The Role of Communication & Meteorological Satellites in Disaster Management Support
- Experience of ISRO

Presentation By
Indian Delegation

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Key Vulnerability:

- 5700 Km Long Coastline - Cyclone-prone
- 40 Mha - Flood-prone
- 68% of Net Sown Area (116 Districts) - Drought-prone
- 55% Total Area - Seismic Zones III - V
- Sub-Himalayan/ Western Ghats - Landslide-prone
Super-cyclone in Orissa during 28-30 Oct 1999

Meteorological imagery from INSAT-2E
Damage due to Earthquake in Bhuj – 26 Jan 2001
Areas affected by Tsunami of 2004 in India

• The worst affected area – An archipelago of 572 islands called Andaman & Nicobar Islands
• Three coastal districts of Tamil Nadu State in South India.
• The coastal areas of State of Pondicherry.
• One district of Kerala State in South India.
• Two districts in Andhra Pradesh.
SPACE IN DISASTER MANAGEMENT

Observation for Information

Preparedness
Mitigation
Reconstruction
Disaster event
Relief
Rehabilitation

Information for Decision

Decision for Action

FLOOD MAP
DROUGHT MAP
DAMAGE MAP
HAZARD ZONES
RISK MAP
SUPER CYCLONE OVER ORISSA COAST

- CYCLONE FORECASTS BASED ON INSAT VHRR IMAGES
- USE OF MESOSCALE MODELS FOR IMPROVING TRACK FORECAST
INSAT Pictures of Nov. 9, 2005
55 mm Rain at SHAR during 1000-1430 IST
DROUGHT MONITORING
KARNATAKA STATE
IRS WiFS based NDVI

Severely drought affected districts

May-July 2000
Increasing NDVI

May-July 2001

Satellite derived NDVI

BHIWANI DISTRICT

Excess (1988)
Normal (1991)
Drought (1987)

Country

State 1
State 2

District 1
District 2

Mandal 1
Mandal 2
(Cluster of villages)
Applications driven programme
Self reliance in building & launching satellites

- 2.5 m resolution, 30 Km Swath
- Stereo mission; +26° / -5° forward/ Aft view
- Revisit : 5 days
- Along Track Stereo viewing - first of its kind in the world

Four Decades of Indian Space Programme

TODAY, 2004

ONE
AMONG
THE
SIX
NATIONS

42+ 4 Missions
CARTOSAT-1 Image
Airborne SAR data over Bihar State

Darbhanga Area

During Floods – Airborne SAR data of 24-Jul-2004

Affected Embankment
Programmatic Response to Tsunami
Multi-Tasking for Disaster Reduction

Tsunami affected A& N Islands

ISRO Telemedicine Network

Multi-tasking

Satcom VSATs: Deployable terminals, Mobile WLL VSATs

Space + Other IT-enabled Services
- Tele-education: Broadband System
- Tele-Medicine: Broadband System
- Disaster Management Support: Emergency Communication, Vulnerability, Risk & Early Warning
- Spatial Info. support, Weather info., Farmers Advisory services,..
- Access to: Telephone, Fax, Internet

Used for locating the missing children.

Trinkat Island

Pre-Event

Post-Event

Multi-Tasking for Disaster Reduction

Programmatic Response to Tsunami

Tele-education: Broadband System
Tele-Medicine: Broadband System
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Katchal Island
before & after Tsunami

IRS-P6 AWiFS Image of 21-Dec-04

IRS-P6 AWiFS Image of 26-Dec-04
.Locale-specific Early Warning System
Cyclone Warning Dissemination System (CWDS)

Inputs
INSAT VHRR Imaging/Cyclone Tracking
Cyclone Warning

Cyclone Warning Centre
Earth Station

C-Band Uplink
S-Band Downlink

More than 250 CWDS Installed in the Coastal Areas
Focus: Track, Intensity, Landfall predictions
- **Type-D terminal**
  - Briefcase terminal with solar panel on the cover, and battery back-up.
  - Two-way voice link capability.
  - Uplink and downlink work in S-band.
  - Development & evaluation completed, units under field trial.
  - Serviced by a central Hub with DAMA NMS.
Strengthening of Observation Network

Automatic Weather Station (AWS)
Developed thro’ Industry Partnership

- Large No. of AWS - replacing human observers worldwide
- Facilitate frequent/continuous observations
- Data transmission via satellite to receiving station; and directly as input to numerical models

Diagram:
- Satellite Transmitter
- Dedicated Team/User Dept.
- Data Processing Center
- Met. Sensor Data
Strengthening of Observation Network

Doppler Weather Radar

IMD - ISRO Doppler Weather Radar at Sriharikota

- Continuous monitoring of severe weather events
- Key parameters for atmospheric studies
- Urgent need to expand the Radar network to cover entire coastal areas, NE region, major cities, …
Decision Support Centre at NRSA, Hyderabad

Disaster Forecasting Organizations
(CWC, IMD, ...)
Other Sources
(Press/TV, Local Bodies, NGO)

Satellite Data Programming and Acquisition
(NRSA Earth Station / NDC)

Data
- Satellite, Aerial
- Coarse - High Resolution
- Optical Microwave

Acquisition of data

Database, Knowledge Banks

Ground / Ancillary Information

Data Analysis

Hardware & software

Customized Analysis Tools

Outputs

Dissemination to Users
VSAT, FTP, Web page, E-mail etc.

ALERT (Advance) Info. on Disaster

ASAR/ALTM/DC etc.

Flight Planning

Defense clearance

Data acquisition, processing and transfer to DSC

Defense clearance

Data acquisition, processing and transfer to DSC
DMS - Infrastructure

Aerospace Systems

- Imaging ‘Hot spot’
- High Resolution Imaging
- Laser Terrain Mapper
- Met/Ocean Observation
- Emergency communication
- All weather mapping
- Real Time Mapping

Institutional Interfaces

- Knowledge networks
- Decision Support Centre (DSC)
- Rapid Mapping Vulnerability, Risk...
- User community
- Concerns
- Scientific Inputs
- Policy / Management decision

Communications Backbone
Terrestrial & Satellite based (Mobile Terminals, VSAT, WLL VSATs, CWDS, S&R, ..)
Virtual Private Network under DMS

Knowledge Institutions

State Emergency Centres

Decision Support Centre

Nodal Agency

VPN

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Conclusion

The Disaster Management Support programme of ISRO is the outcome of the extensive efforts put towards optimally utilizing the capabilities of the space systems to provide critical inputs to the disaster management efforts.

Prime Minister of India talking to Tsunami disaster affected people, with satellite communication antenna in the background.