Disaster Management Policy / Communication Systems of Japan

@ITU/MIC Training Course on

Bridging the Standardization Gap

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M I C

1. Disaster Management

2. Communication Network for DM

3. Radio Systems in detail

4. Summary

Disaster Management
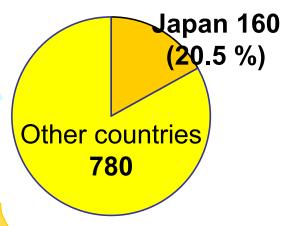
What is "disaster management"?

- We cannot avoid disaster
- But we may make forecast to some extent
- Information is essential to reduce damage
- Management include
  - Pre-avoid serious damages
    - Data gathering, Early warning, Smooth evacuation
  - Recover quickly
    - Information is most needed

Japan is disaster-prone

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More than **two out of ten big earthquakes** in the world happen **in Japan***.

We need Disaster Management!!

Disaster Management

Timely warning

Smooth evacuation

Information exchange

Number of big earthquakes

Japan 160 (20.5 %)

Other countries **780**

NOTE*: This is based on data of Japanese Meteorological Agency (JMA) and USGS from 1997-2002.

Long list of natural disasters

Japan has wide variety of natural disasters

- **Earthquakes**
- **Tsunamis**
- **Typhoons**
  (July – October)
- **Heavy Monsoon Rain**
  (May – July)
- **Floods**
- **Landslides**
- **Volcanic Eruptions**
- **Snow Avalanches**
- **…**

5

| Great Hanshin Earthquake |
| (Southern part of Hyogo pref.) |

Happened
5:46 A.M., January 17, 1995
Main affected Areas
Kobe City and Awaji Island in
Hyogo
Scale of the Earthquake
Magnitude 7.3
Damage
Number dead and missing people
6,435
Number of completely destroyed
buildings 104,906
Number of burned buildings 7,483

Kobe on fire

Bus that stopped on the verge of
the destroyed expressway

Storms and floods in 2004

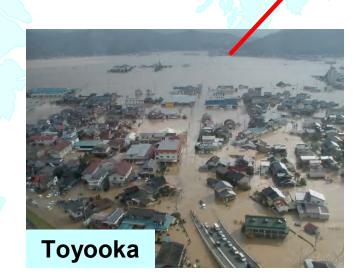Fukui

Niigata

Toyooka

Happened
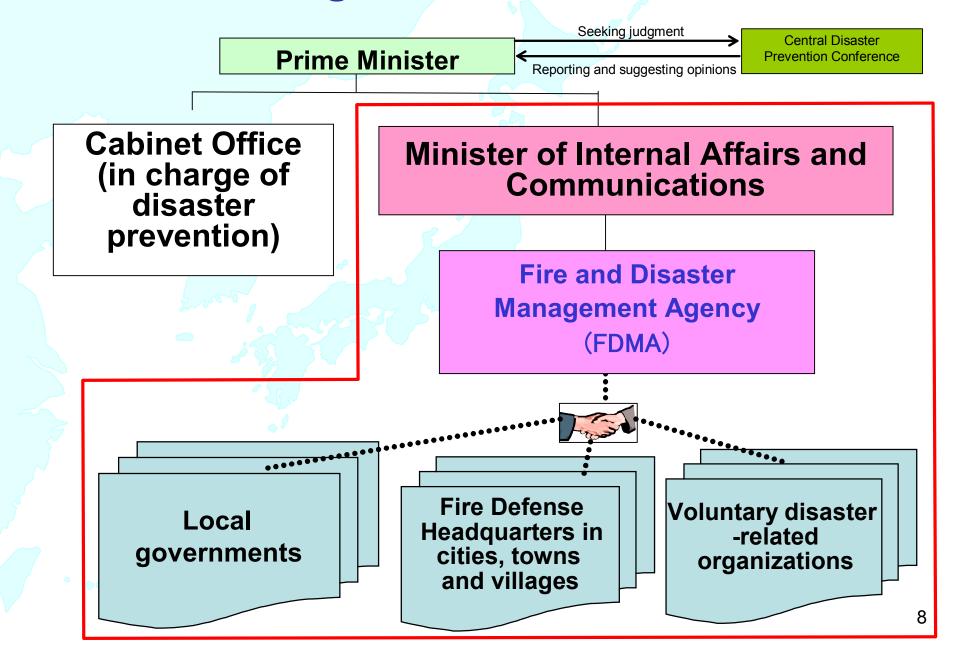June~October, 2004
Main affected Areas
Niigata,Fukui,Toyooka(Hyogo)etc
Damage
Number dead and missing people
234
Number of completely destroyed
buildings 1,342

