Case Studies of Disaster Management for Different Countries <u>NIT Durgapur</u>

Case Study 1: Japan (11 March 2011)

- **Type of Disaster:** Earthquake followed by Tsunami, Flood and Nuclear Reactor disaster.
- Area Affected: Iwate, Miyagi and Fukushima Prefecture
- Area Affected in Square Kilometres: 555.36 sq. km
- Population Affected: 12,554 killed, 15,077 missing, 2886 injured
- **Category:** Developed country



Impact on Communication System:

- 1. Around 7 million homes suffered from Power cut problem for one week.[2]
- 2. Access to Telecommunications (including landline and mobile phone service) was significantly reduced as mobile networks were downed and carriers limited the number of allowed calls to avoid further system overloading.[2]
- 3. Several undersea telecommunication cables sustained major damage during the main tremor and the tsunami.[1]
- 4. PicoBTS, NanoBTS, and MacroBTS, terrestrial links had been destroyed.[3]
- 5. Ten Very Small Aperture Terminals (VSAT) were swept away by tsunami.[4]
- 6. A maximum of 29,000 mobile base stations ceased to function (including those by power outage)[4]
- 7. A maximum of 1,900,000 terrestrial communication channels (telephone, FTTH, ADSL, etc.) became unavailable for 3 to 4 days.[4]

Solutions used in Recovery:

During Disaster

1. Twitter:

• Twitter was the only functioning communication tool during the disaster for real time news updates and to determine the whereabouts and well-being of loved ones.

• Less than an hour after the quake, with the country's phone system knocked out, the number of tweets coming from Tokyo were topping 1,200 per minute, according to Tweet-o-Meter.[8]

> After Disaster

- 1. Delivered satellite terminals urgently by cars, helicopters and manpower; it took a few days.[4]
- 2. NTT installed emergency use public phones in evacuation centres' utilizing portable satellite equipment. They also installed Internet access points with the cooperation of other companies.[5]
- **3.** Several Wi-Fi hotspot providers started providing free access to their networks, and some American telecommunications and VoIP companies such as AT&T, Sprint, Verizon, T-Mobile and VoIP companies such as net TALK and Vonage offered free calls to Japan for a limited time.[1]

4. Unmanned Aerial Vehicle (UAV) :

- A UAV (unmanned aircraft) named RQ-4 Global Hawk that performs surveys of large geographic areas, was deployed from Anderson Air Force Base in Guam to assist with disaster relief. Using radar and optical surveillance, the aircraft was used to assess damage to infrastructure throughout the affected area.[10]
- Due to nuclear radiations emission humans were advised to avoid the area. To remedy the imagery collection issue, remotely operated UAVs were deployed to the area. A United States Air Force Global Hawk UAV equipped with telescopic, infrared sensors was used to determine the effectiveness of attempts to cool the reactors.[11]
- A wide aperture array sensor was loaded under wings of UAV.
- 5. Remotely controlled robots were being sent 2,500 meters to the ocean seabed to repair damaged cables.[2]
- 6. Use of portable and auto pointing antennas to rapidly connect base stations to core network.[3]

7. IPSTAR:

- Use of 4/2 Mbps IPSTAR broadband service.
- The service can be activated as soon as the terrestrial networks are detected to be down.
- It is capable of providing a wide range of IP based solutions, along with Internet access.
- Used Femtocells were coupled with IPSTAR backhaul to provide indoor service in designated areas.[3]
- 8. The Ushahidi Social Network Trends Map, Google Person Finder, and Twitter were used to locate trapped disaster victims, direct disaster victims to clean water, food, and shelter, and expeditiously inform familial members of the post-disaster fate of loved ones.[6]

- **9.** "The Global Disaster Relief" Facebook page posted a set of time-stamped maps that show how news spread through status updates about the earthquake and resulting tsunami.
- **10.** Approximately 90% exchange offices and mobile base station equipments were restored by mobile power supply vehicles and privately owned power generators, and through facility restoration, such as by backup relay routes, in 10 days. [7]

11. Mesh Network:

- Any user can start a new static, ad-hoc or hybrid mesh network to share images, videos etc. For that one has to open MeshKit on their Android phone and starts a new mesh. Other phones with MeshKit installed push (notify) their owner that a new network is starting they can choose to join or disregard it.
- A few dozen phones and laptops interconnect and become a wireless ad-hoc mesh, sharing thoughts and passing around images. [12]

