Restoration Status for Damage Caused by the Great East Japan Earthquake and Future Responses

December 13, 2011

Nippon Telegraph and Telephone Corporation

Hirofumi Horikoshi
Corporate Overview

Name: Nippon Telegraph and Telephone Corporation
Date of Establishment: April 1, 1985 (In accordance with the NTT Law)
Head Office: Tokyo, Japan
Consolidated Subsidiaries: 536 companies
Operating Revenues: 10.3 trillion*
Employees: 219,350*

*(as of March 31, 2011)

* Percentage figures show the percentage of voting rights (Mar. 2010)

**Consolidated**

**Holding Company**

- NTT East
  - Regional communications business
- NTT West
  - NTT Communications
  - Long distance and international communications business
- Dimension Data
  - Global IT Services & Solutions
- NTT DATA
  - Data communications business
- NTT DOCOMO
  - Mobile communications business
- Other 531 group companies
  - real estate, finance, construction and power business

* consolidated
1. Restoration Status

2. Major Restoration Efforts

3. Main Activities for Securing Means of Communication, Efforts in Providing Life Support to the Affected People

4. Major Countermeasures against Future Disaster
1. Restoration Status

2. Major Restoration Efforts

3. Main Activities for Securing Means of Communication, Efforts in Providing Life Support to the Affected People

4. Major Countermeasures against Future Disaster
Occurrence of the Great East Japan Earthquake Disaster

At 2:46 p.m. on March 11, 2011, a great earthquake of magnitude 9.0 with its epicenter off Oshika Peninsula, Miyagi, hit East Japan, accompanied by a huge tsunami assaulting the coasts of the northeastern Pacific Ocean.
Occurrence of the Great East Japan Earthquake Disaster
Fukushima Nuclear Power Plant
Example of Damage from the Tsunami

On the day of the disaster
(at the height of the disaster)

Next day after the disaster

Source: from the public
Many exchange office buildings and facilities were affected by the large-scale earthquake and tsunami.

Further damage was caused due to depletion of battery capacity associated with the prolonged disruption in commercial power supply.
Damage Condition of Communication Facilities

1 Building facilities

Before tsunami

The building was carried 500 m away from its original site

Satellite photo

The building was found here

Original site of NTT Tokura Building

Tsunami carried away Shichigahama Building

Tsunami carried Tokura Building to the sea
Damage Condition of Communication Facilities

② Relay transmission lines (cables and ducts)

Conduits broken as the Kesen Bridge collapsed (Iwate)
Damage Condition of communication Facilities

3 Telephone poles

Destroyed by Tsunami
(Concrete Pole)

4 Mobile phone base stations

Carried by Tsunami

Damage to poles and a mobile phone base station (Miyagi)
### Damage Status and Financial Impact

<table>
<thead>
<tr>
<th>Damage to exchange office buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demolished: 16 buildings</td>
</tr>
<tr>
<td>Flooded: 12 buildings</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Damage to telephone poles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washed away/collapsed: approximately 28,000 poles (coastal areas)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transmission lines and switchboards washed away</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission lines: 90 routes disconnected (excluding the nuclear power plant area)</td>
</tr>
<tr>
<td>Washed away/damaged aerial cables: approximately 2,700km (coastal areas)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Damage to base stations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of stations requiring restoration: 375 stations (including 68 stations within a 30km radius of the nuclear power plant)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Damage status</th>
<th>March 31, FY2011</th>
<th>March 31, FY2012 (Estimation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approximately 260 million USD (profit/loss)</td>
<td>Approximately 320 million USD (CAPEX)</td>
<td></td>
</tr>
<tr>
<td>230 million USD (profit/loss)</td>
<td>Approximately 65 million USD (CAPEX)</td>
<td></td>
</tr>
<tr>
<td>130 million USD (profit/loss)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Widespread, prolonged power outages occurred in and around northeastern Japan due to damage to generation plants, substations, and power distribution facilities caused by the earthquake and tsunami.

Power outage impact in terms of the number of households affected in prefecture

- Mar 11 (day of earthquake): 7.8 million households
- Mar 12 (a day later): 2.6 million households
- Mar 13 (2 days later): 1.5 million households
- Mar 18 (7 days later): 0.3 million households
1. Restoration Status

2. Major Restoration Efforts

3. Main Activities for Securing Means of Communication, Efforts in Providing Life Support to the Affected People

4. Major Countermeasures against Future Disaster
By end of April, all exchange offices and base stations in currently inhabited areas had been largely restored.

We will restore the communication facilities in the nuclear plant area and currently difficult-to-live areas as roads and other infrastructures there are restored.

