

The 3rd International Disaster Prevention Cooperation Forum



Evolution of Information Technology for Disaster Management in Japan

12-13 February 2004

Satoru Nishikawa

Executive Director

Asian Disaster Reduction Center

➤ History of IT for Disaster Response in Japan

- Lessons from 1959 Ise-Wan Typhoon
- Development of Basic Emergency Telecommunication System
- Lessons from 1995 Kobe Earthquake
- Development of Damage Estimation Systems
- Development of Practical Local Disaster management & Command System

➤ Application of Latest IT for Disaster Management & Reduction

- Application of New Space Technology
- New System for Vital Information Dissemination
- Dissemination of Hazard Maps for Saving Lives
- Dissemination of Personalized Emergency Information

Severe Damage by Series of Typhoons in Japan

Year	Typhoon	Death Toll
1945	Makurazaki Typhoon	3,756
1947	Catherine Typhoon	1,930
1948	Ion Typhoon	838
1950	Jane Typhoon	539
1951	Ruth Typhoon	943
1954	Toyamaru Typhoon (with big ferry shipwreck)	1,761
1958	Kanogawa Typhoon	1,269
1959	Ise-wan Typhoon	5,098

1959 Ise-Wan Typhoon was
the First Epoch-Making Turning Point

Response oriented approach to preventive approach

Individual approach to comprehensive multi-sectoral approach

Investment for disaster reduction

Emphasis on Strong Link of Information Flow among Various Sectors

- Stronger Coordination among various gov't sectors
- Involvement of Semi-Public Sectors

Electric Companies, Railway Companies, Public Broadcasting etc.

Investment for Disaster Prevention

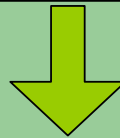
Flood Control & Land Conservation Works

Forest Conservation

Meteorological Observation

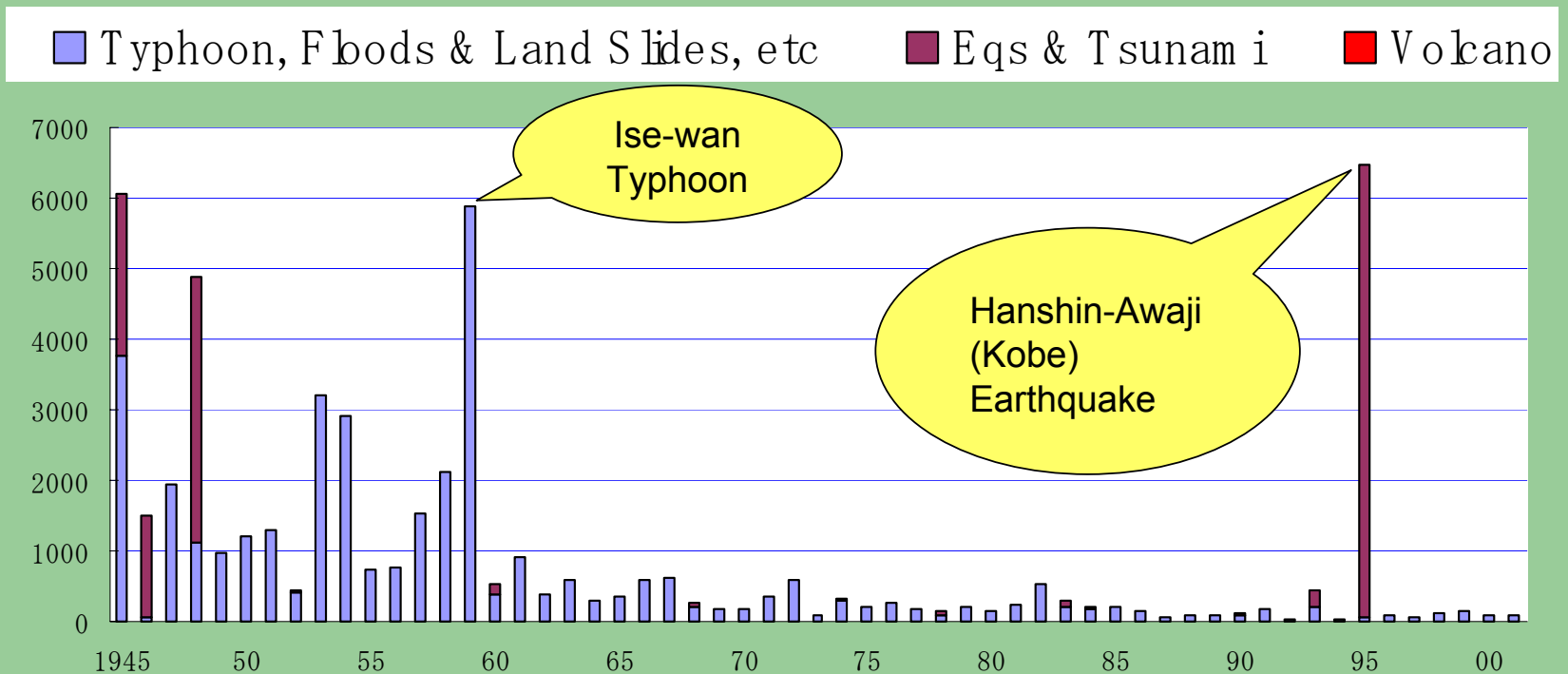
- Mt. Fuji Rader Site
- Meteo-Sats

Emergency Telecommunication Systems



Great Success in decreasing Typhoon & Flood Casualties

The Number of Casualties by Natural Disasters in Japan



Disaster Telecommunication Systems

Legal basis

- The Role of the Radio Law (Enacted in June 1950) at the Time of Disaster

- Securing Communications in Emergency (Article 74 in the Radio Law)
- Planning Communications Routes to Secure Communications in Emergency and Training (Article 74, Paragraph 2 in the Radio Law)

- Disaster Countermeasures Basic Law (Enacted in November 1961)