Problem faced with Twitter

The biggest problem was the reliability of twitter updates, particularly in calls for help, that were misplaced, or lies. It was found that numerous unreliable "retweets" (RTs), where users of the service repeated inaccurate information and that this was one of the biggest information-related problems facing those involved. [9]

Suggested Solution:

Twitter communication could be improved if official hashtags were announced during disasters and the number of retweets for a given hashtag could be limited to avoid the wider spread of disinformation. [9]

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Case Study 2: Pakistan (July 2010)

- **Type of Disaster:** Flood
- Area Affected : Azad Jamu & Kashmir , Balochistan, Gilgit Balistan , Khyber Pakhtonkhawa , Punjab , Sindh
- Area affected in Square Kilometres: 132,000 square kilometres
- Population Affected: 14,571,885
- **Category:** Underdeveloped country



Situation before flood:

- The level of Pakistan's technological infrastructure in the flooded areas was very poor.
- The non-availability of satellite imagery of the country made the volunteer developers struggle in plotting where relief was a priority.[2]

Impact on Communication System:

• Although the loss of terrestrial communication system was not too high, but the applications of modern tools used was limited and did not prove much successful. [2]

Solutions used in Recovery:

> During Disaster

- 1. Humari Awaz:
 - This is a mobile phone based social networking channel available to all cell phone operators in Pakistan. Through this network, one can create their own

group and anyone can join it for free. The group founder can then send one SMS, which will automatically be sent to all the group followers.

- The purpose of establishing "Humari Awaz" was to build mobile based networks around shared interests, themes and subjects and to create social networks that facilitate more people to people interactions.
- A text SMS "HELP" or "MADAD" sent to 7111 helps the users to go through the registration process.[2]

> After Disaster

1. FloodMAPS:

- It is local website tool which derives from the reliability of Google Earth and Google Maps to track the path of the flood and monitor devastation like washed out bridges that needed to be rebuilt, etc.
- These maps provided detailed views of thousands of villages affected by the downpour, broken down by region.[2]

2. Google Crises Response:

- Google's tool, Google Person Finder, which is used to connect those seeking information about loved ones, and Google Resource Finder, which helps locate medical facilities and other emergency services during a crisis, were used to some extent during flood relief operations.[2]
- Google Person Finder is a web application that allows individuals to post and search for the status of relatives or friends affected by a disaster. The program also lets press agencies, non-governmental agencies and others contribute to the database and receive updates by using the Person Finder API based on the People Finder Interchange Format (PFIF) open standard.[5]
- Procedure to find people in the aftermath of a disaster:
 - a. Embed Google Person Finder in your site.
 - b. Download data from Google Person Finder.
 - c. Upload data into Google Person Finder. [6]

3. PakRelief Crowd Map, Pak Flood Incident Reporting System:

- People with access to working mobile phones were asked to text a message to 3441 and relay their first hand information about the nature of emergencies and the needs of people in a particular flood affected location.
- The information was then verified and mapped onto the CrisesMap. PakRelief would then notify a relief agency working nearby of that particular incident and the type of help required.[1]

4. ZTE Network Management:

- The communication network was maintained by ZTE in disaster areas, and provided a strong surviving power for the provision of relief to local residents.
- After disaster, ZTE immediately set up a "Disaster Evaluation and Rescue" team and deployed maintenance engineers to advance into the disaster areas, and ensure that communication was maintained in a normal and stable state.[3]

5. Social Networking Sites like Facebook and Twitter:

- These sites helped the Pakistani community to be connected and to raise the voice for the help of flood victims throughout the world. They were able to mobilize people in different parts of the world to help the flood victims.
- Using Twitter also got different celebrities throughout the world to tweet their fans to help flood victims at Pakistan.[2]

6. Sahana:

• It was one of the information management tools providing resources on the Pakistan flood response. It could provide the raw data, in various formats including maps, and is built on an open source rapid application development framework and supported by a global community of volunteers.[2]

7. NetHope:

Fourteen Skylogic VSATs deployed in Kashmir and NWFP provinces, NRKs deemed heavy and technical.

