizations and citizens. National Plan for Disaster Management (2010-2015) approved in 2010 also approved Bangladesh Climate Change Strategy and Action Plan (BCCSAP 2009). Disaster and climate risk reduction fund and climate change adaptation fund has been allocated in the national budget. CDMP also intend to incorporate disaster and climate risk in the policy and plans of the stakeholder ministries and organizations.

5.1.3 Adoption of space technology in effective early warning

One of the most effective example of risk reduction activity in Bangladesh is early warning of cyclones, which have brought down the number of deaths from few hundred thousands in the past to few hundreds in the recent years. The space based information has been effectively used for cyclone forecast and early warning by BMD. The dissemination of the early warning information to the community level is effectively done by the CPP with help of it's over 48,000 volunteers.

5.2 Technological awareness and capacity with respect to space-based information

Much of the success of saving lives during recent cyclones can be attributed to the weather forecast and early warning capacity developed by BMD that involves satellite based meteorology. However, contribution of earth observation (remote sensing) satellites in disaster management and emergency response is not as significant as it should be, thereby indicates underuse of the capacity existed in the centres of excellence (SPARRSO and CEGIS) based in Bangladesh. The immediate emergency response is still planned based on the reports on damage assessment obtained from the field persons alone.

5.2.1 High level of awareness at decision-makers level

The TAM team had the opportunity to talk to heads of government departments. The awareness level on the use of space technology is generally high, which is something to be expected considering the space-related infrastructure development

and capacity building activities carried out by SPARRSO and BMD. The projects implemented by the centres of excellence such as CEGIS contribute significantly to employ use of remote sensing and GIS in development planning and disaster management. The organisations like SPARRSO and CEGIS offer their services to several ministries to incorporate geospatial technologies in their activities. Early warning provided by BMD has been the key factor in saving life of people due to frequent cyclones that hit Bangladesh. This involvement by institutions in using geospatial technologies potentially arises out of high awareness levels among decision makers on the benefits of space-based technologies in their respective areas. This is one of the strengths in Bangladesh that was noted by the TAM team.

However, the stakeholders mentioned constant need for awareness programmes to the decision makers at high and mid-levels. As technologies advance, ways via which space-based information is accessed and used changes dramatically. Decision makers need to be informed of these technologies and their benefits in order to implement policies that promote appropriate uptake and usage in national development plans, including disaster management and related sectors of natural resources development and environmental management.

The telecommunication and disaster management authorities are fully aware of the importance of satellite communications and satellite navigation in the disaster management, considering their recent experiences that mobile phone communication was out of order for several days during major cyclones.

5.2.2 Technical capacity exists, although not adequate, in the key institutions

It is evident that Bangladesh Metrological Department (BMD) has operationalised benefits of space technology by establishing strong weather forecast and early warning system, although there is concern about lack of optimal infrastructure and trained human resource.

FFWC/IWM and CEGIS have developed operational capacity on risk identification of water related disasters based on geospatial information, remote sensing imagery and flood early warning system. Geo database established by CEGIS is valuable asset to facilitate the space based information application for disaster risk reduction.

CDMP has been able to demonstrate the operational use of geospatial information for disaster risk reduction.

There is a strong foundation in Bangladesh to apply space and geospatial technologies in disaster management, with defined and interrelated stakeholders. The SPARRSO act as a focal point that links various stakeholders on the matters related to space technology including government, industry, international institutions and academia. Translating this capacity to offer direct benefits to the disaster management has been hampered by lack of access to requisite geospatial data and the absence of a coordinated, government-driven, and functional National Spatial Data Infrastructure (NSDI) for Bangladesh. These gaps can be looked at as an opportunity for further strengthening the inter-departmental cooperation. Strengthening capacities of provider organizations like SPARRSO and CEGIS and user organizations like DMB and DRR will certainly form a good foundation for sustainably introducing applications of geospatial technologies in disaster management.

There are a number of key institutions within Government with competent, well trained professionals and technicians that are currently adept at use space technologies (RS and GIS, Satellite communication and satellite meteorology), as is evident from the fact that over 50 personnel in Bangladesh are trained by the Centre for Space Science Technology Education for Asia and the Pacific (CSSTEAP) based in India.

Discussions with the stakeholders during the workshop, revealed that efforts in capacity building need to be consistent, especially in the areas of using satellite based earth observation and satellite meteorology. It was felt that a critical number of staff from the DMB, DRR and other stake-holder organisations need to be trained. This will result in the capacity in the user department to derive benefits of the services offered by those technical organizations.

5.2.3 Status of fundamental datasets and National Spatial Data Infrastructure (SDI)

The most crucial element to using space-based information is availability of spatial data infrastructure (SDI) and a baseline GIS database. SDI is a framework of spatial

data, metadata, users and tools that are interactively connected in order to use spatial data in an efficient and flexible way. Another definition is the technology, policies, standards, human resources, and related activities necessary to acquire, process, distribute, use, maintain, and preserve spatial data.