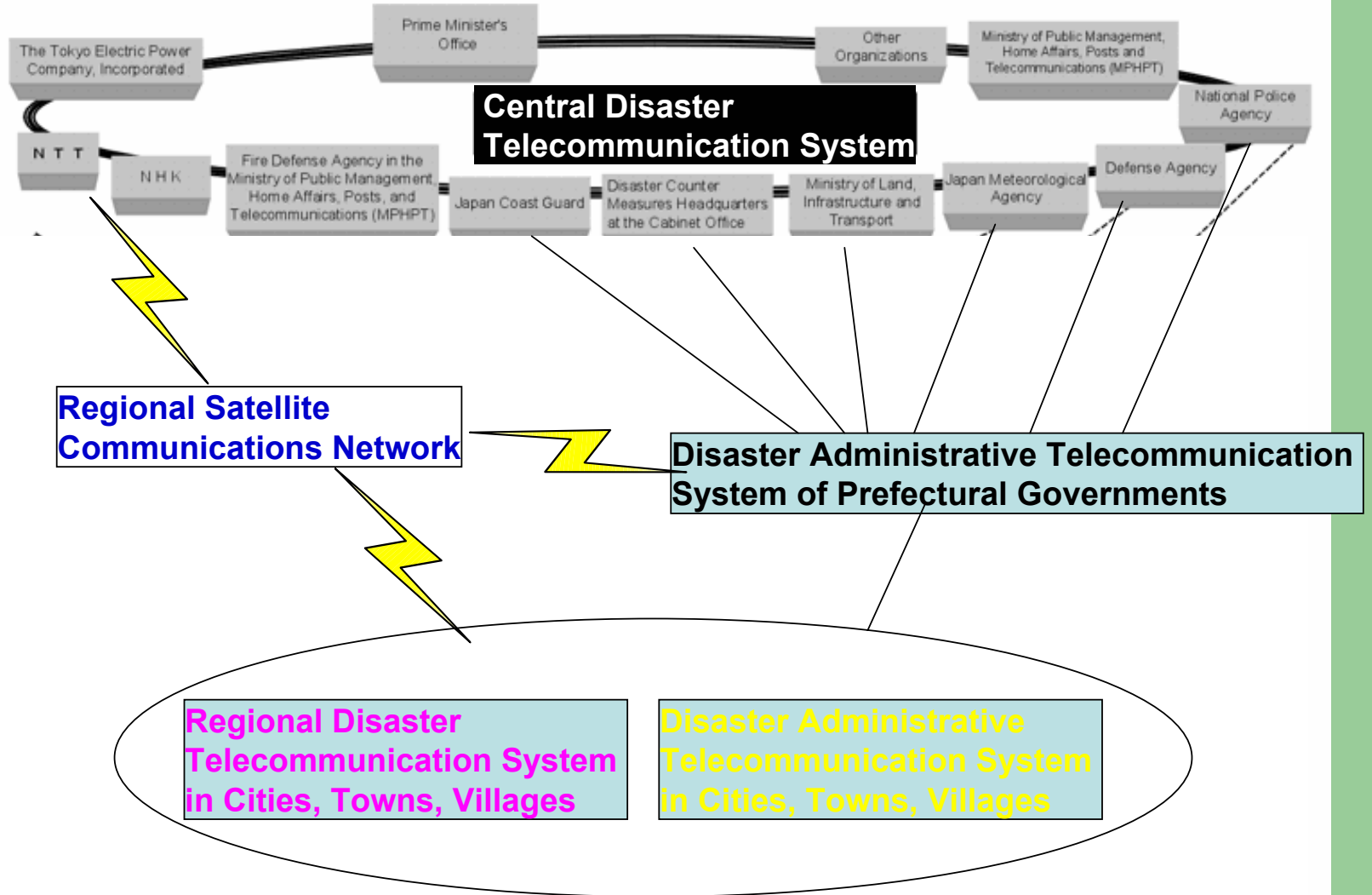
- The law was enacted to take overall and deliberate disaster management measures based on the experience gained in the aftermath of the devastating Ise-wan Typhoon in September 1959.
- The law was revised based on the experience of the Great Hanshin-Awaji Earthquake of January 1995.

Disaster Telecommunication Systems

-cont'd-

- **Building a disaster telecommunication system in harmony with actual conditions**
 - Started the Central Disaster Telecommunication System (Fire Fighting and Disaster Telecommunication System, and the Intercommunication operations of the Disaster Telecommunication System). Using this system, disaster prevention organizations such as the fire defense, the police, and Japan Coast Guard can exchange information mutually
 - Started the Disaster Administrative Telecommunication System for prefectural and local governments.
 - Started the Disaster Administrative Telecommunication Systems in Cities, Towns, and Villages (Broadcast and Mobile) in 1978. Up to that year, the license for broadcast telecommunication systems and that for mobile telecommunication systems were issued separately.
 - Started the Regional Disaster Prevention System (Multi Channel Access System) in 1988.
 - Started the Regional Satellite Communications Network in which satellites were used.