7

Disaster management--structure
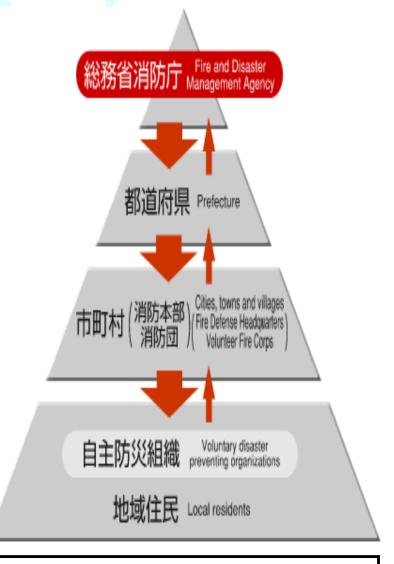
Prime Minister

Seeking judgment →

← Reporting and suggesting opinions

Central Disaster Prevention Conference

Cabinet Office (in charge of disaster prevention)

Minister of Internal Affairs and Communications

Fire and Disaster Management Agency （FDMA）

Local governments

Fire Defense Headquarters in cities, towns and villages

Voluntary disaster-related organizations

8
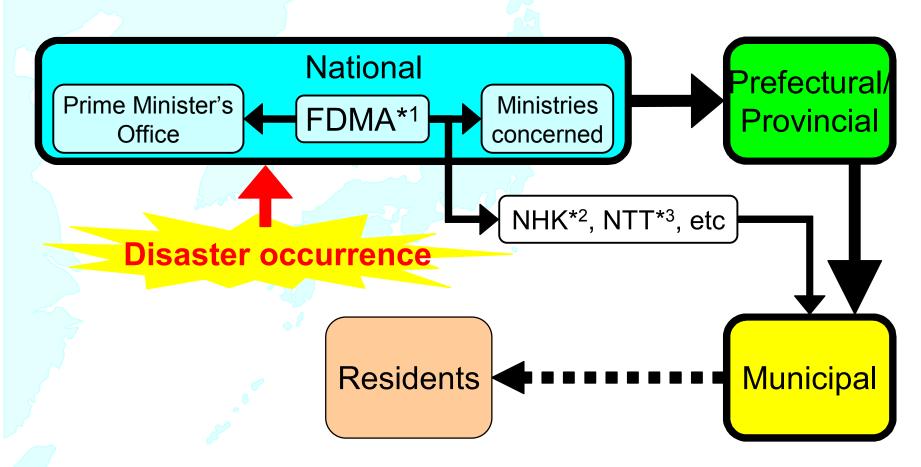
Information Distribution when disaster happens
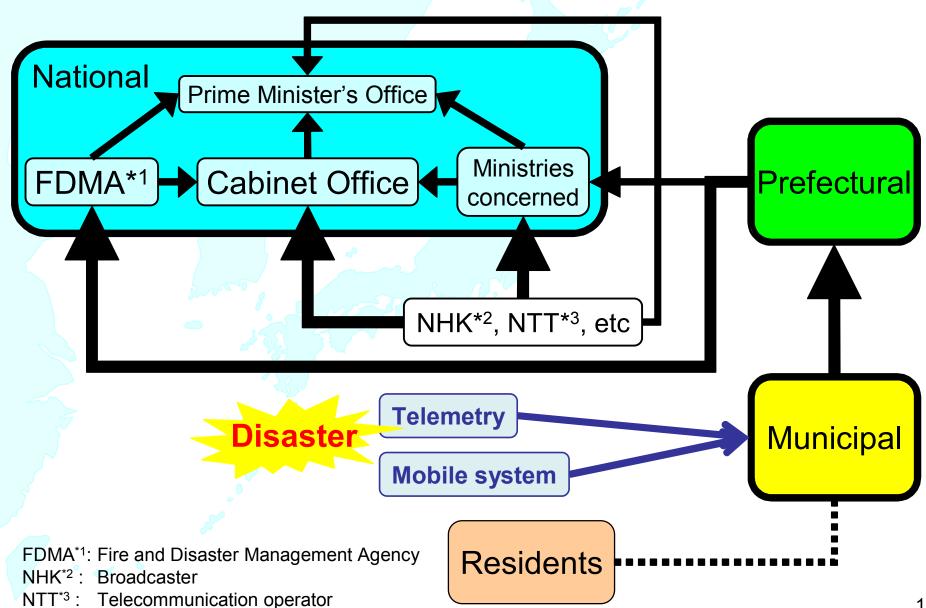
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National
- Prime Minister's Office
- FDMA*1
- Ministries concerned