Use of space-based information inevitably calls for the availability of a spatial data infrastructure (SDI). SDI forms the base to use any other information that is spatial in nature, including remote sensing data. In other words, remote sensing data can be considerably more useful when integrated with other baseline and ancillary data.

Currently SDI guidelines have not been formally released by any organization. The mission team understood that Survey of Bangladesh (SOB) is entrusted with an official responsibility to establish SDI in consultation with other organizations in Bangladesh.

There is a substantial amount of GIS data covering the entire country but it is not cohesive. The mission team could not get indication that any single agency currently has the entire baseline GIS data for the entire country which can be shared with all other departments and institutions involved in using of geospatial information. This seriously limits the integration of information available in various government organisations and its use in disaster risk reduction and emergency response.

5.3 Strengthening disaster management by relevant employing geospatial and IT tools

5.3.1 Foster contribution of geospatial and space based information during disaster event

It was noted that ~~Di~~Directorate of Relief and Rehabilitation (DRR) plans emergency response activities based on the information received through the Project Implementation Officers (PIO) at *Upazilla* level. This mechanism has not employed relevant geospatial tools to collate such information. The mission team felt strong need of such tools which will bring all field information together in GIS platform in order to generate situation maps. These maps, in conjunction with satellite images, can provide much precise and meaningful information for emergency response

planning. The mission team felt strong need of generating awareness about in this area at DRR.

The mission team was told that early estimates on the post disaster damage assessment, that are based on the preliminary assessment, differ significantly when more data is made available at later stage. This the result being that the relief operations are performed in absence of reliable and accurate information needed to support its activities. This also exposes the fact that about lack of coordination between the technology organizations and user departments like DRR.

On the contrary, a huge amount of disaster related data collected by the field officers is not available to the organizations involved in providing geospatial services and geospatial data generated by the organizations is not easily accessible by the user department.

5.3.2 Need to update disaster management documents and guidelines to include role of space-based and geospatial information

Developing a clear and coherent strategy is of paramount importance for enforcing inputs from space-based information in disaster management. Based on the discussion between the TAM team, DMB and other stakeholders about the important documents such as SOD and National Plan for Development Management, it was felt these documents need to provide guidelines on improving disaster management by strengthening the stakeholders engaged in providing relevant information using space technology (earth observation satellites, meteorological satellites, satellite based communication and navigation).

5.4 Use of international mechanisms

Space community, mainly SPARSO is aware of international mechanisms like International Charter, Sentinel Asia and SERVIR. However, disaster management community is largely unaware of how these mechanisms can be effectively used during emergencies.

Sentinel Asia is an initiative to make the best use of earth observation satellites data for disaster management in the Asia-Pacific region. Besides emergency situation, member country can join working groups related to the flood and wildfires which provides valuable

data and models for risk assessment. As one of the member or Sentinel Asia, SPARRSO can access the images through Sentinel Asia mechanism via dedicated communication system WINDS.

The International Charter Space and Major Disaster provides rapid maps for emergency response based on the latest satellite images. Bangladesh can activate the International Charter in the case of a major disaster in consultation with the local UN Office (WFP, UNDP etc.). UN-SPIDER is authorised to activate International Charter if requests come through local UN agencies.

Bangladesh is member state of ICIMOD, an intergovernmental institute based in Kathmandu, Nepal. ICIMOD is one of the host of SERVIR, named as SERVIR Himalaya. Bangladesh should take benefit of SERVIR by availing the services specially improving flood forecast. Detailed about SERVIR is mentioned below.

SERVIR- Enabling the use of Earth observations and predictive models for timely decision making to benefit society

SERVIR is a Regional Visualization and Monitoring System that integrates earth observations (e.g. satellite imagery) and forecast models together with in situ data and knowledge for timely decision- making to benefit society, which was initiated in 2005 by NASA and USAID. There are three regional offices under the system till now, namely SERVIR Africa, SERVIR Latin America and SERVIR Himalaya.

SERVIR addresses the nine societal benefit areas of the Global Earth Observation System of Systems (GEOSS), namely: disasters, ecosystems, biodiversity, weather, water, climate, oceans, health, agriculture, and energy. The effort intensively utilizes and integrates NASA satellite observations and predictive models, along with other geographic information (satellite, sensor, and field-based) for environmental monitoring, natural resource planning and disaster management. The objectives of the project is to implement access to and sharing of environmental data; Strengthen regional infrastructure to facilitate SERVIR national implementation and to build a community of data custodians and users around the SERVIR Data Portal. Till now, SERVIR has become a platform for collaboration and cross-agency coordination, international partnerships, delivery services and applications, supporting not only national governments, but also universities, NGOs and the private sector.