Central Disaster Telecommunication System



The Disaster Telecommunication Systems

Fire Defense Disaster

-cont'd-

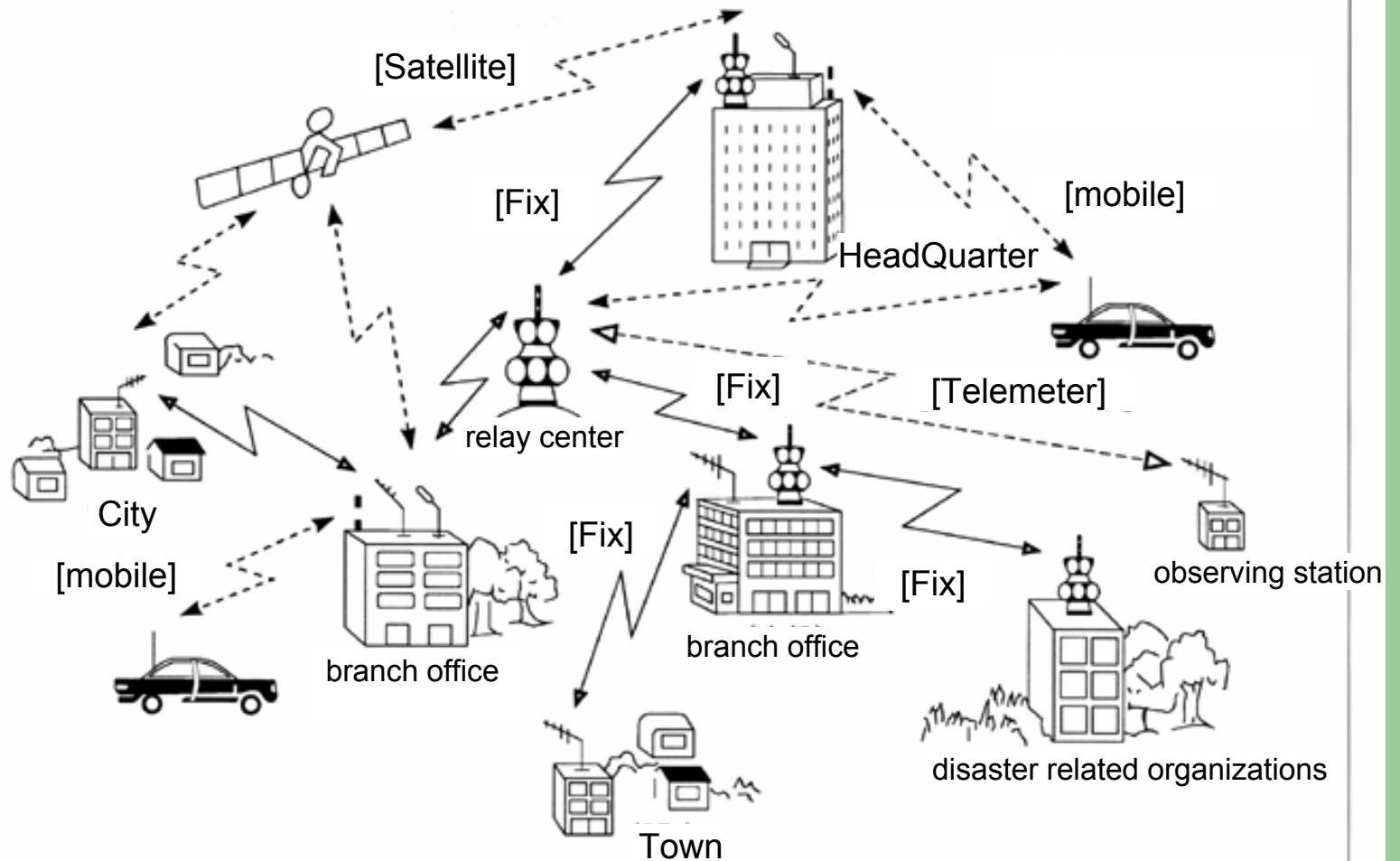
Telecommunication System

- This system is a communication network to connect the Fire and Disaster Management Agency and all the prefectural governments in Japan. It is used for mutual communications by telephone and facsimile and for broadcast from the Fire and Disaster Management Agency.

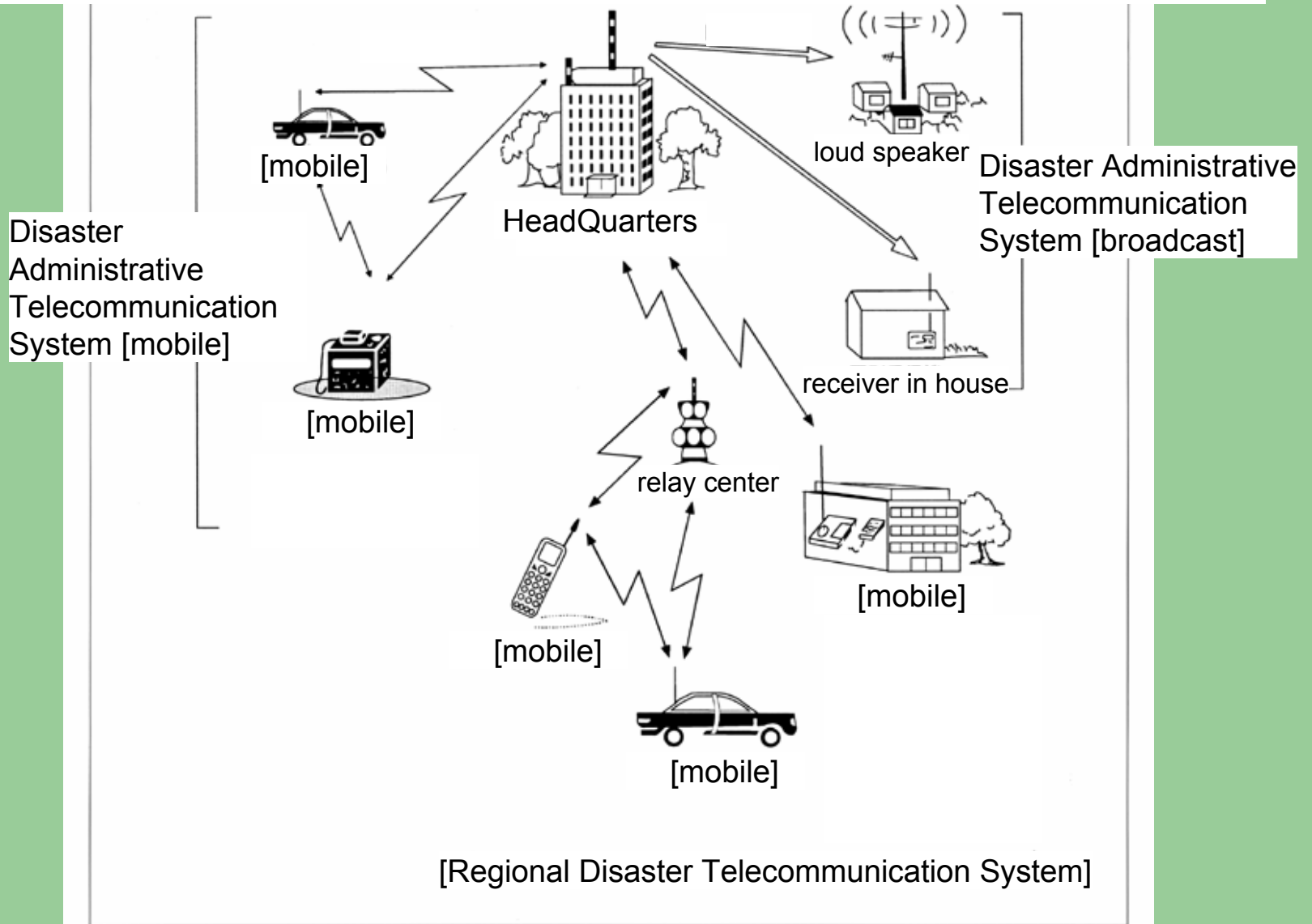
Disaster Administrative Telecommunication Systems of the Prefectural Governments

- This system is a communications network which connects prefectures and local communities (cities, towns, villages) and the disaster related organizations. The purpose of the network is to collect and transmit information. Including a system which uses satellites, the Disaster Administrative Telecommunication System is installed in every prefecture.