Disaster occurrence

NHK*2, NTT*3, etc

Prefectural/ Provincial

Municipal

Residents

FDMA*1: Fire and Disaster Management Agency
NHK*2 :   Broadcaster
NTT*3 :   Telecommunication operator

10

Information Collection…

National

Prime Minister's Office

FDMA*1 → Cabinet Office ← Ministries concerned

Prefectural

NHK*2, NTT*3, etc

Disaster

Telemetry

Mobile system

Municipal

Residents

FDMA*1: Fire and Disaster Management Agency
NHK*2: Broadcaster
NTT*3: Telecommunication operator

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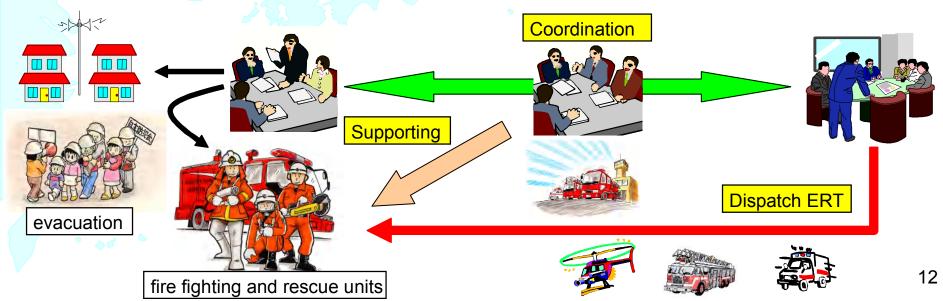
11

Scheme for the disaster response

City level	Prefecture level	National level
★**Responsible for first response to disasters** ① **Set up disaster management HQ** ② **Evacuate residents** ③ **Dispatch fire fighters and rescue teams**	★**Supporting city level activities** ★**Coordination between city level and national level activities**	★**Supporting city level responses** ★**Dispatch of ERT in a large-scale disaster**

Coordination

Supporting

Dispatch ERT

evacuation

fire fighting and rescue units

Tsunami evacuation area

The tsunami evacuation area

Directions to the evacuation area

Construction of the escape route

13

Emergency Response Team

ERT=Fire fighting team nominated by the fire defense headquarters (of cities, etc) throughout the country

Purpose

● To ensure the country's fire defense and disaster management aid system in order to effectively and promptly carry out lifesaving activities, etc. when a large scale disaster including earthquake occurs.

Background
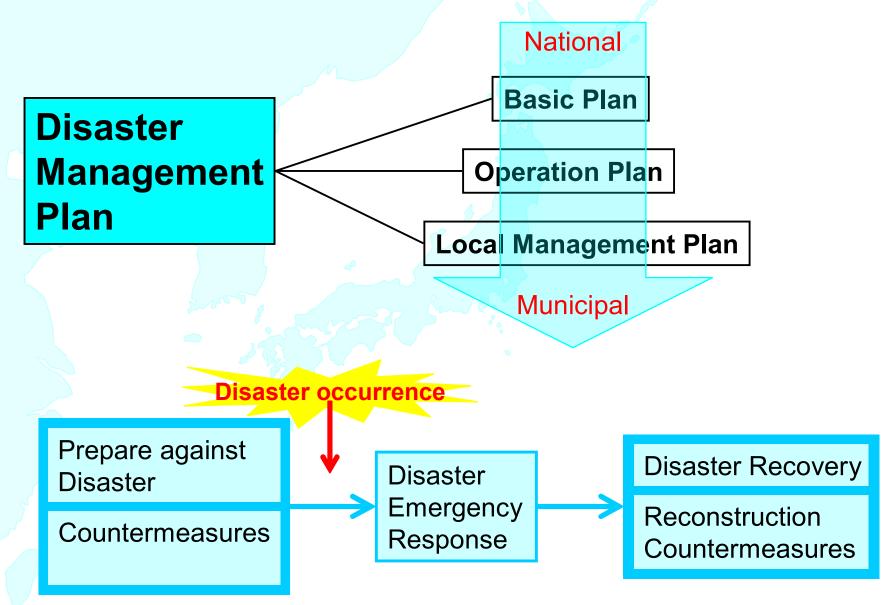
● This team was established in 1995, learning a lesson from Great Hanshin Earthquake.