5.5 Emergency Communication

BTRC and DMB are already discussing ways to promote disaster management communication. During recent cyclones (such as cyclone Alia), often mobile based

communication was out of order for several days which hampered relief operations. Although communication radios are available in the south coastal belt, the need of satellite based emergency communication system remains vital.

The priority is to support the coastal belt that is prone to impact of cyclones. It is important to include armed forces in DM communication who are often deployed in case of disaster. The discussion with BTRC confirmed that the resources related to the satellite based emergency communication need to be stationed in Bangladesh for easy and timely deployment during cyclone season.

6. Recommendations

The recommendations are based on the observations made by the TAM team outlined in the previous section. These recommendations also capture the essence of the meetings and interaction held with the Minister of Food and Disaster Management, heads of the key stakeholder government departments, and group discussions conducted during the TAM workshop involving over 50 officials from the Government, UN, Academia, NGOs and private sector.

The recommendations focus on concrete steps, which can realistically be implemented within a short to mid-term timeframe. The recommendations focus on the challenges and opportunities in the following specific areas:

- Policy and coordination,
- Capacity building and awareness raising,
- Information management and sharing,
- Data and access
- Emergency communication

The mission team states that the proposed recommendations should not be considered in piecemeal way since disaster management is an overarching issue that needs consideration in all sectors related to development and environmental management.

For example, the proposed recommendations about capacity building will have to go hand-in-hand with institutional strengthening, fostering information flows and policy level interventions. The capacity building activities will be in vain if a staff being trained do not have a formal role to provide certain services in the national disaster management system, or are without the necessary resources to carry out these functions. The space-based emergency information products will not contribute to a better emergency response if disaster information flows within the country is too slow and end-users do not have the technical capability to evaluate the information received and integrate it into their plans. Finally, generating space-based information products requires specialized skills. To be successfully used in Bangladesh, it requires strong institutional support through appropriate disaster management strategy, clear data sharing arrangements, and a great willingness to cooperate across different governmental and non-governmental institutions.

6.1 Summary recommendations

The recommendations were presented during wrap-up meeting of the mission team experts with the key government stakeholders departments on 24 June 2011. Thus, recommendations mentioned in this section are the shared outcome of the discussions between mission team and the stakeholders.

- **Policy:** Update National Plan for Disaster Management (NPDM) and Standing Orders on Disaster (SOD) to mention use of space-based information and technology into the disaster management framework for improved capabilities of risk management and emergency response.
- **Coordination:** Enhance coordination between organisations of MOD (technology providers) and MoFDM (technology users) thus ensure working level cooperation among DMB, DRR, SPARRSO and BMD with sole purpose of considering space based resources as a shared resources for the purpose of disaster management and ensuring that space technology organisations provide services directly to the end users.
- **Awareness raising and capacity building:** Frequent awareness raising programmes for decision makers to strengthen institutional preference to utilize the space based information to support the disaster management. In addition, DM institution need to develop a capacity to interface between the technology provider organisations and DM institutions. For example, appropriate capacity in DMB and DRR will be able to leverage upon the services offered by SPARRSO, BMD and other organisations like CEGIS.
- **Information management and sharing:** Develop data and information sharing policies, standards and coordination mechanism for supporting DM at national level based on the notion that data is national property and needs to be shared openly particularly in case of disaster. To facilitate the data sharing, the data catalogue and sharing platform should be created based on existing resources. Information product should cater precise requirement of the end users.
- **Data access**: Access to National Spatial Data Infrastructure (NSDI) templates, baseline data and operational disaster related databases to all stakeholders. The access should ensure timely availability of appropriate satellite data and geospatial data and strong data policy to conform with the data standards and formats.
- **Emergency Communication**: Provision of the satellite based emergency communication systems to be stationed in Bangladesh. Satellite Communication technology should be utilized to train CPP volunteers. Provision of standby assets like flyway terminals, satellite telephones, mobile terminals and back up power sources.

6.2 Detailed recommendations

6.2.1 Policy and Coordination

- While NPDM addresses disaster risks comprehensively, there is need to update National Plan for Disaster management to make provisions to incorporate space-based information, satellite based emergency communication and improved early warning systems.
- Coordination mechanism between DMB, DRR, SPARSO and BMD need to be revisited and adapted to provide effective service during emergencies,
- Policy level interventions are required to enhance clear cooperation and information sharing between BMD and SPARSO.
- DMB, as a stakeholder of the services provided by SPARRSO and BMD, should play a role in strengthening SPARSO and BMD to enable them to deliver precise, timely and comprehensive services.
- SPARSO/CEGIS should provide rapid mapping products directly to DMB and DRR during emergency and should make effective use of international mechanisms (Sentinel Asia and International Charter).
- Duplication of data generation efforts should be avoided through an effective coordination.

