Chapter – VI:
Communication Systems for disaster preparedness

With advancements in information technology and communication, disaster forecasting and quick response have become possible. Timely deployment and use of telecommunication resources play a crucial role in saving life, mitigating disaster and relief operations.

Forecasting and early warning is essential for minimizing loss of life and property and enabling the agencies concerned to plan rescue and relief measures. Effective early warning systems can also significantly reduce the impact of disaster on human life.

Our findings on implementation and performance of the communication networks of the country are discussed in the succeeding paragraphs.

6.1 Disaster Management Support Programme

Department of Space (DOS) in March 2003 started the Disaster Management Support (DMS) programme to harness the benefits of the space based technology for applications in disaster management in the country.

DMS programme aimed to provide timely support and services from aero-space systems, both imaging and communications, towards efficient management of natural disasters.

It included creation of digital data base for facilitating hazard zonation, damage assessment, monitoring of major natural disasters using satellite and aerial data, establishing satellite based reliable communication network and deployment of emergency communication equipment.

Under this programme, a Decision Support Centre (DSC) was set up at the National Remote Sensing Centre. DSC constantly monitored flood events and tracked intensity of cyclones originating in the Indian Ocean region. It also monitored the prevalence and severity of agricultural drought in 13 states during the kharif crop season[1] every year, active forest fires on a daily basis[2], and all the major earthquakes and landslides in India and the adjoining region. The status of various components of DMS programme is given in Chart 6.1.

[1] June to October
[2] from February to June

Chart 6.1: Status of various components of Disaster Management Support programme and other communication networks

6.1.1 National Database for Emergency Management (NDEM)

Department of Space had undertaken a project to develop National Database for Emergency Management. The mirror image of the database was to be maintained in MHA under a team of experts located there.

NDEM was conceived as a Geographic Information System (GIS) based repository of data to support disaster management in the country.

The NDEM activity envisaged the timely provision of necessary geospatial information to the stakeholders. The scope of NDEM encompassed all possible disasters, natural as well as human-induced and technological. Developing a GIS based national database and application of geospatial technologies were considered central to the effective realization of NDEM goals.

6.1.1.1 Implementation of the project

During the period 2006-12, DOS made a budget provision of ₹ 22.30 crore for the NDEM project under Disaster Management Support programme, out of which only ₹ 6.34 crore were spent (2006-07 to June 2012). In addition, ₹ 9.68 crore were spent on civil works for constructing facility for housing NDEM project.

Project was to be completed by 2011 but it had not become operational till July 2012.

We noted serious gaps in data collection, its storage and utilisation. Details are provided in **Annex - 6.1.**

DOS stated (July 2012) that the implementation of NDEM project was planned as a multi-institutional coordinated effort. Different datasets ingested into NDEM project were generated and were available with different organizations. It however, added that the database implementation was delayed as response from nodal departments was not encouraging.

6.1.1.2 Non identification of nodal officers

In August 2007, MHA instructed all states, nodal Ministries and Departments to identify a nodal officer to act as a single point of contact with National Remote Sensing Agency (NRSA) for sharing geospatial data sets for NDEM project. However, 6[3] out of 37 central departments and organizations and 8[4] out of 35 states and UT Governments had not identified nodal officers for providing geospatial data for NDEM server (May 2012).

6.1.1.3 Data for NDEM

The technical document for NDEM project was sent to nodal Ministries and states by NRSA (March 2008). They were required to provide the details of database available with them. Only 5[5] out of 37 central organizations and departments had

[3] Election Commission of India, National Hydrographic Organisation, Ports Authority of India, Ministries of Shipping & Surface Transport, Water Resources and Rural Development

[4] Himachal Pradesh, Jammu & Kashmir, Nagaland, Odisha, Uttarakhand, Chandigarh, Dadra & Nagar Haveli and Lakswadeep

[5] Airports Authority of India, Ministries of Steel and Railways, Department of Space and National Bureau of Soil Survey & Land Use Planning

supplied the data as of July 2012, of which, only four had supplied data in usable form.

Similarly, only 3[6] out of 35 states and UTs had supplied the data, of which, data from one state i.e. Punjab was in usable form and was ingested in NDEM.

6.1.1.4 Steering committee meetings

The steering committee was to oversee the implementation of NDEM project at the apex level. We noted that the last meeting of the steering committee was held in June 2007 and no meeting was conducted during the last five years.

6.1.1.5 Mirror image of the database

Mirror image of database was to be maintained in MHA by a team of experts. This could not be done as MHA was yet to finalize the mirror site (July 2012).

We noted that after making efforts for more than seven years and expenditure of ₹ 16.02 crore, the critical facility of NDEM project had not been created due to ineffective coordination by the implementing agencies.