Outline

● Prime Minister makes plans on basic matters related to the organization of the teams.
   Commissioner of the FDMA registers the teams based on the plan.

● When a large scale disaster occurs, the teams are dispatched by request of Commissioner of the FDMA .

● 2,963 teams (the scale of 36,000 fire-fighters) have been registered.
                                                    (As of April 2005)

14

Disaster Management Plan in Japan

National

Disaster Management Plan

Basic Plan

Operation Plan

Local Management Plan

Municipal

Disaster occurrence

Prepare against Disaster

Countermeasures

Disaster Emergency Response

Disaster Recovery

Reconstruction Countermeasures

Based on Disaster Countermeasures Basic Act (Est. 1961).

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15

Communication Network for DM
--Disaster Management Communications system (DMCS)

What is DMCS?

**Group of communication tools
to support disaster management**

DMCS functions
-how we manage disaster

DMCS functions

- **Data Gathering** ➔ **Telemeter**

- **Message Sending** ➔ **Regional Simultaneous Communication System**

for Residents

Old example of DMCS

Fire Bell (Japan)

Kan Kan Kan !!
Kan Kan Kan !!

Gon Gon Gon !!
Gon Gon Gon !!

Kentongan (Indonesia)

FIRE

Save people's life

Get away!!

Where!?

I don't know!!

Harry up!!

19

Modernized version of DMCS

~ Regional Simultaneous Communication System ~

Message Control Unit

Display Control Terminal

FLOOD WARNING

WARNING

House Receiver

Loud Speaker

Character Display Unit

20

Some other components of DMCS...

Water level/Wind gauge

Water Level Gauge

Wind Gauge

Telemetry Control Equipment

Earthquake Sensor/Recorder

Prefecture

Municipal

National

Seismograph

Communication components of DMCS

Satellite System

National

Core Network System

Prefectural

Municipal

Fixed System

Mobile System

(Regional simultaneous Communication system)

22

Integrated Network of DMCS

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Relay station

Loud Speaker

House Receivers

Monitor Camera

Central Station

Warning

Telemeter

Seismograph

Character Display Unit

Position Observation Buoy

More serious presentation of DMCS Network

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Legend:
- Central Disaster Management Radio Communication Network
- Fire Disaster Management Radio Communication Network
- Prefectural Government Disaster Management Radio Communication Network
- Municipal Disaster Management Radio Communication Network
- Other Communication Network

National

- Prime Minister's Official Residence
- Cabinet Office
- Ministry of Land, Infra-Structure and Transport
- Fire and Disaster Management Agency
- National Police Agency
- Defense Agency
- Maritime Safety Agency
- Meteorological Agency
- Other Designated Administrative Organs
- Japan Red Cross Society and Other Designated Public Corporations

Provincial

- Construction Work Office
- Prefecture
- Prefectures Police Headquarters
- Main Self Defense Force Corps
- Maritime Safety Offices (Maritime Safety Stations)
- Meteorological Offices (Weather Stations And Observations)
- Broadcasting Firms
- Other Disaster Management Related Agencies and Authorities

Municipal

- Municipalities
- Fire Division HQs, Fire Stations
- Police Stations
- Hospitals
- Schools
- Local Voluntary Disaster Management Organizations
- Other Disaster Management Related Agencies And Authorities

Residential Areas

- Residents

Labels:
- Communication Network for Flood Control and Road Construction
- Emergency Communication Network
- Emergency Communication for Police
- Emergency Communication for Defense
- Emergency Communication for Maritime Safety
- Emergency Communication for Meteorology
- Multicasting
- Broadcasting

24

DMCS in National and Provincial governments

Fixed communication system communicates with 54 disaster management related agencies and Authorities

Satellite communication system communicates with 28 disaster management related agencies and Authorities

Central Government

Provincial

A Communication Satellite

Tachikawa Substitute Facility of the Government HQs for Disaster Management

9 Disaster Management Organizations located in Tachikawa Garrison of Defense Agency

Communication Network for Disaster Management Organizations located in Tachikawa Wide–area Disaster Management Base