Disaster Administrative Telecommunication Systems of the Prefectural Governments



Disaster Administrative Telecommunication Systems and Regional Disaster Telecommunication System in Cities, Towns, and Villages



1995 The Great Hanshin-Awaji (KOBE) Earthquake was the Second Epoch-Making Turning Point

- **When the Earthquake Hit**

05:46, January 17, 1995

Magnitude 7.3 , 7th degree Japan's Intensity Scale

Depth of Epicenter 16km (Very shallow)

- **Deaths and Damage**

Deaths : 6,432 in all stricken areas

Injured : 43,792 (10,683 seriously injured)

Fully/Half-destroyed structures : Approx. 517,730

Shelters and evacuees at peak :

1,153 shelters, 317,000 evacuees

Damage in yen : Approx. ¥10 trillion (85Billion US\$)

Death : 6,433 in all stricken areas



Railway train tracks were mangled



Characteristics of Stricken Area

- **Directly hit the Metropolitan area**
 - Major Center for Government, Economic and Culture with 3.6million
- **Capital of Prefecture**
 - Local Governments (Prefecture, Cities) Headquarter were also heavily destroyed
 - Government Officials including Disaster Management Experts were also victims

Lesson

Delay of First Response due to lack of information

- Damaged Headquarter
 - Local Government Command initially paralyzed
 - Destroyed almost all traffic system
 - Telecommunication, even satellite telecommunication system were cut off due to power failure
- ⇒ It took three days to grasp the entire picture of damage

Kobe Municipal Government Headquarter



HYOGO Prefectural Government Headquarter



Difficultly in Communication at HYOGO Prefecture Headquarter



Electric Power & Telephone Line after the Earthquake

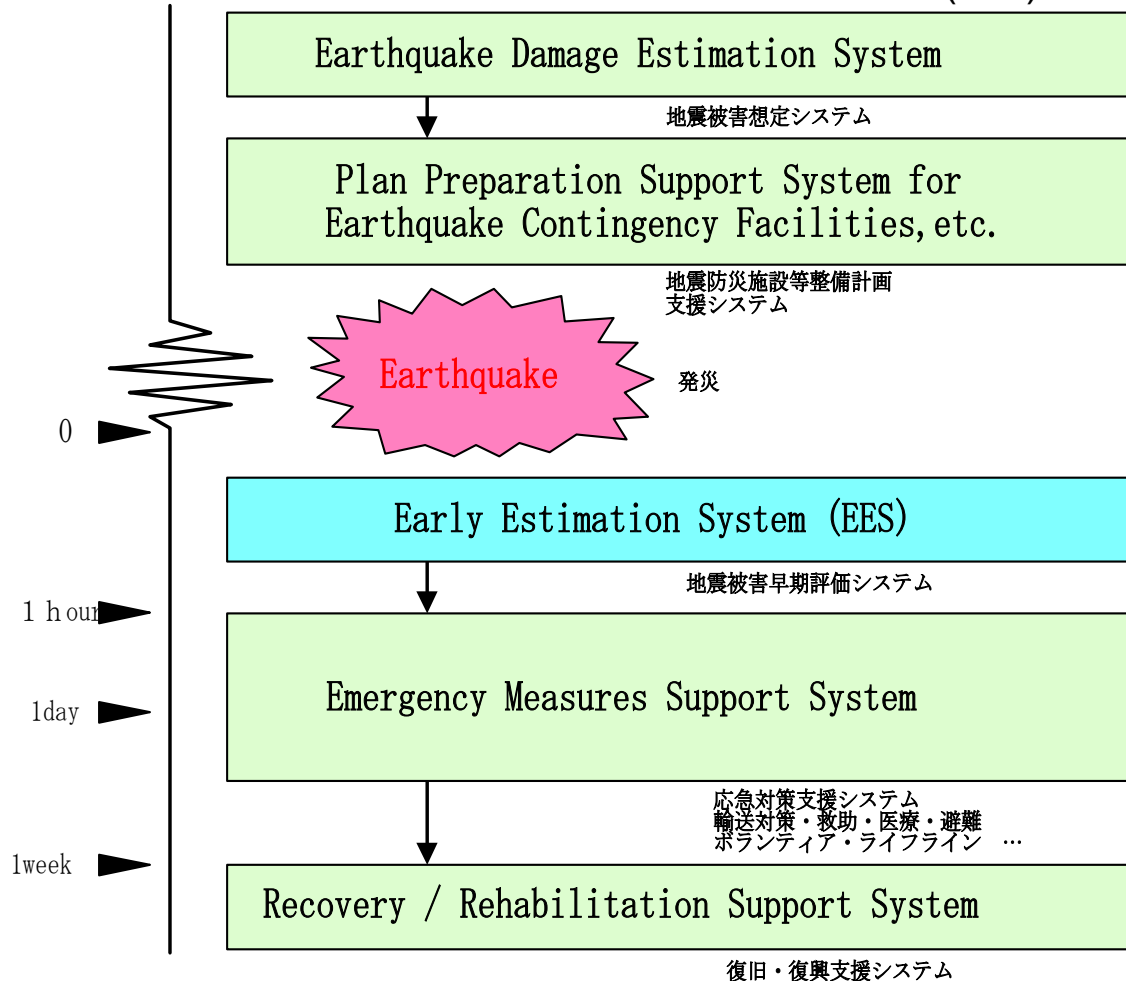


National Countermeasures

- **Establishment of the Cabinet Information Collection Center**
- **Enhanced Governmental System**
 - Minister of State for Disaster Management
 - Chief Cabinet Secretary for Crisis Management
- **Development of Disaster Information System(DIS)**
 - Early Estimation System
 - Emergency Measure Support System