6.1.2 Airborne Laser Terrain Mapping and Digital Camera (ALTM-DC) system

Indian Space Research Organisation (ISRO) formulated a programme for creation of a digital, thematic and cartographic data base for hazard zonation and risk assessment. Under this programme ISRO and National Remote Sensing Agency (NRSA) planned to cover one lakh sq km every year for the development of close contour information of ground using the Airborne Laser Terrain Mapper (ALTM) system, thereby envisaging coverage of all the priority flood prone areas (five lakh sq. km.) in a period of five years.

The system was proposed to be used to generate close-contour data[7] for disaster prone regions of the country. Based on this, frequency of floods/cyclones, and demographic information, hazard zonation and risk maps were to be generated.

DOS/ISRO spent ₹ 23.75 crore from April 2003 to June 2012 for procurement and operationlisation of ALTM-Digital Camera. The system arrived at NRSA in May 2004.

CAG's Performance Audit Report on the activities of National Remote Sensing Centre (Department of Space), No. 21 of 2010-11 also highlighted that there was a delay in implementation of the project due to delay in obtaining clearance from Ministry of Defence and non availability of pilots.

We noted that an action plan was prepared by NRSA for ensuring systematic acquisition of ALTM data during 2007-11. However, the survey work was conducted only up to August 2010. By then, data acquisition for only 38,020 sq km was completed against the target of 60,000 sq km[8] (let alone the original objective/plan of covering five lakh sq km in five years).

[6] Punjab, Tripura and Mizoram

[7] NDMA envisaged maps to scale 1:10000 with contours at an interval of 0.5/1.0 m

[8] This target was as per plan of action for acquisition of ALTM data for priority areas during 2007-11

Thus, after investment of ₹ 23.75 crore in procurement and operationlisation of ALTM-Digital Camera, less than 10 *per cent* of the flood prone area of the country was covered to generate close contour and detailed topographic information.

6.1.3 Disaster Management Synthetic Aperture Radar

Disaster Management Synthetic Aperture Radar (DMSAR) operating in C-Band[9] was used to acquire aerial radar data during natural disasters when no satellite data coverage was available. It was used for purposes like flood mapping, damage assessment, etc. The system was to be developed by Space Applications Centre, Ahmedabad and operated by National Remote Sensing Agency (NRSA), Hyderabad. The project was approved in February, 2003 with a total budget estimate of ₹ 20.20 crore.

We noted that DMSAR surveys including (i) test flights (ii) pre-flood sorties, and (iii) flood sorties were carried out during the year 2007 and 2008 in different parts of the country by using the prototype developed by NRSA. However, after October 2008 no aerial survey was carried out using DMSAR equipment.

Aircraft and ASAR instruments

National Remote Sensing Centre suggested a triggering mechanism for DMSAR data acquisition in November 2009. Demonstrations and trainings were to be provided by ISRO to State Governments to build capacity for aerial data acquisitions.

We noted that no action had been taken by ISRO/DOS for establishment of such trigger mechanism. No demonstrations and trainings were provided to the states' agencies (July 2012). Thus, even the developmental model of DMSAR could not be used and the system remained idle.

Support through DMSAR under ISRO's Disaster Management Support programme by acquiring aerial radar data during natural disasters could not be materialized even after incurring an expenditure of ₹ 28.99 crore[10] and a lapse of six years from the scheduled date of completion.

[9] C-band is a name given to portions of the electromagnetic spectrum, including wavelengths of microwaves that are used for long-distance radio telecommunications. DMSAR operates in C- band at 5.35 GHz.

[10] The additional amount was spent from DMS overall budget.

6.1.4 Satellite based communication network for disaster management

For providing emergency communication, at the behest of MHA, ISRO was to set up a satellite based Virtual Private Network (VPN) facilitating secure data access through a dedicated electronic network connecting all the key players of disaster management. The VPN was to be set up in three phases. In the 1st phase, MHA, Cabinet Secretariat, NDMA, PMO, other key data providing agencies[11], and NRSA were to be connected with 20 multi-hazard prone State Emergency Operation Centres (SEOCs). The subsequent phases were to see expansion of the network to link the multi-hazard prone District Emergency Operations Centre (DEOCs) in the country.

The network was proposed to be ready for regular operation from December 2005. We noted the following:

The communication equipment was procured and delivered to the states by the middle of 2006.

The Disaster Management Support-VPN was made functional using a full transponder on Edusat satellite in September 2006. However, VPN services were not provided from 28 September 2010 to 31 March 2011 as the satellite stopped working. In October 2010, 13 MHZ on INSAT 3E were allocated for DMS-VPN but the re-orientation of hub towards INSAT 3E could only be completed in June 2011. Subsequently a request was made in February 2012 to re-orient the network to GSAT 12.