6.2.2 Capacity Building and Awareness

- Frequent awareness raising programmes should be conducted under auspices of DMB to appraise decision makers by SPARRSO, BMD and CEGIS.
- DMB and DRR should develop capacity to utilise products and services of SPARRSO, BMD, IWM and FFWC. This can be achieved by imparting skills to the personnel within DMB and DRR who can act as an interface between technology products providers and users.
- Specific training requirements of staff of BMD and SPARRSO should be addressed to improve their capability to utilize advancements in the technology.
- Critical mass of officials need to be trained in all stakeholders departments, both providers and end users. Such training capacity exists in the country with SPARRSO, CEGIS and BMD.

- Extensive capacity development exercise needs to be undertaken in collaboration with international donor agencies to enhance capacity of organization involved in using space-based information such as Survey of Bangladesh, the organisation that is envisaged to play a critical role in providing NSDI and supply baseline spatial data.
- The specific training programmes should be conducted in cooperation with UN and other regional/international organization to bring best practices of rapid mapping for disaster monitoring and loss assessment using satellite remote sensing and allied data.

6.2.3 Information management and sharing

- Data and information products by SPARRSO and CEGIS should cater correct and timely need of the DMB and DRR.
- Information sharing mechanism should be established to integrate information from all sources needed for disaster management.
- Best practices and tools incubated by CDMP need acceptance by DMB and other stakeholders to ensure that these are used in practice in near future.
- Strong data and information sharing policy is needed to allow DMB, SPARRSO, BMD and other institutions the access to data and information available with all stakeholders and vice versa.
- Working-level Forum should be in place where inter-agency information management can be discussed and coordinated. Activities will include
    - Agree upon data standards (formats, codes, methodologies, etc.)
    - Create of catalogue of data to avoid duplication (e.g. survey of surveys)
    - Facilitate data sharing
    - Share experiences and plan jointly
- The Forum described above should ensure that the DMB incorporates Information Management Practice into its preparedness and response activities and can share information with other response actors. To achieve “Information Management Readiness” the DMB will be able to draw upon the expertise of other government bodies (through clearly defined mechanisms) including SPARRSO, CEGIS, BMD, SoB, FFWC, local government engineering department (LGED) and Bangladesh Bureau of Statistics (BBS).
- Datasets and data standards required to support operational information management are available and meet minimum levels of quality. These

"common operational datasets" are ready to be used and are in the hands of the DMB who has the capacity to use them. Common Operational Datasets include:

  - Administrative and Geographic boundaries/entities
  - Communities/Populated Places
  - Census and Socio/Economic data associated with these places
  - Key infrastructure including health facilities and schools
  - Transportation Network (including transportation schedules and available fleets)
  - Natural Features (rivers, coastlines, elevation, and Land use)

- Data policy is necessary to maintain data interoperability. The DMB and DRR need basic tools for coordination in place before an emergency. These include:
  - Up-to-date contact list of key actors and organizations with an operational emergency response capacity,
  - An internet presence to easily share data,
  - A mechanism for establishing "who is doing what where",
  - The ability to integrate information from multiple sectors to support effective decision making

6.2.4 Data and access

- SoB is the main agency to provide national spatial data infrastructure(NSDI). Availability of NSDI is critical to develop effective GIS based information system for disaster management.
- Spatial datasets and satellite data archives available with SPARRSO and CEGIS should be organized to have easy retrieval during emergency
- Linkages with regional and international initiatives (UN-SPIDER, Sentinel Asia, international Charter, GEO) should be effectively used by SPARRSO in cooperation with DMRD and local UN organisations.
- CEGIS, as the centre of excellence, should be allowed to access to all data, including space based information, during emergency situation to cater rapid mapping needs.
- Presently socio-economic data is not being fully utilized for disaster management. Work needs to be initiated to develop and deploy easily accessible and scalable data base containing population, infrastructure,

agriculture and any other pertinent information for use as a reliable data set during emergencies.

6.2.5 Communication

- Satellite based communication plays a pivotal role in emergency situation as terrestrial communication network is frequently affected during disaster like cyclone. It is therefore pertinent that Bangladesh Telecommunication Regulatory Commission ensure availability of satellite phones to the first responders. This could be achieved by ensuring availability of appropriate number of satellite phones to the Ministry of Food and Disaster Management to be used in case of emergencies.
- DMB and BTRC should consider provision of the satellites based emergency communication systems to be stationed in Bangladesh. This should include standby assets such as flyway terminals, satellite telephones, mobile terminals and back up power sources should be consider.
- Satellite communication technology should be utilized to train CPP volunteers spread across the provinces.

7. Next Steps

One of the mission objective is to facilitate preparation of implementation plan to ensure that actions are taken on the recommendations. Given the nature of UN-SPIDER as a platform and the wide range of recommendations whose implementation will require external partners and funding, it seems reasonable to develop partnerships for implementation along with an implementation plan.