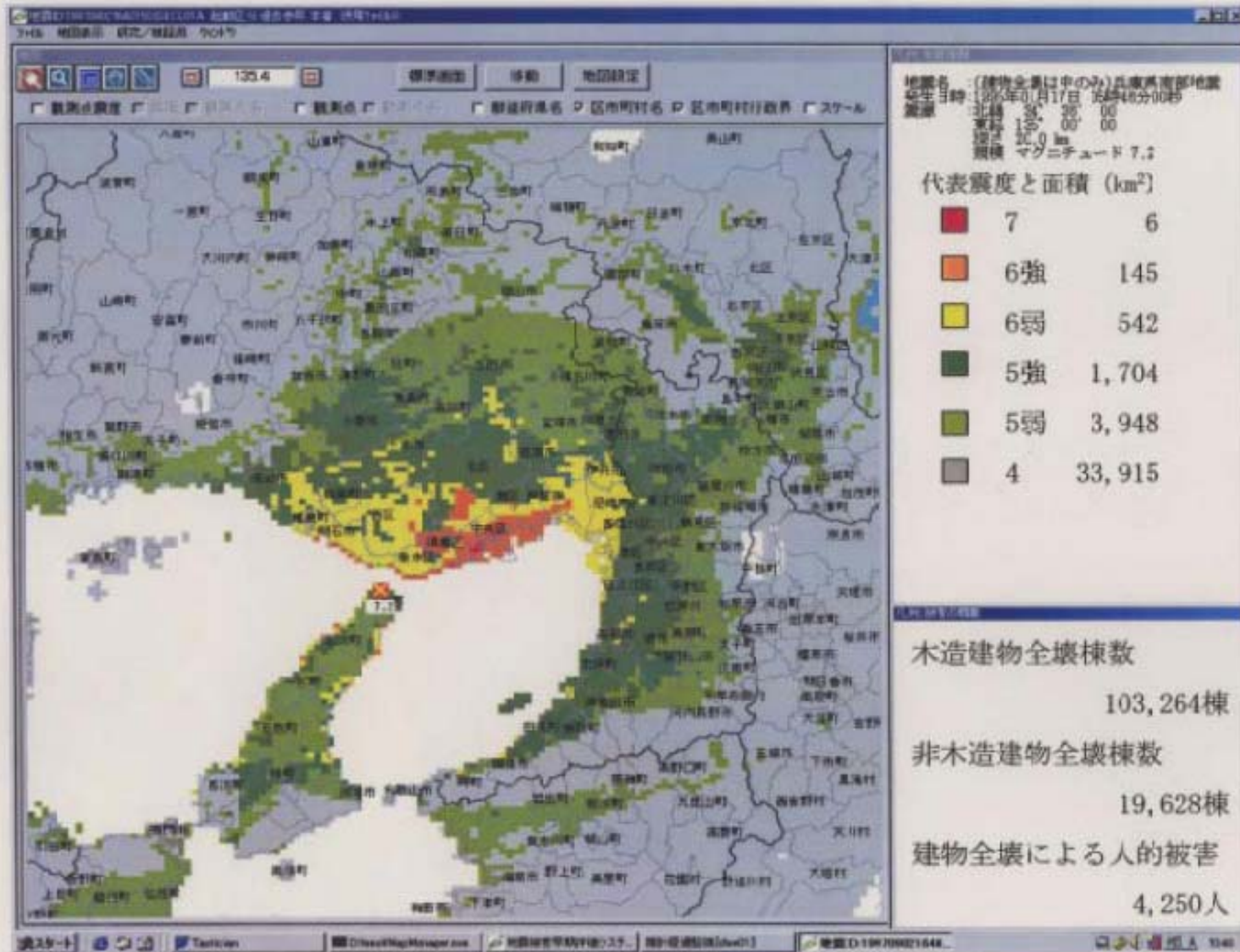
Disaster Information System / Earthquake

地震防災情報システム(DIS)



Estimation of damaged buildings and casualties

地震発生30分以内で大まかな人的被害、建物被害を推計(EES)



Countermeasures in Hyogo Prefecture “Phoenix Disaster Management System”



Characteristics of the "Phoenix Disaster Management System"

- Realized a practical system based on the lessons we learned from the Great Hanshin-Awaji Earthquake.
- To support all-important decisions made at the Emergency Management Headquarters.
- The system is designed to open for the local community and to support it by its society.
- To reinforce the relationship and to share the common information with the disaster management-related organizations.
- To utilize the administrative activities in non-disaster times.

Seismic intensity data

Seismographic Information network System

Meteorological data

L-ADESS(Local Automated Data Editing and Switching System)

Local meteorological data

Meteorological information distributors

River & basin data

River & Basin Information System

Landslide & washout disaster data

Landslide & washout disaster information system

Kobe municipal water-disaster management data

Kobe municipal water-disaster management information system

Video images from high view camera

Fire Defense Headquarters (Kobe, Himeji, Amagasaki, Nishinomiya, Kakogawa)

Video Images from helicopters

Police Headquarters helicopter TV camera system



Hyogo Prefecture Disaster Management Center

Environmental Information Collection and Distribution System

- ◆ **Seismographic information**
 - Earthquake and seismic wave information
 - Seismic intensity of each area
 - Hyogo prefecture's seismic intensity
- ◆ **Environmental information**
 - AMEDAS
 - Typhoon information
 - HIMAWARI
 - Radar AMEDAS
 - Simple weather forecast
 - Simple weather report
 - Synthetic Radar
 - Weekly weather forecast
 - Warning and alarm
 - Alarm for water-disaster management notice
 - Water level of river & basin inside the prefecture
 - Rainfall inside the prefecture
 - Thunder lightning information
- ◆ **Environmental information www**
 - Local meteorological information
 - Meteorological radar in 10 min.
 - Water level of river & basin in 10 min.
 - Rainfall in 10 min.
- ◆ **River & basin information**
 - Rainfall measured by radar
 - Water level and rainfall measured by telemeter
 - Earth and sand disaster information
 - Analysis of the movement of rain-fall area
- ◆ **Kobe municipal water-disaster information**
 - Kobe municipal radar information
 - Tidal level of the Kobe port
- ◆ **Information from the Fire & Disaster management Agency**
 - Earthquake information
 - Visual information from the helicopter
 - Petrochemical complex information
 - Dangerous objects information

Damage Estimation System

- ◆ **Damage estimation**
 - Number of collapsed houses and buildings
 - Number of outbreak of fire
 - Number of killed people
 - Number of injured people
 - Number of evacuated people

Damage Estimation System

- ◆ **Disaster information**
 - Damage report on offices
 - Disaster information news
 - Municipal demand measurement
 - To open the Disaster Management Headquarters
 - To display the disaster level and condition report
 - Disaster management equipment and facility preparation

Visual Information System

- ◆ **Visual information**
 - Camera placed on top of each Fire Defense Headquarters
 - TV camera visuals from police office's helicopter
 - TV broadcasting