8. LIVPOD:

- It is a cloud computing service designed for sharing live notes on the ground, between the Emergency Relief teams and their different partners, using mobile devices such as smart Phones / pads / laptops, etc.
- It provided people an easy way to upload breaking news onto a common data server and, in return, get specific details and/or global views on the situation in terms of immediate needs, food availability, refugee camps management, logistics, etc.
- Small web maps for mobile use are automatically created through Google Maps or other similar APIs.[2]

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Case Study 3: Haiti (12 January 2010)

- **Type of Disaster:** Earthquake (7.0 magnitude)
- Area Affected: Port au Prince, Petit Goave, Grand Goave, Leogane, Carrefour, Miragoane, Delmas, Verrettes, Santo Domingo
- Area affected in Square Kilometres:
- **Population Affected:** 3 million
- **Category:** Least Developed Country



Impact on Communication System:

Solutions used in Recovery:

After Disaster

1. New free applications were made available for iPhone, Blackberry, Android and Windows Mobile cell phone platforms. Downloading the new apps allowed users to stay updated on how the American Red Cross was helping in Haiti through a real-time newsfeed, and by connecting to popular American Red Cross social media channels such as Facebook and Twitter. Users could also help support the relief and recovery efforts by donating via text, phone or Web.[2]

2. Ushahidi:

- It is an open-source crisis-mapping software which first provided a way to capture, organize, and share critical information coming directly from Haitians. Information was gathered through social media (e.g., blogs, Twitter, and Facebook) and text messages sent via mobile phones.[3]
- Initially all volunteer crisis-mapping teams combed through both social media sources, including Twitter, Facebook, and blogs, and traditional media sources to identify actionable pieces of information that could be of use for responders on the ground. If a piece of information was deemed useful and had a location attached to it, volunteers would find the GPS coordinates through Google Earth and OpenStreetMap and map it on haiti.ushahidi.com for anyone to view and utilize. Through the aggregation of individual reports, the crisis mappers were able to identify clusters of incidents and urgent needs, helping responders target their response efforts.[3]

3. Satellite Imagery:

- There was extensive use of remote sensing data, including satellite imagery and aerial photography, to guide damage assessment, rescue and recovery efforts. The organizations involved in these efforts included ImageCat, the World Bank's Global Facility for Disaster Reduction and Recovery, the Rochester Institute of Technology, the Earthquake Engineering Research Institute, and MCEER. [4]
- ImageCat, in collaboration with other partners, formed the Global Earth Observation Catastrophe Assessment Network (GEO-CAN). This network uses very high-resolution aerial and satellite imagery to determine which structures have completely or partially collapsed or are heavily damaged. Their findings have been and will be used by the World Bank to help develop plans for the reconstruction effort.[4]

4. LIDAR:

- They have also used Light Detection and Ranging (LIDAR) technology to create a three-dimensional map of the region to further enhance their knowledge of the damage.[4]
- LADAR is an optical remote sensing technology that can measure the distance to, or other properties of a target by illuminating the target with light, often using pulses from a laser.[5]

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Case Study 4: India (23-26 May 2009)

- **Type of Disaster:** Tropical Cyclone AILA
- Area Affected : Kolkata, East Midnapore, Howrah, Hooghly, Burdwan, South 24 Parganas of West Bengal
- Area affected in Square Kilometres: 26570 square kilometres
- **Population Affected:** 330 killed 8,208 missing, 1 million rendered homeless, 350,000 others affected
- **Category:** Developing country



Infrastructure:

There are only 42 km of railway line and about 300 km of metalled road network. Almost all the islands are devoid of any conventional electricity supply. Governmental effort to provide solar energy systems at subsidized rate has also not been much successful because of the very little purchasing power of the islanders.

Only means of communication with the mainland as well as with other islands is through long journeys through river channels. Such transport is not well organized and people have to depend on the private mechanized boats which are often overloaded while negotiating treacherous waters. [1]

Impact on Communication System:

- 1. GSM / CDMA networks were downed and took 4-5 days to come up again.
- 2. Suffered from electricity failure for several days.
- 3. Road connection to several remote areas was cut off.[2]

Solutions used in Recovery:

The Amateur Radio was used to setup communication in several districts. Volunteers carried a suitcase containing HF Transceiver, VHF transceiver, 2 Hand-helds, Inverted 'V' antenna for 20/40M, VHF whip antenna, 100 meters of coaxial cables, tools.

The District Administration provided fully charged heavy duty 12V Batteries which was judiciously used to run the transceivers up to 5 days for uninterrupted communication at two remote locations.

The messages were mostly on requirement of relief material, administrative reports on disbursement of relief, reports on public health as well as situation reports of medical camps and movement of officials.