- UN-SPIDER is committed to support Bangladesh through its network and partners organizations. UN-SPIDER plans to work with DMB/DMRD, MoFMD and offer policy level inputs to strengthen technical capacity of MoFMD with respect to use of space-based and geographic information for disaster management.
- UN-SPIDER encourages DMB/DMRD, MoFMD to access remote sensing data available for DRR through international organisations to facilitate recruitment of technical expert to strengthen capacity of DMRD, MoFMD in using space-based and geographic information for disaster management.
- UN-SPIDER will facilitate the activities of awareness raising and capacity building for the staff of Bangladesh Government for in use of remote sensing technology in cooperation with NDRCC and APSCO in China, CSSTEAP in India and CDMP/DMB based in Bangladesh.
- During emergency, under the framework of space aid, UNSPIDER could act as the bridge to facilitate the product service provider(such as NDRCC) and Bangladesh disaster management agencies provide product directly to DRR agency of Bangladesh based on their requirements and try to assist to coordinate the related data.

For the implementation of the policy-related recommendations it might be advisable to use the network provided by the CDMP platform within the country.

Annexes

Annex I: Programme of the Technical Advisory Mission at a glance

Day 1: 19 June, 2011

Visit to the host organization (DMRD) and meeting with the Joint Secretary of DMRD

Visit to Disaster Management Bureau (DMB) and meeting with Director General of DMB

Visit to the Centre for Environment and Geographic Information Services (CEGIS) and meeting with Executive Director of CEGIS

Visit to Department of Relief and Rehabilitation (DRR) and meeting Director General of DRR

Day 2: 20 June 2011

Visit to Bangladesh Meteorological Department (BMD) and meeting with Director General

Visit to Space Research and Remote Sensing Organisation (SPARRSO) and meeting with the Chairman

Visit to the office of Comprehensive Disaster Management Programme (CDMP)

Visit to the Survey of Bangladesh (SoB) and meeting with Director General of SoB

Day 3: 21 June 2011

Technical workshop on the "Use of Space Technology for Disaster Risk Reduction", attended by over 80 participants from the Government, non-government, Academia and UN organisations involved in disaster management and potential users of geospatial technologies.

Day 4: 22 June 2011

Visit to Cyclone Preparedness Program (CPP) office

Meeting with the Chairman of Bangladesh Telecom Regulatory Commission (BTRC)

Visit to Institute of Water Modelling (IWM) and Flood Forecast and Warning Centre(FFWC) office

Day 5: 23 June 2011

Wrap up meeting with the all stakeholders

Annex II: List of organisations in Bangladesh visited by the UN-SPIDER Technical Advisory Mission

1. Disaster Management Bureau (DMB)
2. Directorate of Relief and Rehabilitation (DRR)
3. Centre for Environmental and Geographic Information Services (CEGIS)
4. Bangladesh Meteorological Department (BMD)
5. Space Research and Remote Sensing Organisation (SPARSO)
6. Comprehensive Disaster Management Programme (CDMP)
7. Survey of Bangladesh (SOB)
8. Cyclone Preparedness Programme (CPP)
9. Institute of Water Management (IWM)
10. Flood Forecast Warning Centre (FFWC)
11. Bangladesh Telecom Regulatory Commission (BTRC)
12. Early Recovery Facility (ERF)

Annex III: List of organisations participated in the workshop on 24 June 2011

Government Organisations

Cyclone Preparedness Program- CPP

Bangladesh Telecom Regulatory Commission- BTRC

Bangladesh Meteorological Department- BMD

Survey of Bangladesh- SoB

Ministry of Defense- MoD

Bangladesh Bureau of Statistics- BBS

Space Research and Remote Sensing Organization- SPARRSO

Directorate of Relief and Rehabilitation- DRR

Disaster Management Bureau- DMB

Local Government Engineering Department- LGED

Flood Forecasting and Warning Center- FFWC

Forest Department

Comprehensive Disaster Management Programme- CDMP

Disaster Management and Relief Division- DMRD

Directorate of Agricultural Extension- DAE

Bangladesh Water Development Board- BWDB

Soil Research Development Institute- SRDI

Bangladesh Television- BTV

Bangladesh Agricultural Research Council- BARC

Government Trustee Organisations

Center for Environmental and Geographical Information Services- CEGIS

Institute of Water Modeling- IWM

NGOs

Bangladesh Development Center- BDC

UN Offices/Others

WFP

SDC

UN - OCHA

UN-SPIDER

CSSTEAP (India)

SUPARCO (Pakistan)

NDRCC (China)

APSCO

Annex IV: List of registered participants of the one day Workshop on 24 June 2011

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Annex V: Centre for Space Science & Technology Education in Asia and the Pacific (CSSTEAP)