Emergency Management System

- ◆ **Damage information**
 - Activity guidance
 - A list of conditions of each activity
 - Regional disaster management plans
- ◆ **Call for all members**

Map Information System

- ◆ **Map information**
 - Hyogo prefectural map
 - Map of 1/500,000
 - Map of 1/25000
 - Detailed area map
 - Layer map

Communication Backup System

- ◆ **Exchange information**
 - Internet
 - Electrical mail
 - Electrical bulletin board system

Hyogo Governmental Office LAN (ATM-LAN FDDI)

The information flow of the "Phoenix Disaster Management System"

Disaster management
WAN
(Dedicated digital line + ISDN)

General public circuit

Hyogo Satellite
Communication
Network System



Prefectural Residents Bureau

Every information will be displayed on the Hyogo Prefectural Home Page

Japan

- Fire & Disaster Management Agency ● Disaster management WS
- The Prime Minister's Office ● Disaster management WS
- Ministry ● Disaster management WS

Cities and Towns, Fire Defense Headquarters, and Police Headquarters

- City and town offices ● Disaster management WS(Digital camera)
● Satellite Communication
- Fire defense headquarters ● Disaster management WS(Digital camera)
● Satellite Communication
- Police headquarters, police stations ● Disaster management WS

Prefectural Government Office and Local or Regional Organizations

- Prefectural Residents Bureau ● Disaster management WS
● Satellite Communication
- Public Works, Agricultural and Forestry Offices ● Disaster management WS

Disaster Management-related Organizations

- The Grand Self Defense Force and the Maritime Self Defense Force ● Disaster management WS
- The Fifth Precinct Maritime Safety Agency ● Disaster management WS

Lifeline-related Organizations

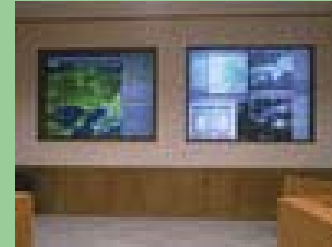
- NTT West Japan, Kansai Electric Power, Osaka Gas, and Nisseki ● Disaster management WS

Main Facilities of the Emergency Management Headquarters

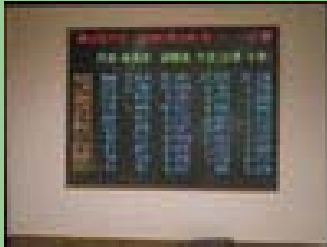
Emergency Management Headquarters



A large screen



A large text display board (LED)



System operating room

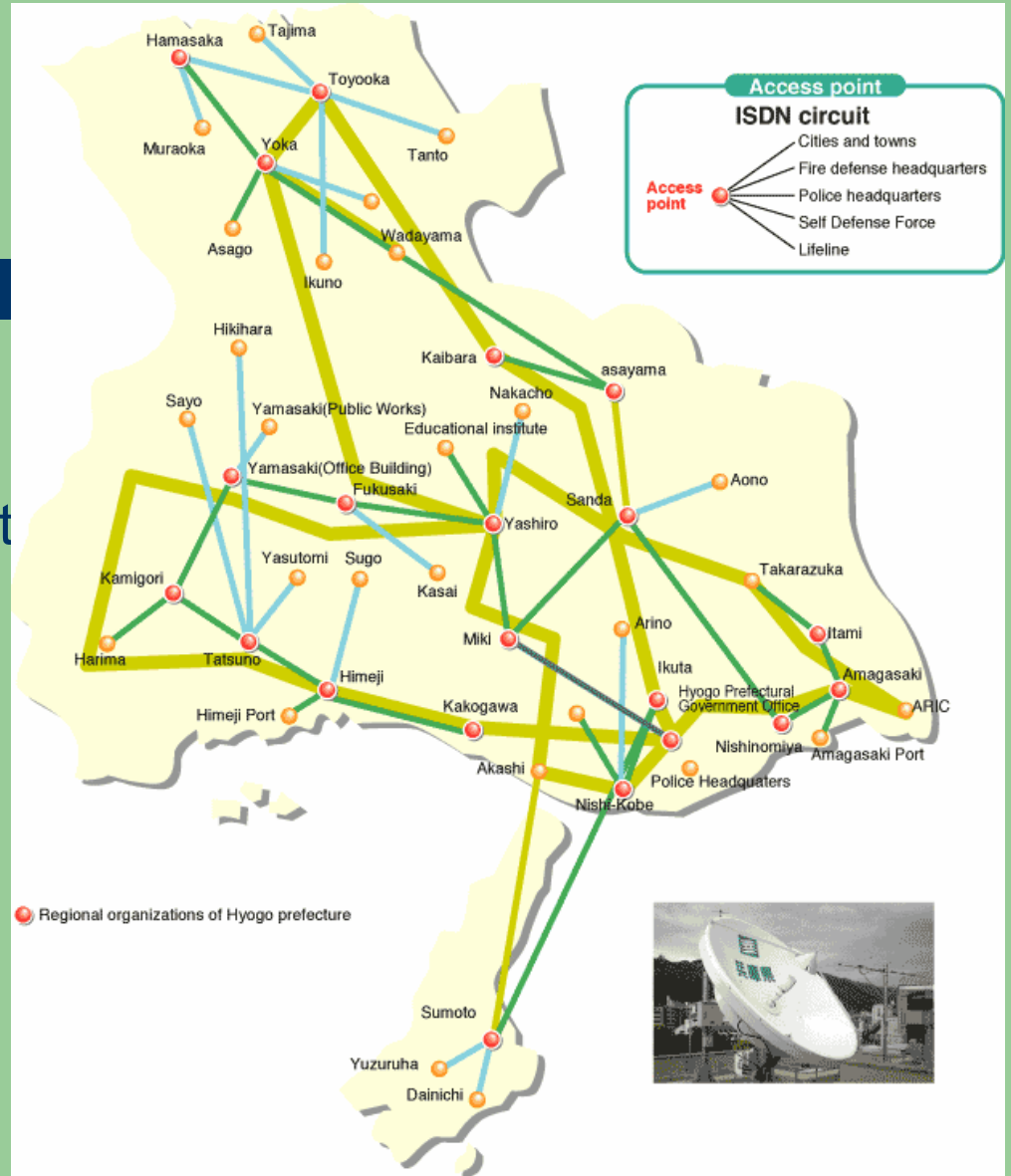


Network operating room



Network of the "Phoenix Disaster Management System"