The mobile communications from private cell phone operators was partially restored. Amateur Radio communication was asked to remain as backup communication as information received by administration included new weather warnings and rise in river water currents on account of High Tides.[3]

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Hurricane Sandy

- **Type of Disaster:** Tropical Cyclone Sandy
- Area Affected: Caribbean, Bahamas, United States, Florida, North Carolina, Virginia, Washington D.C., Maryland, Delaware, New Jersey, Pennsylvania, New York, Canada
- **Damage:** At least \$50 billion (2012 USD)
- **Population Affected:** 60 million, more than 100 died
- **Category:** Both in developing and developed country



Impact:

Power and Network outage: The super storm caused major power and Internet outages in a region that is home to more than 60 million people. Unsurprisingly, the impacts on Internet connectivity have been severe. For instance, several major data centers in Manhattan lost power or were flooded. Besides all the local impacts to the United States, New York City also happens to be a major hub of international telecommunications. As a result of outages there, we've observed Internet traffic shift away from the city as carriers scramble for alternative paths.

Two days after Hurricane Sandy walloped the East Coast, electrical utility companies warned hundreds of thousands of customers from Long Island to New Jersey that they may be left in the dark for more than 10 days.

Transport disrupted: New York Metropolitan Transit Authority and others indicated Tuesday that it may take weeks to restore the MTA for its roughly 8.7 million daily riders. More than 19,500 flights have been cancelled as a result of the storm, according to flight tracking site FlightAware.com. More than 7,000 Tuesday flights were cancelled, FlightAware figures show. By 9 a.m. Wednesday, more than 2,800 Wednesday flights and more than 480 Thursday flights had been cancelled. The Immediate effects of Hurricane Sandy on growers and shippers have been tighter supply conditions and elevated rates. The extent of the impacts on the market are still not fully known, but the WG-CHRW Transportation team are prepared to deal with challenging conditions for at least the next 7-10 days.

Dry pump: Gasoline shortages are hobbling businesses and hampering recovery efforts throughout communities hard hit by Hurricane Sandy, a situation that experts say could persist for several more days (As of Nov 2, 2012). It sounds like a Halloween nightmare: after a major storm, wide swaths of the country are without power going into Election Day. Electronic voting machines cannot operate, denying Americans the right to vote and throwing the result of a presidential election into question.

Relief measures:

The Edison Electric Institute, the main industry association, said utilities were calling up an "army" of 53,000 workers. About 1,000 VDOT crews and contractors will work throughout the storm to keep the roads as safe as possible and motorists informed of road conditions. Hurricane Sandy caused an estimated \$20 billion in damages to New York alone, leaving many with the added frustration of lost data and the task of getting that data back. The steps taken after a disaster, especially with flooded hard drives can be of paramount importance to successfully recovering important data according to data recovery specialists DTI Data. Customer Service staff is available from 8 a.m. to 6 p.m. at 1-800-275-2583 to assist members and ensure they have uninterrupted access to health care services during the storm's aftermath. All precertification, referral, and hospital admission requirements are waived for Monday, October 29 through Friday, November 2 for medically necessary care.

The Defense Department says it is flying 17 aircraft from California to New York loaded with power generation equipment and crews to help restore power to the millions of homes and businesses devastated by Hurricane Sandy. The airlift is one part of several efforts the Pentagon says it is making to support Sandy relief efforts. The Pentagon says the utility equipment is being provided by southern California power companies, including Con Edison and Pacific Gas and Electric Co.

The equipment includes 10 double bucket trucks, nearly 20 pick-up trucks, and a number of other trucks and equipment, as well as a mobile command center. It will arrive at the air guard base at Stewart International Airport Thursday afternoon The Air Force said the passengers and cargo includes a total of 632 short tons of equipment and supplies -- with 69 vehicles belonging to the Southern California Edison utility company. The USS Wasp is due to arrive in New York City Thursday

and the USS San Antonio and the USS Carter Hall will arrive on November 2. Once in place, these vessels will be prepared to support potential Defense Support of Civil Authorities (DSCA) missions. They will also be available to provide refueling and command and control of DoD helicopter support missions in the area. Assets included with these ships include 6 MH-60S rotary wing aircraft with rescue swimmers; 4 MH-53E heavy lift helicopters.

The DoD continues to support the water pumping mission and is currently moving 120 high-flow water pumps with more than 400 qualified personnel to New York and New Jersey. DoD elements are also performing an assessment of the Hoboken terminal alongside local, state, and Federal civilian partners.