UN-OOSA (as per the UN General Assembly Resolution 45/72 of 11 December 1990) established Centre for Space Science & Technology Education in Asia and the Pacific (CSSTEAP) in India on November 1, 1995. Department of Space, Government of India has made available appropriate facility and expertise to the Centre through the Indian Institute of Remote Sensing (IIRS), Dehradun, Space Applications Centre (SAC) and Physical Research Laboratory (PRL), Ahmedabad. The Centre's headquarters is located in the campus of IIRS at Dehradun, India. To carry out the educational programmes, CSSTEAP has arrangements with IIRS, Dehradun for RS & GIS course; with SAC, Ahmedabad for SATCOM and SATMET courses; and PRL, Ahmedabad for Space & Atmospheric science course. The Centre offers 9 months Post Graduate level courses in the fields of (a) RS & GIS, (b) Satellite Communications (SATCOM), (c) Satellite Meteorology and Global Climate (SATMET), (d) Space & Atmospheric Sciences (website:www.cssteap.org). The centre also organizes short term workshops and awareness programmes in the above mentioned disciplines. The Centre is guided by a Governing Board represented by member countries and an international technical Advisory Committee.

CSSTEAP (Affiliated to UN) has conceptualized short duration programmes to strengthen the capability of professionals in the region for understanding space-based technology, information obtained, vulnerability & risk analysis services, recovery, mitigation and solutions to reduce Disaster Risks and losses. In the overall educational curriculum of CSSTEAP program, sufficient emphasis is made by inclusion of topics related to the Disaster Risk Reduction. Apart from this, the Centre has organized/organizing short courses on these areas.

CSSTEAP contributes in the domain of DRR in general. Bangladesh can be benefitted by the following CSSETAP activities:

- CSSTEAP facilitates in providing support to one or two CSSTEAP PG diploma students from Bangladesh in pursuing M.Tech research in Disaster Risk Reduction;
- Organizes specialized theme specific short courses in the area of DRR. These would be focused in generating awareness among decision makers and capacity building in Disaster Management institutions;
- CSSTEAP encourages joint international collaborative research & capacity building program involving scientist/experts from CSSTEAP and researchers, experts, management authorities of various line departments from Bangladesh;
- Organizes brain storming sessions involving experts, professionals, key disaster management authorities from other countries to discuss and make

recommendations to develop guidelines, management plans and polices for the use of space based information in DRR and emergency response. This would be significant in facilitating capacity building, developing new contacts and understanding the capacity building requirements of countries in the region for space based information support to Disaster Risk reduction;

- Develops a network and establish strong linkage between CSSTEAP and nodal institutions in other countries of the region towards initiative for improved Risk assessment strategies and sharing appropriate satellite data and geo-spatial data; and
- With the support of International funding CSSTEAP can organize short courses in Bangladesh for participants of organization/institutes involved in RS & GIS technologies in Bangladesh involving the participation of experts from Bangladesh.

List of Short courses conducted by CSSTEAP in the area of DRR

- International Short Course on Geoinformatics for Disaster Management from August 12- September 6, 2002 at IIRS, Dehradun
- International Short Course on Geoinformatics for Disaster Management from August 16- September 10, 2004 at IIRS, Dehradun
- International Training Course on 'Application of Space Technology for Disaster management support with emphasis on flood risk management; from August 20 - September 14, 2007 at IIRS, Dehradun.
- International Course on 'Application of Space Technology for Disaster Management Support With Emphasis On Drought Monitoring, Desertification And Crop Yield Prediction' from July 14, 2008 to Aug 8,2008 at IIRS, Dehradun
- Interpretation of High Resolution aerospace imagery for environmental Management and Geo-Hazard assessment January 25- February 12 , 2010 at IIRS, Dehradun.
- International Course on Application of Space Technology for Disaster Management support with Emphasis on Geological Risk Mitigation April 12- May 07, 2010 at IIRS Dehradun
- International Course on 'Application of Space Technology for Disaster Risk Reduction to be conducted from April 9- May 4, 2012 at IIRS, Dehradun (forthcoming)

Annex VI : Asia Pacific Space Cooperation Organization (APSCO)

Asia Pacific Space Cooperation Organization (APSCO) is an inter-governmental organization with full international juridical personality. APSCO starts its formal operation in December 2008, and has granted the permanent observer status its formal operation to the Committee on Peaceful Uses of Outer Space of United Nations since 2009. The main objective of APSCO is to promote the peaceful uses of outer space in Asia-Pacific Region, and to carry out the cooperation in the fields of space technology and space applications among Member States and regional countries. At the present, Member States consists of Bangladesh, China, Iran, Mongolia, Pakistan, Pure, Thailand and Turkey. The Headquarter of APSCO is located in Beijing, China. The further information is available at www.apsco.int.