Metropolitan Government of Tokyo

Electric Power Company

Prime Minister's Official Residence

Defense Agency

Damaged Area

Receiving Station

On-site Disaster Management HQs

Cabinet Office

Automobile type equipment

Handy type equipment

Japan Red Cross Society

Ministry of Land Infrastructure and Transport

Communication Network for Disaster Management Organizations in Central Tokyo

47 Prefectures

Communication Network for Regional Disaster Management Organizations

Regional Designated Public Corporations

DMCS in Municipal gov't and Residential Area

Helicopter TV transmission system

Helicopter + camera on it

Local authorities satellite communications

Super Bird

Office of Prime Minister

Cabinet Office

Fire and Disaster Management Agency

Fixed helicopter TV receiver + satellite base on the earth

Prefectural office, fire department

Other government agencies

Portable helicopter TV receiver + satellite base on a car

Portable helicopter TV receiver + Portable satellite base on the earth

Heli-TV in Mid-Niigata Earthquake

Happened   17:56 P.M., October 23, 2004
Affected Area   Chuetsu district, Niigata
Scale of the Earthquake   Magnitude 6.8
Damage   Number of dead people   59

Image information of suffered area

Tokyo Fire Department

Dispatch ERT

Collapsed site in Miyouken dam

Photo by the Tokyo Fire Department Air Squad

A rescue operation by the hyper rescue team in Myouken dam, Nagaoka-city

撮影：東京消防庁広報課

Request Dispatch ERT

Fire and Disaster Management Agency

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28

Detailed description of major systems to support DMCS

1. RSCS

Indoor/Outdoor terminals

Central station

Loud
Speaker

Warning

Character display unit

Monitor camera

Regional Simultaneous Communication System
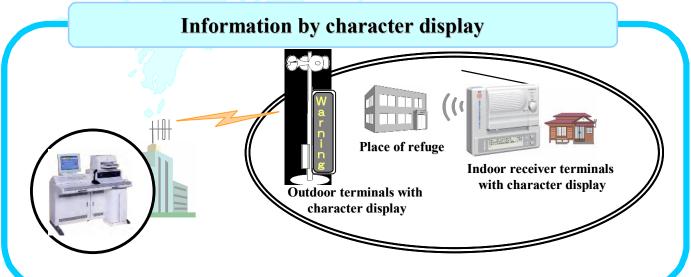
(Recommendation ITU-R F.1105)

Major functions of RSCS(1)

Simultaneous conversation by multicasting

Loud speaker

Central station

Information by character display

Warning

Place of refuge

Outdoor terminals with character display

Indoor receiver terminals with character display

31

Major functions of RSCS(2)

Data transmission (Facsimile, information, Picture)

PC

Digital Camera

FAX

Place of refuge

Outdoor terminals

Collect data and information from monitoring camera and telemeter

Monitor camera

Monitor water level

Typhoon area

Outdoor terminals

Rain gauge

Another application of RSCS--Tsunami warning

- **Loudspeakers are an effective measure to draw public attention in a coastal area.**

- **Announcement using loudspeakers can cover 300 to 500 m; a siren can reach up to 1 or 2 km.**

RSCS is a World Standard

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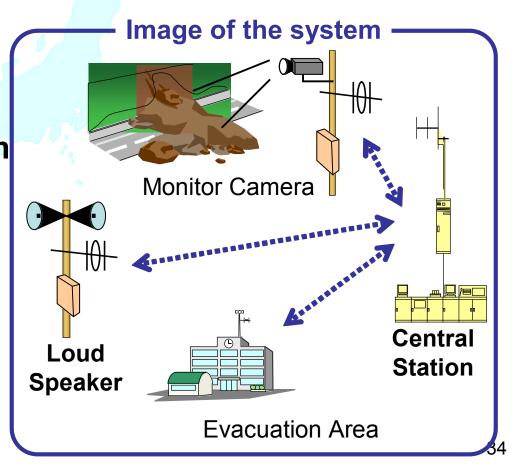
Revision of Rec. ITU-R **F.1105**

" Transportable fixed radiocommunications equipment for relief operations"

• Japan's **Regional simultaneous communication system** (ARIB STD-T86) was added