On Wednesday, the Secretary of Defense approved the use of National Defense Reserve Fleet vessels for first responder lodging in New York and New Jersey. Three ships, the TS Empire State, TS Kennedy, and FV Wright are assigned to this mission and will be moved to support lodging as requested by FEMA. The TS Empire State is currently in N.Y. and was used Wednesday night to shelter on-site first responders.

At the request of FEMA, DoD continues to provide Westover-Massachusetts, McGuire-Dix Lakehurst-New Jersey, Dover-Delaware, and a Federal Staging Area at Fort Devens-Massachusetts as Incident Support Bases and Base Support Installations. Eight active duty helicopters are in place at Hanscom AFB, Mass., to support search and rescue and logistics missions.

The following forces are prepared to deploy within 24 hours in response to anticipated FEMA requests to respond the effects of Hurricane Sandy: 14 helicopters are available for awareness and assessment and search and rescue; approximately 8 heavy lift aircraft are available for potential evacuations; Engineer unit and logistical support units are also available for supporting response.

U.S. Transportation Command completed the transport of 120 medical professionals into the affected areas Wednesday. These Disaster Medical Assistance Teams (DMAT), including doctors and nurses, are caring for at-risk nursing home residents and other at-risk elderly.

1.5 million meals (loaded onto 55 trucks) began arriving in New York from Charleston and Martinsburg, W.Va. The last truck will arrive Thursday evening.

1.3 million meals are staged at vendor facilities, awaiting movement orders; vendors are also ramping up to produce an additional 1.3 million to 2.8 million meals/day, depending on FEMA requirements.

60 fuel trucks carrying approximately 200,000 gallons of fuel have arrived at Incident Support Bases in Westover AFB, Mass and McGuire AFB, N.J.; fuel contractors have an additional 600k gallons available (with trucks) in southwestern Va.

3 generators are slated to arrive at Incident Support Base McGuire on November 3; The DoD is ready to assist civilian authorities with temporary emergency power with 200 generators staged at forward locations. The United States Army Corps of Engineers has teams deployed to strategic locations in N.Y., N.J., and Pa., and has the resources to haul, install, operate and maintain generators where requested.

The National Guard in New York and New Jersey continues to stand up forces for response and recovery operations. N.Y. relief efforts are focused on Nassau and Suffolk Counties, Long Island, and the New York City area.

2,310 New York Guardsmen are on duty conducting search and rescue, assisting with neighborhood health and comfort searches (knocking on doors), logistics, harbor patrol, and transportation for engineers.

2,073 New Jersey Guardsman are supporting New Jersey responders. Mission sets include shelter support, debris removal, and power generation

The National Guard is also deploying air assets to assist, including eight light/medium lift helicopters to ISB McGuire to conduct search and rescue operations. 198 light/medium and four heavy lift rotary-wing aircraft are available to perform reconnaissance and personnel/cargo carrying missions.

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- **Type of Disaster:** Tropical Cyclone Nilam
- Area Affected: Indian states of Tamil Nadu and Andhra Pradesh, and the town of Pondicherry
- **Death toll:** More than 30 died
- **Category:** Developing country



Impact:

Rescue operations are under way in India's southern city of Chennai to find five sailors missing from an oil tanker that ran aground in a cyclone. The authorities say they are concerned because the vessel is carrying oil which could create a major problem if it spills out. Seven people were killed when Cyclone Nilam struck the south-eastern coast with winds of up to 100km/h (60mph). Schools, colleges and cargo operations at the port in Chennai were shut. Fishermen in both states were warned not to venture out to sea. Roads and agricultural land across the coast have been badly damaged and power lines have been brought down in several areas by the cyclone struck. Around 30 died in this cyclone. On November 1st, more than 200 boats ran aground due to strong winds. Floodwater totally inundated 51486 hectares of directly sown farmland and 13421 hectares of transplanted farmland; and partially submerged 4404 hectares of directly sown area and 12189 hectares of transplanted area in Tamilnadu. **TV9 reported that over 12,000 poor had remained hungry over the past three days and no government official had visited the storm affected villages despite the prolonged shortage of food and lack of electricity.**

Measures Taken:

Coast guard helicopters and boats are combing the sea for sailors from the Pratibha Cauvery. More than 100,000 people were evacuated ahead of the storm and shifted to higher ground, into schools and other temporary shelters. Reports say more than 300 schools and community centres in Chennai have been kept ready to receive evacuated people. Control rooms have opened in the vulnerable coastal districts of Andhra Pradesh.

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