As of July 2012, the status of operationlisation of VPN network was as under:

- Out of 10 primary nodes, one node at IMD, Delhi was not fully operational.
- Out of five monitoring nodes, two[12] were not operational.
- Out of 20 state nodes, two nodes[13] were not operational.

The reasons provided for non-operationlisation of the nodes are given in **Annex - 6.2**.

MHA stated (December 2012) that Satellite Base Virtual Private Network (VPN) for disaster management support was launched by Department of Space to strengthen the communication backbone. Due to flooding of the building where it was located, the same was shifted to DCPW Campus. However, its formal transfer to DCPW was in the pipeline. Out of 37 nodes, 32 are functioning presently.

Thus, DMS Communication Network which was to become functional by December, 2005 was not fully operational even after six years of receipt of the communication equipment and incurring expenditure of ₹ 6.77 crore.

6.1.5 Doppler Weather Radars

For the surveillance and monitoring of severe weather system such as cyclones, ISRO planned to develop and establish Doppler Weather Radars (DWRs). The DWR systems were to substantially increase the lead-time for cyclone warning by providing quantitative information on

[11] IMD, CWC, GSI, SOI, INCOIS and NIDM

[12] At the Prime Minister's Office, Delhi and the Prime Minister's residence, Delhi

[13] At Shimla and Mumbai

the intensity and radial velocities of cyclones. These were also to improve the understanding and forecasting of thunderstorms, hailstorms, tidal waves, wind turbulence and shear[14].

These radars were to be set up jointly by India Meteorological Department (IMD) and DOS with the available indigenous technology on data and cost sharing basis. The Cabinet Secretary directed (November 2005) IMD and ISRO to work towards setting up of DWR's in Assam by 30 June 2007. In March 2006, a draft MoU was prepared jointly and IMD was requested to approve the same. But no response from IMD was received (July 2012).

Doppler Weather Radar

Pending finalization of MoU with IMD, in April 2006, ISRO decided to proceed with the development of two S-band radars for the North-Eastern region on its own. ISRO also initiated the process of development of two more S-band radars in the Himalayan region with participation by DRDO in February 2008. Later ISRO decided to develop C-band Radar at Thiruvananthapuram in January 2009. These radars were to be supplied, installed and commissioned by M/s Bharat Electronics Limited[15], Bangalore. Against a budget of ₹ 47.15 crore for these works, ₹ 35.64 crore was spent (March 2012) but the radars were yet to be set up.

DOS stated (July 2012) that all the four S-Band DWRs were ready for delivery at BEL. They further stated that DOS (ISTRAC[16]) had not taken the delivery of these radars officially as there were inter-departmental issues regarding diverting the radars.

We noted that IMD had requested BEL in July 2010 to explore the possibility of diverting the radars manufactured for ISRO to meet their emergent requirements at Goa, Kochi, Karikal and Paradeep. ISRO agreed for diversion in September 2010 but four radars were yet to be set up (July 2012).

Under construction building for S-Band DWR at Cherrapunji

[14] Wind shear is a difference in wind speed and direction over a relatively short distance in the atmosphere.

[15] BEL is industrial partner of DOS in development of radars

[16] ISRO established a comprehensive network of ground stations to provide Telemetry, Tracking and Command support to satellite and launch vehicle missions known as ISRO Telemetry, Tracking and Command Network

Thus, an amount of ₹ 35.64 crore spent by DOS under DMS programme for setting up of the five radars was blocked without yielding any fruitful results due to lack of effective co-ordination with IMD. Out of five sites, only two sites i.e. Cherrapunji for one S-Band DWR and Thiruvananthapuram for C-Band DWR were finalized. Civil works were in progress and hence these were yet to be made operational (July 2012).

Thus, despite an expenditure of ₹ 111.17 crore, none of the five components under DMS programme were fully operational (July 2012).

6.2 Other communication networks:

6.2.1 National Disaster Communication Network

During a disaster, the existing terrestrial communication networks are prone to failure. To address this risk, NDMA decided to set up the National Disaster Communication Network (NDCN).

NDCN was planned as a network of networks by providing appropriate connectivity to the existing communication networks viz. NICNET, State Wide Area Networks (SWANs) and POLNET, etc., to various Emergency Operation Centres. The concept paper for the project was sent by NDMA to MHA in October 2007. We noted delays at various stages involved in the preparatory work of the project, since the submission of the concept note. As a result, the ambitious project of NDMA to provide networking for integration of various disaster management tools in the country was still at the preparation stage even after a lapse of more than four years (June 2012).

MHA stated (December 2012) that NDCN Project was very comprehensive and important, detailed consultations with various stake holders had to be held and accordingly the project was formulated to bring about effective coordination among various communication networks presently working in the field of Disaster Management.