Approved on 3 May, 2006

Image of the system

Monitor Camera

Loud Speaker

Central Station

Evacuation Area

Communication Modes of RSCS

Configuration	Outline
Simultaneous communication	One-way simultaneous communication from the Master to **all** Substations on stand-by.
Multicasting	One-way communication from the Master Station to all or some Substations. The Substation is switched to a simultaneous communication by the Master Station when the Substation performs the simultaneous communication.
Group communication	One-way communication from the Master Station to a group of Substations.
Individual communication	Bidirectional communication between the Master Station and a specific Substation.
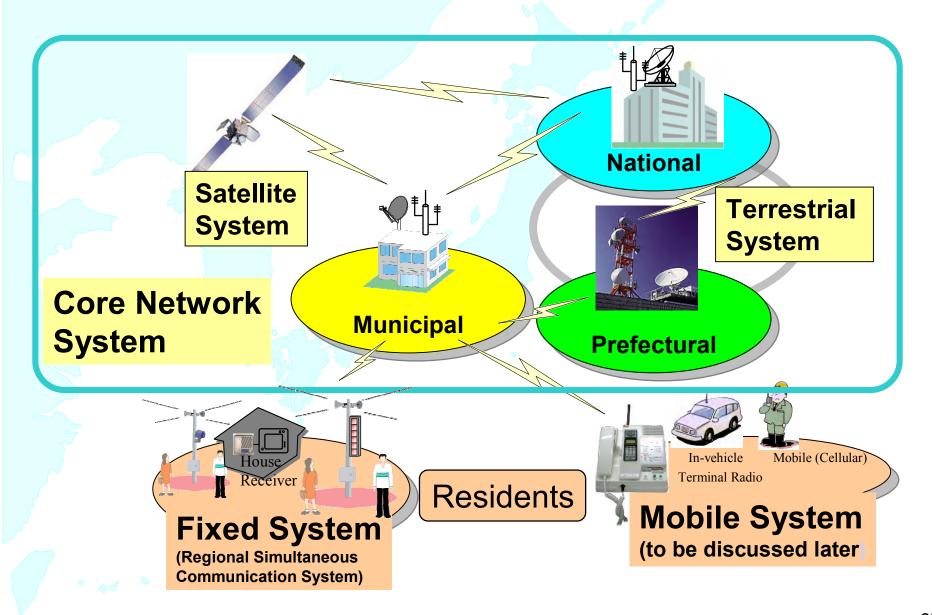
Technical Specifications of RSCS

- **Frequency band:**
  VHF/UHF bands are preferable.
- **Channel interval:**15 kHz
- **Transmission method:**
  TDD (Time Division Duplex)
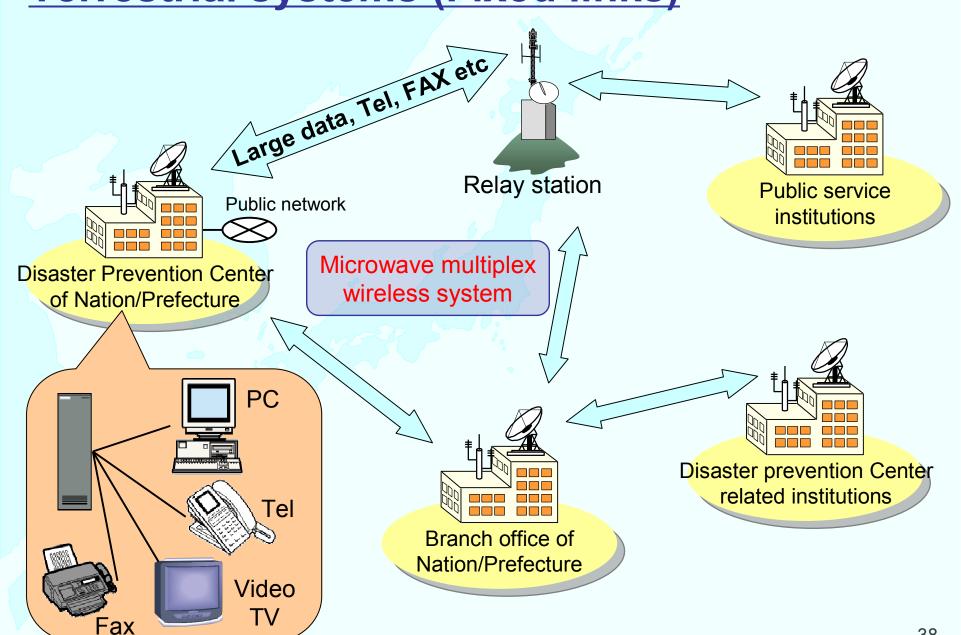- **Access method:** TDMA
- **Modulation scheme**
  e.g.,16QAM

2. Core networks

Satellite System

National

Terrestrial System

Core Network System

Municipal

Prefectural

House Receiver

Residents

In-vehicle Terminal Radio

Mobile (Cellular)

Fixed System
(Regional Simultaneous Communication System)

Mobile System
(to be discussed later)

Terrestrial systems (Fixed links)