As Bangladesh is APSCO Member State, many activities are ongoing to promote Space Technology applications. These activities should foster inter-agencies coordination between Bangladesh Space Research and Remote Sensing Organization (SPARRSO), the national focal point of APSCO in Bangladesh, and disaster mitigation agencies. Some of the training programmes conducted by APSCO to benefit Bangladesh are as below:

1. Every year since 2008, APSCO has offered few seats to Bangladesh under MASTA program which is Chinese Government scholarship for students from APSCO Member States, studying Space Technology Applications in Master Degree level such as Remote Sensing and Geographic Information Systems etc. at Beihang University, Beijing, China. Students from Bangladesh graduated and returned their home country to contribute to development of country.
2. APSCO offers short-course training programs in Space Technology Application to its Member States. In Bangladesh APSCO and SPARRSO co-organise short course training on Remote Sensing application for Flooding in November 2011. This training programme is an opportunity for Bangladesh disaster management agencies to build their capability in space technology.

Some of the projects undertaken by APSCO namely Data Sharing Program and Remote Sensing Satellite Construction would bring long-term benefits to Bangladesh. Bangladesh contributes to these projects by providing experts and administrative support. In 2008, APSCO, in cooperation with the Chinese Government offered FY Satellite Data Broadcasting System (DVBS) to Bangladesh. APSCO initiatives offer several benefits to Bangladesh such as capability building, data access and experience sharing with the APSCO Member States.

Annex VII: National Disaster Reduction Centre of China (NDRCC)

NDRCC is the professional agency to provide technology support to disaster management in China. The main responsibility of NDRCC includes information management, disaster risk assessment and product service, space technology application, research on scientific technology and policies, research and development of technical equipment and disaster relief materials, publicity and education, training, and international cooperation.

At present, NDRCC has established disaster information system, remote sensing system, on-site support system, assessment system, and have the capability to take on disaster monitoring, assessment for almost all kinds of disaster. In the application of Space technology, NDRCC can apply almost all kinds of optical satellite and radar satellite to monitor and assess disaster losses. In the establishment of operation system, NDRCC has set up a complete operation system, including operation model, work regulation and product system. In technology and product service, NDRCC has established the operation of rapid mapping for disaster monitoring and assessment. Moreover, NDRCC have formed a stable expert team in Space technology and its application in disaster, and can take on all the technology training to different users and engineer. According the technology support, NDRCC hope to have some contribution to the following aspects:

Provide Technical Support to Bangladesh

UN-Spider Beijing Office can act as a bridge to arrange NDRCC to provide technical support to Bangladesh. Under the arrangement of UN-spider, NDRCC can carry out disaster risk monitoring, losses assessment along with Bangladesh against some certain disasters, such as flood, drought, landslide, etc. At the same time, NDRCC can also finish this work, and then to provide products to Bangladesh directly according to the requirement of DRR in Bangladesh. Of course, it is extreme important for UN-Spider Beijing Office to coordinate the data (including satellite data, basis geography data, on-site investigation data), and to provide to agencies.

Carry out Technical Training to Bangladesh

According to the lack of technical team, UN-Spider Beijing Office can try to find some way to provide opportunity of training and exchange to Bangladesh in the field of Space-based Technologies, such as some workshops, short-term training, long-term training. About the short-term training, UN-Spider Beijing Office can arrange NDRCC to hold professional l

training to technical staff for Bangladesh. The training can be concentrated in the skill on data processing, remote sensing interpretation, data analysis, products makes, etc.

Organize to Provide Rapid Mapping During Flooding Season to Bangladesh

It is the rainy season and flooding season from May to September in Bangladesh. As the situation of Space-based Technologies is so weak in Bangladesh, it is urgent to provide some ready products for their disaster emergent response, such as to provide rapid mapping of flooding losses. For this work, NDRCC can give a support under the organization of UN-Spider Beijing Office.

Annex VIII: OCHA's Role and opportunities specific to Bangladesh

Globally, OCHA is the part of the United Nations Secretariat responsible for bringing together humanitarian actors to ensure a coherent response to emergencies. OCHA also ensures there is a framework within which each actor can contribute to the overall response effort. OCHA's mission is to:

- Mobilize and coordinate effective and principled humanitarian action in partnership with national and international actors in order to alleviate human suffering in disasters and emergencies.
- Advocate the rights of people in need.
- Promote preparedness and prevention.
- Facilitate sustainable solutions.

Since its establishment in 2005, OCHA's Regional Office for Asia and the Pacific (ROAP) has sought to minimize the vulnerability of populations in the region to humanitarian crises. ROAP has provided support and assistance to governments, UN agencies, NGOs and other humanitarian actors in response to a number of major natural disasters, including through the deployment staff with a range of technical expertise. The Regional Office also works to build response capacity in the region *before* disasters strike, by strengthening emergency preparedness. ROAP staff have expertise in Public Information and Advocacy, Information Management, and Civil-Military, and also carry out work related to the Humanitarian Reform process including the promotion of inter-agency coordination at the regional level.