6.2.2 National Disaster Management Informatics System

NDMA in March 2008 proposed to establish the National Disaster Management Informatics System (NDMIS) for utilizing the GIS platform tool in disaster management. NDMIS was to host the core database and disaster specific database for carrying out vulnerability analysis and risk assessment.

We noted that when NDMIS was proposed, NRSC was already developing NDEM for MHA. To avoid duplication of work, NRSC on request of NDMA made a presentation in March 2008 for establishment of NDMIS. NRSC submitted the project proposal for NDMIS in September 2009. Based on the project proposal, NDMA submitted the concept note to MHA in April 2010. MHA however, had concerns regarding data availability and justification for a separate project other than NDEM.

We noted that even after four years, the development of NDMIS was yet to be

approved by MHA (May 2012) and the project was still in the conceptualization stage. The project was delayed in the process of resolution of the issue of duplication of the efforts for NDEM and NDMIS.

MHA stated (December 2012) that the project had been carried out for the first time in the country, its preparation had taken some time as it was evaluated with National data for emergency management to avoid duplication.

Audit noted that both NDEM and NDMIS projects had not been operationalised. This had affected the development of a GIS based national database and application of geospatial technology for disaster management in the country.

6.3 State disaster preparedness:

6.3.1 Communication network

- In ANI, Indian Space Research Organisation (ISRO) installed a V-SAT system (DMS Node) under Disaster Management Support programme at Port Blair in 2006 which was non functional for several years. We further noted that there were 13 Emergency Operation Centres (EOCs) but only seven Video Conferencing Systems were procured in two batches in March 2007 and March 2012. Further, the installation was completed at only three EOCs. Thus, connectivity between State Control Room and the remaining ten EOCs was yet to be established through VSAT.

- DDM, ANI proposed (March 2011) to establish a dedicated "Ocean Information Dissemination System" through Indian National Centre for Ocean Information Services (INCOIS) in SCR In April 2011. DDM requested INCOIS to make necessary arrangements to install the dedicated system alongwith a hotline, which was yet to be made functional.

- State Disaster Management Plan of West Bengal proposed an ambitious central communication network for disaster management connecting SEOC to DEOC and DEOCs to Block Emergency Operation Centres (BEOCs) through VSAT etc. However, no progress was noted in the development of this network.

- GoI had sanctioned two Doppler Radars (June 2008) for Uttarakhand to strengthen early warning indicators related to disasters. The Doppler Radars were to be purchased, installed and manned by IMD and the State Government was to make available land for this purpose. These radars were proposed to be installed in Nainital and Mussoorie but were not installed due to non availability of land (August 2012).

6.3.2 Communication equipment

- In the test checked districts of Odisha, we noted that timely action was not taken for repair of the communication equipment after reporting of defects. The Annual Maintenance Contract for 35 satellite phones provided to the District Emergency Operation Centres (DEOCs) and other offices had not been renewed. Further, the Annual Maintenance Contract of 414 VHF sets provided to various DEOCs and other offices had expired on 7

September 2011 and had not been renewed (August 2012).

- In Rajasthan, High Band Frequency (HBF) wireless sets were supplied (September 2009) to Superintendent of Police (SP), Barmer and Jalore districts for easy and early communications in case of any disaster. We noted instances of wireless sets lying uninstalled (May 2012) in these districts. The SP, Barmer stated (May 2012) that uninstalled wireless sets were lying in sub store, Barmer and process of their distribution would be started soon.

- An Expert Committee in ANI resolved (January 2010), to strengthen the communication network between the islands by means of Satellite Communication System. Directorate of Disaster Management (DDM) found (July 2010) that only five satellite phones were available in the Islands and thus a proposal was mooted to purchase 13 satellite phones for different locations. The satellite phones were yet to be supplied as of May 2012.

6.3.3 Other issues of concern

- In West Bengal, we noted that warning to the public was given through public address systems, radio, television, etc. Apart from this, no independent communication network for disaster management existed at the state level. The department accepted that the system in place was not fully reliable. We could not ascertain the delays in dissemination of warning as data was not maintained indicating the message in and out times.

- In Uttarakhand, no risk management plan was prepared for early warning. Requisite tools and mechanism for providing early warning indicators in regard to disaster were also not in place. Reliable communication system was inadequate as the sharing of disaster information was delayed by more than three hours in 50 to 86 *per cent* cases.

Recommendations:

- ***DOS should ensure that National Database for Emergency Management (NEDM) is operationalised at the earliest.***
- ***Digital, thematic and cartographic data base is required for hazard zonation and risk assessment for development of close contour information of ground. ISRO and NRSA should ensure timely completion of this activity.***
- ***ISRO should fully operationalise the satellite based DMS Communication Network and Doppler Weather Radars at the earliest.***
- ***NDMA should ensure implementation of NDCN and NDMIS projects.***