- Disaster Management WAN
- Prefectural Government Office LAN
- Hyogo Satellite Communication Network



Application of New Space & Telecommunication Technology for Immediate Reporting

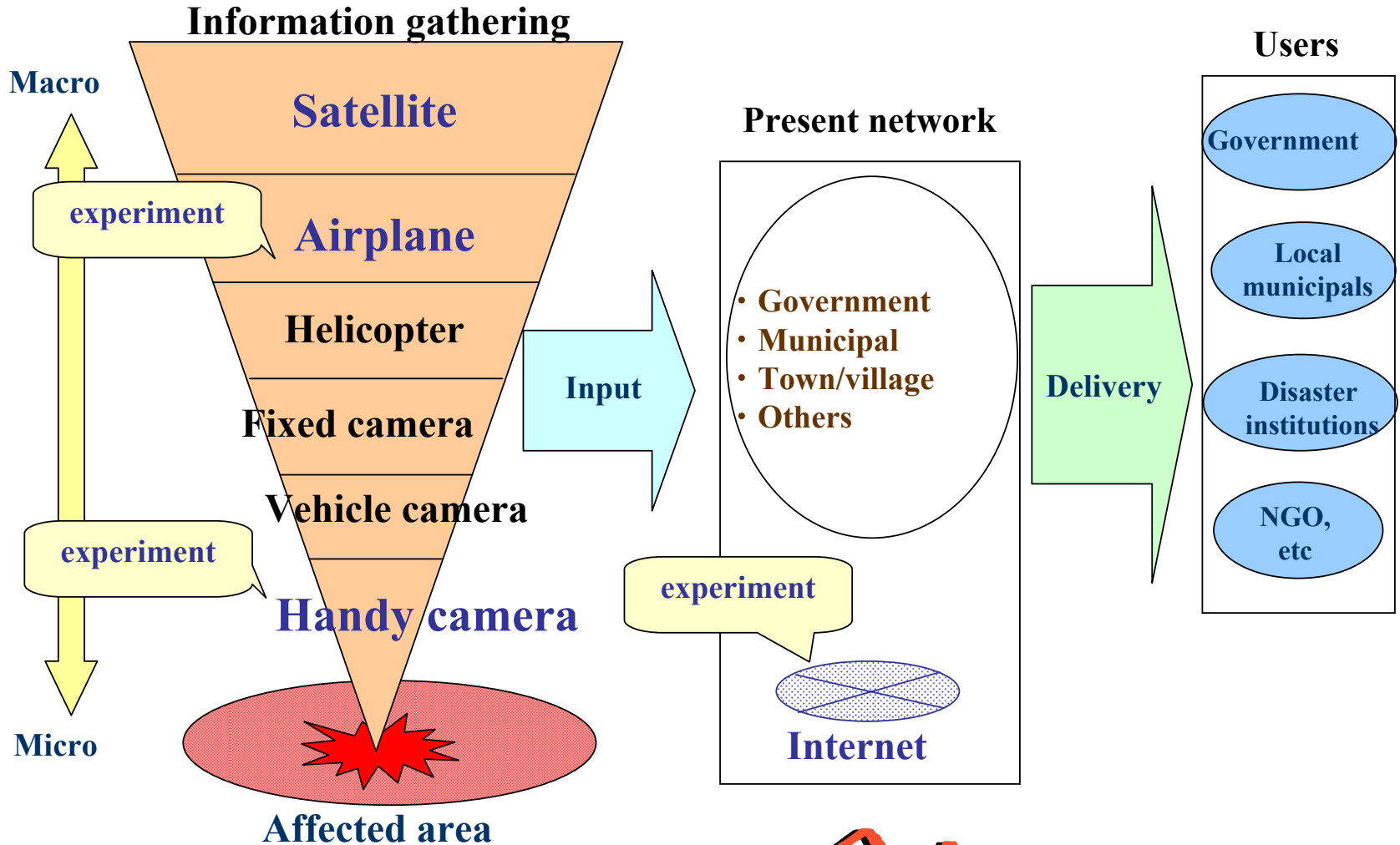
RISCS (Realtime Image Sharing system with ultrahigh-speed Communication Satellite)