OCHA does not have a presence in Bangladesh, but has provided support to the Resident Coordinator and UN Country Team on several occasions. ROAP supported the drafting of an inter-agency contingency plan and also a tabletop exercise to test emergency response procedures in 2007. The Disaster Emergency and Response Group (DER) is the main humanitarian coordination forum in Bangladesh. Meetings take place on an ad hoc basis, usually in response to a particular disaster (following Cyclone Sidr the group met on a weekly basis). The group is primarily an information-sharing mechanism, with participants including the Government, UN agencies, NGOs, the Red Cross/Red Crescent, donors and the media. The DER is chaired by MFDM, with secretariat support provided by UNDP.

ROAP plans to work in close collaboration with, and within the recommendations of the Disaster and Emergency Response sub-group by providing ad hoc, and as-requested capacity building support, in terms of cluster-rollout developments, information management readiness and civil-military cooperation.

Annex IX: Asian Disaster Reduction Centre (ADRC)

ADRC is engaged in the following basic activities: (http://www.adrc.asia/project/index.html)

1. Information Sharing: via website, utilizing GLIDE number, and international meeting.
2. Human Resources Development: by seminars, WSs, trainings, and visiting researchers program
3. Building Community Capabilities: by tools for encouraging community involvement and ADRRN
4. Cooperation with Member countries, International/Regional Organizations and NGOs

ADRC launched the Peer Review project to facilitate mutual learning for the purpose of achieving the goals established by HFA. Followings are the outline of recommendations and suggestions of the Peer Review 2011 in Bangladesh. (http://www.adrc.asia/publications/drr/index)

Structural measures:

- More cyclone shelters (CS) are necessary. Present CS aren't distributed sufficiently to evacuate. Smaller scale CS should be built in a much more dense distribution in the local area.
- Reinforcement of embankment river lines and coastal regions is necessary in some areas, but not in all fluvial and coastal areas. Furthermore, new embankments need to be constructed.
- New forestation and forest maintenance measures are necessary. Mangroves are important as natural embankments. Some embankment areas need to be planted with mangroves.

Institutionalization:

- Enactment of the DM Law. Priority should be given to advocacy involving all stakeholders to push for the passage of the DM Law.
- Instead of only DM, DRR is suggested in view of the paradigm shift from response, which is reactive, to risk reduction which is proactive. DRR program is also related to climate change.
- Establishment of an emergency communication system. Communication systems to ensure early warnings can be promoted using mobile phones, which are popular even in rural areas.

- Regular review and revision/updating of Standard Operating Procedures (SOP) in manning of Operations Centers, as well as contingency plans and other operational tools related to DRRM.
- The government should have flagship disaster management projects, especially those involving multiple agencies which might easily get funding from international organizations.
- It is necessary to reinforce the network of all DRR institutions and promote coordination and information-sharing to ensure a common understanding of SOP visions and avoid overlap.

Capacity development:

- There is a need to promote human resource development in all agencies in order to increase their capacity and expertise in using state-of-the art DRR tools and methods.
- Conduct regular disaster drills and exercises including table top exercises covering the issuance of warnings, receipt of those warnings by DM officials, and the timeliness of the reaction of disaster response teams, to learn where the gaps are and where improvements are needed.

Operation:

- Identify and propose projects based on the DM framework involving all stakeholders and in consideration of the problems facing CPP agencies, such as the need for equipment repairs, lack of technical personnel, the need for capacity building and training, deteriorating state of cyclone shelters and a lack of state-of-the-art facilities for accurate warnings.
- Documentation:
- There should be complete documentation of disaster incidents that can be used as reference material during reviews by stakeholders.
- Maintenance of databases is also suggested. These may already be available to some agencies but the DMB should be a repository of all DM and DRR related information.

Annex X: Pakistan Space & Upper Atmosphere Research Committee (SUPARCO)

Pakistan Space & Upper Atmosphere Research Committee (SUPARCO), the national space agency, was established in 1961 and granted the status of Commission in 1981. SUPARCO is devoted for R&D in the field of Space science and to develop indigenous capabilities in space technology for the peaceful uses of outer space as well as applications of space technology for socio-economic uplift the country.

SUPARCO has been involved in Satellite Remote Sensing (SRS) & Geographic System (GIS) applications for the past 40 years for which, it has established all the necessary facilities and trained manpower. As a national space agency, SUPARCO acquires archives and disseminates satellite imagery, provides consultancy services, conducts collaborative research programs and provides short and long term training in the fields of SRS & GIS.

Since earthquake of 2005 SUPARCO has been involved in disaster monitoring and mitigation. It provided valuable space based information during the earthquake of 2005 and the floods of 2010 to the national and international agencies involved in disaster relief, early recovery and rehabilitations /reconstructing phases. It has sufficient expertise and knowledge base to provide training and other support to the Bangladesh Space Research and Remote Sensing Organization (SPARRSO) in the use of space based information for disaster monitoring, management and mitigation.

SUPARCO would support Bangladesh in case of major disaster through provision of imagery and updated maps to assist in rescue/relief, early recovery and rehabilitation/reconstruction phases as the UN-SPIDER RSO.