Large data, Tel, FAX etc

Relay station

Public service institutions

Public network

Disaster Prevention Center of Nation/Prefecture

Microwave multiplex wireless system

PC

Tel

Fax

Video TV

Branch office of Nation/Prefecture

Disaster prevention Center related institutions

38

System Characteristics of Fixed links

- **Frequency band:**
  VHF/UHF bands are preferable

- **Access method**: TDMA

- **Modulation scheme**
  e.g., **QPSK, 16QAM/64QAM/128QAM**

Typical Transmission Rate for various data type

Data Type	Transmission Rate
Voice	64 kbps
Small-capacity Data	64 kbps
Image	384 kbps

System characteristics (cont.)
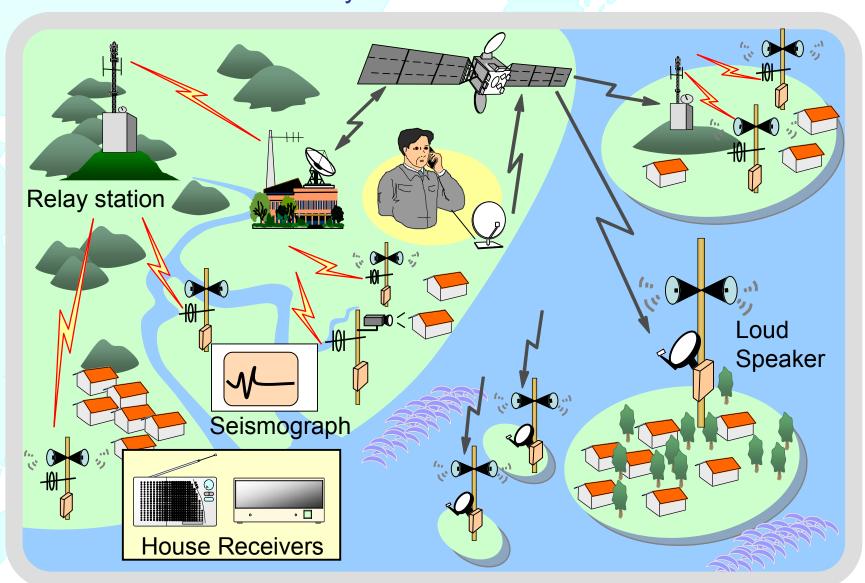
Configuration of communication

Configuration	Outline
Simultaneous communication	Simultaneous communication from the control station or the branch station to several branch stations or terminals.
Group communication	One-way communication from the control station to a group of the terminals.
Individual communication	Bi-directional communication between the control station and a branch station, between tow branch stations, between the control station and a terminal, and between terminals.

Satellite links

Satellites can cost-effectively reach out to local residents in remote areas.

Relay station

Seismograph

House Receivers

Loud Speaker

Example of Earth Stations

Fixed Stations

Portable Stations

Example of satellite services

Service	Communication Link	Network	Channel (Frequency) Assignment
Individual Communication (voice, fax, or low-speed data)	Between any two earth stations (VSATs)	N:N mesh	DAMA (Demand Assigned)
Multicasting (Voice, fax, low-speed data, or IP type data)	1) From Central Disaster Management Agency to: Local Authorities (e.g., prefecture), or local disaster management department 2) From a Local Authority to cities/towns/villages in the district boundary	1:N Star	PA (Pre Assigned)
IP Data Communication	Between any two earth stations (VSATs)	N:N mesh, 1:N Star	DAMA (On Demand) (Reserved)
Digital Video (MPEG-2)	from transmit earth station to receive earth stations with IRD	1:N Star	DAMA (Reserved)