Restoration Status

- **Exchange offices / base stations with disrupted service**
  - Fixed
    - Exchange offices: 385 (560)
    - Base stations: 4,900 (6,000)
  - Mobile
    - Exchange offices: 231 (560)
    - Base stations: 307 (6,000)

- **Nuclear power plant area**
  - After disaster (March 11)
    - Exchange offices: 560
    - Base stations: 6,000
  - March 28
    - Exchange offices: 9
    - Base stations: 68
  - End of April
    - Exchange offices: 0
    - Base stations: 0
  - End of Oct.
    - Exchange offices: 0
    - Base stations: 6
## Major Restoration Efforts

<table>
<thead>
<tr>
<th>Restoration method</th>
<th>Detail of restoration</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Securing transmission lines</td>
<td>- Emergency restoration by connecting damaged sections and newly creating temporary aerial rerouting lines.</td>
</tr>
<tr>
<td>3. Access zone restoration</td>
<td>- Install immediately metal and optical fiber cables using materials stocked for planned constructions, etc.</td>
</tr>
<tr>
<td>4. Restoring mobile base stations</td>
<td>- Install stopgap optical fiber, use microwave transmission and satellite circuits.</td>
</tr>
<tr>
<td></td>
<td>- Use large zone scheme, a method that covers areas normally covered by multiple stations with a single station.</td>
</tr>
<tr>
<td>5. Restoration in the nuclear power plant area</td>
<td>- Restoration of the function at the Iwaki Tomioka Exchange Office, located approximately 10km from the plant, replacement of transmission line.</td>
</tr>
<tr>
<td></td>
<td>- Coverage restoration by using high-performance antenna and deployment of satellite mobile base station vehicle.</td>
</tr>
</tbody>
</table>
Examples of Restoration Efforts

1 Restoration of exchange offices

Since the whole Shichigahama Building had been lost to floods, Outdoor-use circuit switch was installed at the building’s original site.

By suspending existing renewal and installation plans, equipment originally scheduled for a different use are to be diverted for use at the site.

Outdoor cabinet
For narrow-band service
(PSTN, circuit line, …etc.)

Outdoor cabinet
For broad-band service
(internet, VPN, …etc.)

New cables will be installed to connect with existing cabling

Shichigahama Building

Existing cables
New cables
Examples of Restoration Efforts

2. Restoration of transmission lines (from Building A to Building B, Iwate Pref.)

Establish backup relay routes or switch routes to achieve connectivity at disrupted points or to bypass damaged relay transmission lines. Therefore main relay transmission lines to be secured.

Disconnection of the relay transmission line connecting between Building A and Building B due to the earthquake.

- Building A
- Building B

: existing cables
: new cables
### Restoration of access zone

Telephone poles and cables had extensive damages caused by tsunami. After the removal of debris, communication services were restored by installing telephone poles and laying out and connecting cables to residential areas.

#### [Step 1]
After the removal of debris, telephone poles were erected and tow cables were laid.

#### [Step 2]
Installation of aerial cables.

#### [Step 3]
Connections in manholes.

#### [Step 4]
Connections of aerial cables.

Examples of Restoration Efforts
Examples of Restoration Efforts

4 Restoration of mobile base stations

Most mobile base stations have been restored by using microwave transmission, satellite circuits and actively apply large zone scheme* in high-elevation base stations.

* a method that covers areas normally covered by multiple stations with a single station

Microwave transmission
Satellite circuits
Large zone scheme*

Disrupted optical fiber
Disrupted optical fiber, damage from tsunami

Examples of Restoration Efforts

Microwave transmission
Satellite circuits
Large zone scheme*

Disrupted optical fiber
Disrupted optical fiber, damage from tsunami

* a method that covers areas normally covered by multiple stations with a single station
At our request, Tokyo Electric and Tohoku Electric Power Companies restored power supply to the building, and we conducted restoration work there. As a result, the capability of the 6 buildings was restored, and some links to mobile phone base stations were also restored.
1. Restoration Status

2. Major Restoration Efforts

3. Main Activities for Securing Means of Communication, Efforts in Providing Life Support to the Affected People

4. Major Countermeasures against Future Disaster
Main Activities for Securing Means of Communication

- Installation of special public phones using portable satellite equipment (approx. 3,900 phones)
- Rental of free mobile phones (approx. 2,100 units)
- Rental of free satellite mobile phones (approx. 900 units)
- Rental of tablet devices (approx. 670 units)
- Deployment of free Internet booths (approx. 410 locations)
- Installation of free battery recharging station (approx. 410 stations)
Main Activities for Securing Means of Communication

**Disaster emergency message dial**
- approx. 3.5 millions

**Disaster emergency broadband message board**
- approx. 0.3 millions

**Disaster message board**
- approx. 4.5 millions

**Saving messages from people in damaged area**

NTT East staff members deliver messages, on behalf of affected people, to their families, and if the family members are away from home, NTT East registers their messages on the Disaster Emergency Message Dial on their behalf.

- Contact on the phone
- Register messages on the Disaster Emergency Message Dial
- Provide information to mass media
- Provide information on Web site

approx. 3,000 messages

NTT East staff

Evacuation shelters

Safety confirmation
Support using ICT: Restoration Area Maps

Indicating areas where service is available or disrupted, and the restoration schedule of disrupted areas.

Map image

Possible to perform search by address, keywords

Flexible size levels through zoom in/out

Restoration schedule

- Areas restored by mobile base station vehicle
- Areas to be restored by next day
- Areas to be restored by mid-April
- Areas to be restored by late-April
- Areas to be restored in May or beyond

Areas near Rikuzen-Takata, Iwate (As of Mar. 29)

Commenced on Mar. 20, 2011 after being urgently developed, and updated on a daily basis.
1. Restoration Status

2. Major Restoration Efforts

3. Main Activities for Securing Means of Communication, Efforts in Providing Life Support to the Affected People

4. Major Countermeasures against Future Disaster
Basic Standpoint on Future Disaster Countermeasures

① Develop disaster-resistant networks and prompt recovery methods
   ・Distribute key functions across regions and implement multiple routes in preparation against wide-area disasters
   ・Improve power capacity to withstand widespread and long-term power outages

② Promptly reconnect local relief sites
   ・Increase the use of satellite and wireless communications

③ Secure means of information sharing after disasters
   ・Communication needs directly following a disaster, such as confirmation of safety (Strengthen means to meet countermeasures against congestion)
   ・Strengthen means to meet the diversification of customer needs, which are shifting from using voice communications to using email and the Internet

④ Provide services and solutions useful during a disaster or recovery phase
   ・Support of municipalities, schools, remote medical care, etc.

Where solutions cannot be provided by the NTT Group alone, we will collaborate with the central and regional governments.
Large-zone Base Stations

- Construct new large-zone base stations, in addition to normal base stations, to secure communications over densely populated areas efficiently in the event of a disaster resulting or power outage. (104 large-zone base stations, covering approx. 35% of the population)
- Ensure high reliability by adopting uninterruptible power supply systems and duplicate transmission routes

Plan to complete Dec. 2011

Completed at 28 Sep.

Nagoya

Gifu
Measures against Power Outage

Promote use of uninterruptible power supply systems, and extend battery life to 24 hours in base stations to secure communications for prefectural/municipal offices, etc. (approx. 1,900 base stations, covering 65% of the population)

<Base stations in NTT docomo’s buildings>
Engine-driven uninterruptible power supply (approx. 800 stations)

<Tower base stations>
24-hour power supply from battery (approx. 1,100 stations)

Wireless transmission

Prefectural/municipal government offices, etc.

Deploy extend batteries from Tokay area.

Battery

Engine
Use of Satellite Communication

Promote installation and use of satellite communication (telephone, the Internet) to ensure swift restoration of communication in regional disaster relief centers, such as evacuation centers.

- Reinforce current systems
  - Increase number of satellite phones
  - Increase number of transportable base stations that use satellite communication

- Enhance current systems
  - Increase mobility (enhance operational functions, reduce size)

- Introduce technical innovation
  - Develop a new anti-disaster satellite system (supporting broadband access)
  - Study future satellite systems

Both the public and private sectors need to work together in a study on the cost sharing of base stations for emergency communication, and a study on future satellite systems.
Compact Earth Station for Satellite Communication

Under Development
Voice Messages

In the event of a disaster, massive call origination congests the circuit-switched network, making it difficult to get calls through. We are developing a service that converts a voice message into a file and sends it to the called party over a packet network.

Service overview

We cannot connect your call now. Please leave a message.

Call restriction

Here's a message for you

I'm safe, staying in evacuation shelter XX

I'm safe, staying in evacuation shelter XX

Planned for launch within FY2011

Voice call

Packet network

Circuit-switched network

Server

Voice file

Send voice file

Convert the voice message into a file, and automatically send it

Calling party (who wants to send safety information)

Called party (who wants to receive safety information)

Receive voice file

Send voice file

Send voice file
Safety Confirmation System

Multi-terminal

Cross-media
Wide range of sources

- Voice: Disaster Emergency Message Dial (171)
- Text: Disaster Emergency Online Message Board (Web 171)
- Text: Disaster Emergency Message Board
- Video: Web Services (SNS, etc)
- Image: Disaster Emergency Message Board
Dynamic Allocation of Network Resources

Implementation of virtual network technology into call control servers, which provide real-time and highly reliable services such as telephone, can handle rapid increase of traffic in case of emergency, because its network resources are allocated dynamically.

Existing network:
Existing network can NOT handle rapid increase of traffic in emergency, because its network resources are allocated statically.

Virtual technology based network:
Virtual technology based network can handle rapid increase of traffic in emergency, because its network resources are allocated dynamically.
Thank you