Technical Specifications of satellite link

- **Frequency Band**
  - C-band and Ku-band: used in the Asia Pacific region satellites
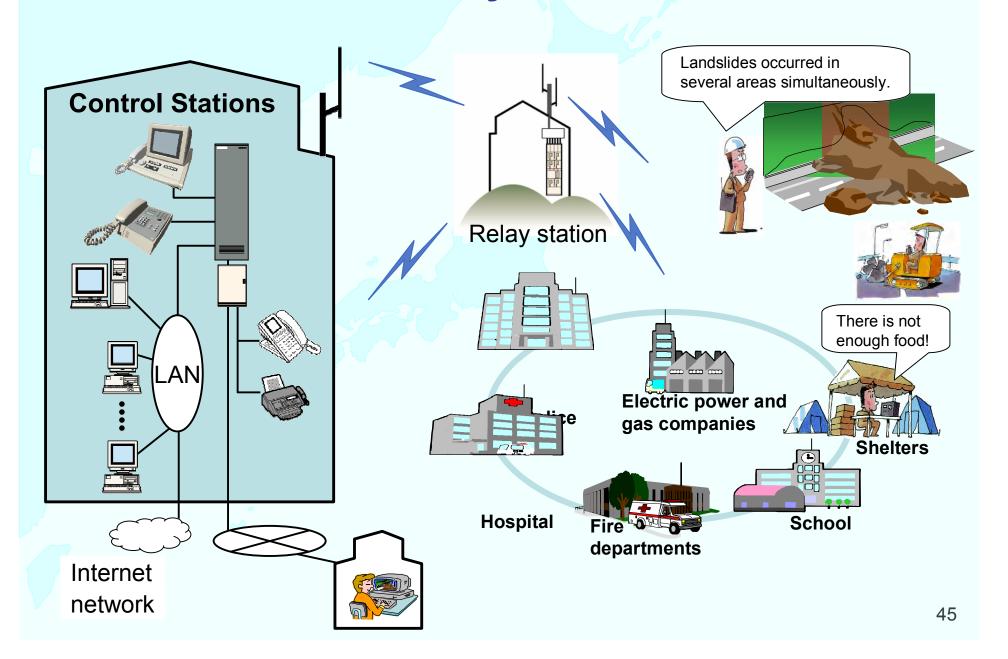 - Ku-band: VSAT is key

- **QoS**
  - BER: better than 1×10^{-6} for 99.8 % of time

- **Transmission Capability**
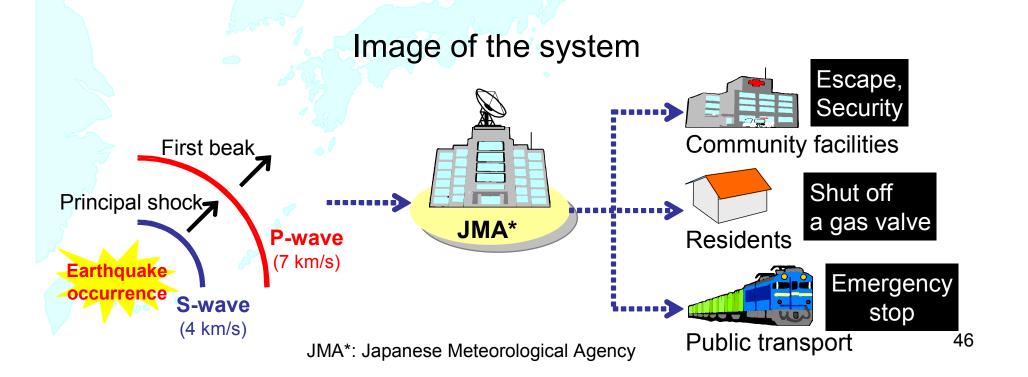 - To have maximum transmit and receive capability for the individual communication channels

3. Emergency Earthquake Warning System

- When great earthquake occurs, this system provides the information to community facilities, residents and public transport etc. in order to prevent damage **10 seconds before** secondary wave (S-wave) reaches which causes big quake.

- This system uses difference of velocity between primary wave (P-wave) and S-wave, which are 7 km/sec and 4 km/sec, respectively.

Image of the system

First beak

Principal shock

Earthquake occurrence

P-wave (7 km/s)

S-wave (4 km/s)

JMA*

Escape, Security
Community facilities

Shut off a gas valve
Residents

Emergency stop
Public transport

JMA*: Japanese Meteorological Agency

46

Summary

- ◆ Disaster management communication system (DMCS) is critical to mitigate disaster damage

- ◆ It is important to send out disaster information to residents right after disaster occurrence

- ◆ Making standards help quick introduction of DMCS

- ◆ Join ITU and APT activities to learn more and be involved

THANK YOU !

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References

ASTAP activities to make standards of DMCS

ASTAP/DMCS-Expert Group

- Telecom Experts in APT region
- Purpose: make APT standard for DMCS
- Start in 2005 Spring
- Surveyed APT needs/current situations
- ASTAP adopted draft Recommendation of standards for DMCS in March this year.
- The Draft is now under the procedures for final approval as APT output documents.

Why we make standards?
(From government points of view)

- ## Standards bring us
  - ### Easy set-up of regulation
    - Adopted by many countries
  - ### Rapid implement
    - Large stock of know-how
  - ### Cost reduction
    - Global competition among vendors

Why we make standards?
(From vendors points of view)

- # Standards bring us
    - ## R&D cost reduction
        - ### Common specification/chips
    - ## Global market opportunities
        - ### Adopted by many countries
    - ## Quick market entry/exit
        - ### Easy planning on market strategy

Making standards is Interaction