JAXA and ADRC

in cooperation with CRL/DAS

Disaster monitoring and information dissemination

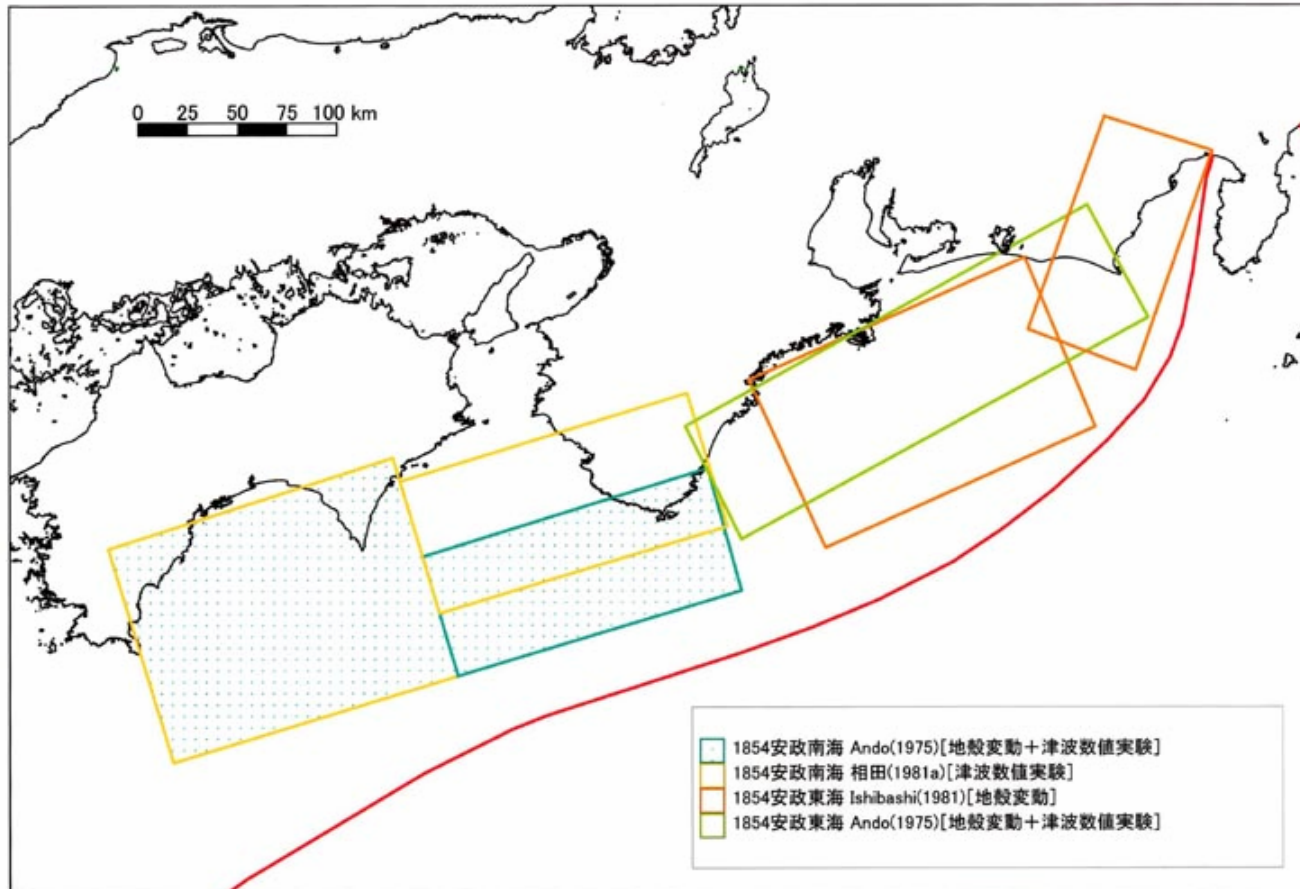


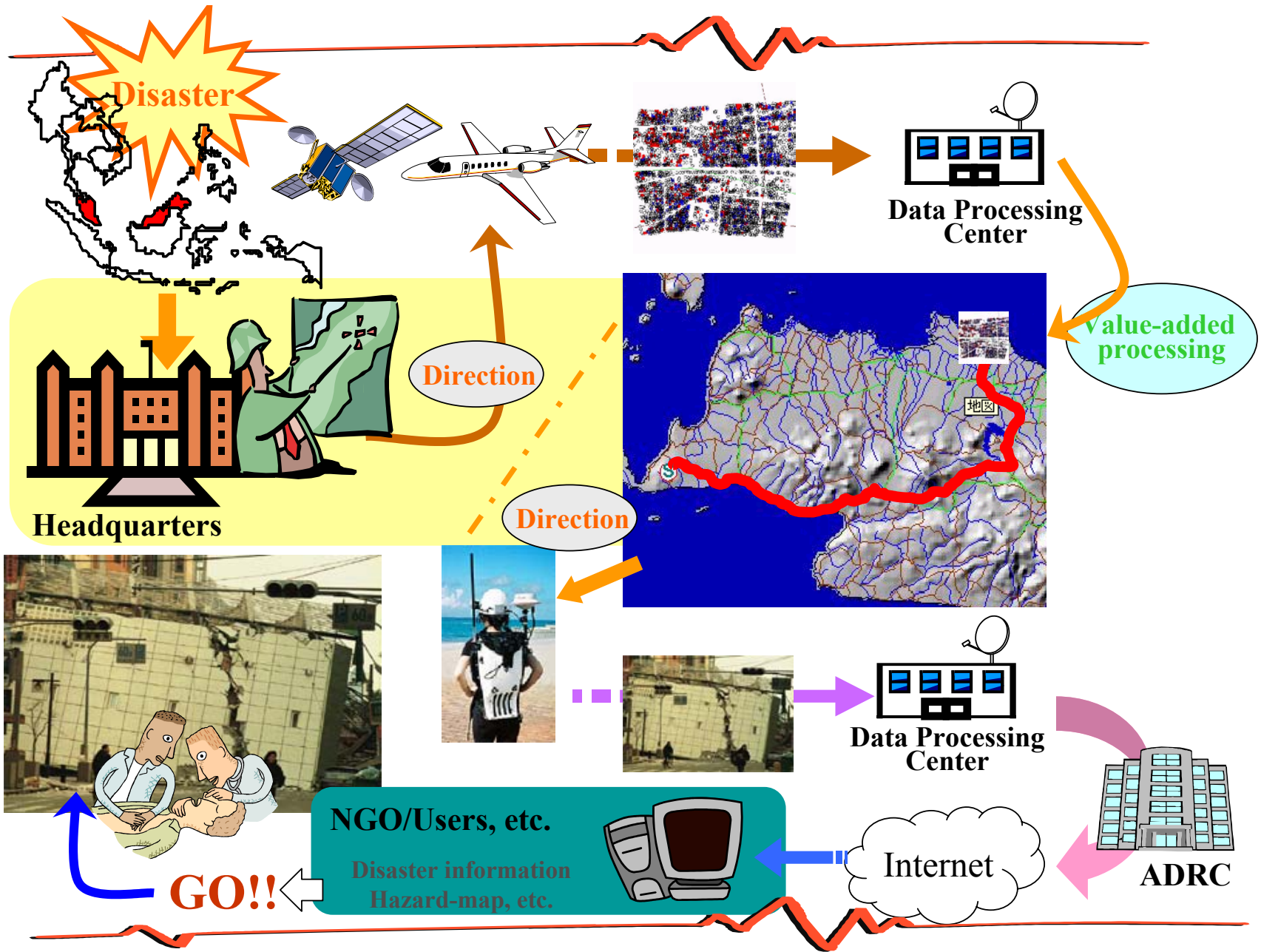
Space Tech will bring breakthrough to Disaster Monitoring

- Making full use of **latest space technology** for disaster monitoring and emergency information communication
- Targeting natural disasters, especially, for **Large-scale Earthquake and Tsunami**.
- If the Earthquake or Tsunami occurs, headquarters must **IMMEDIATELY** grasp the overall damage.
- Jet-plane reconnaissance system will send movie and photo with GIS coordinates within **1 hour** after Earthquake/Tsunami.



Huge Earthquake of M8 class might occur in Japan within 30 years.





Early damage situation grasp of the coast by the airplane and the satellite

Communication Satellite

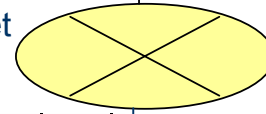
Movie, Photo

Movie, Photo

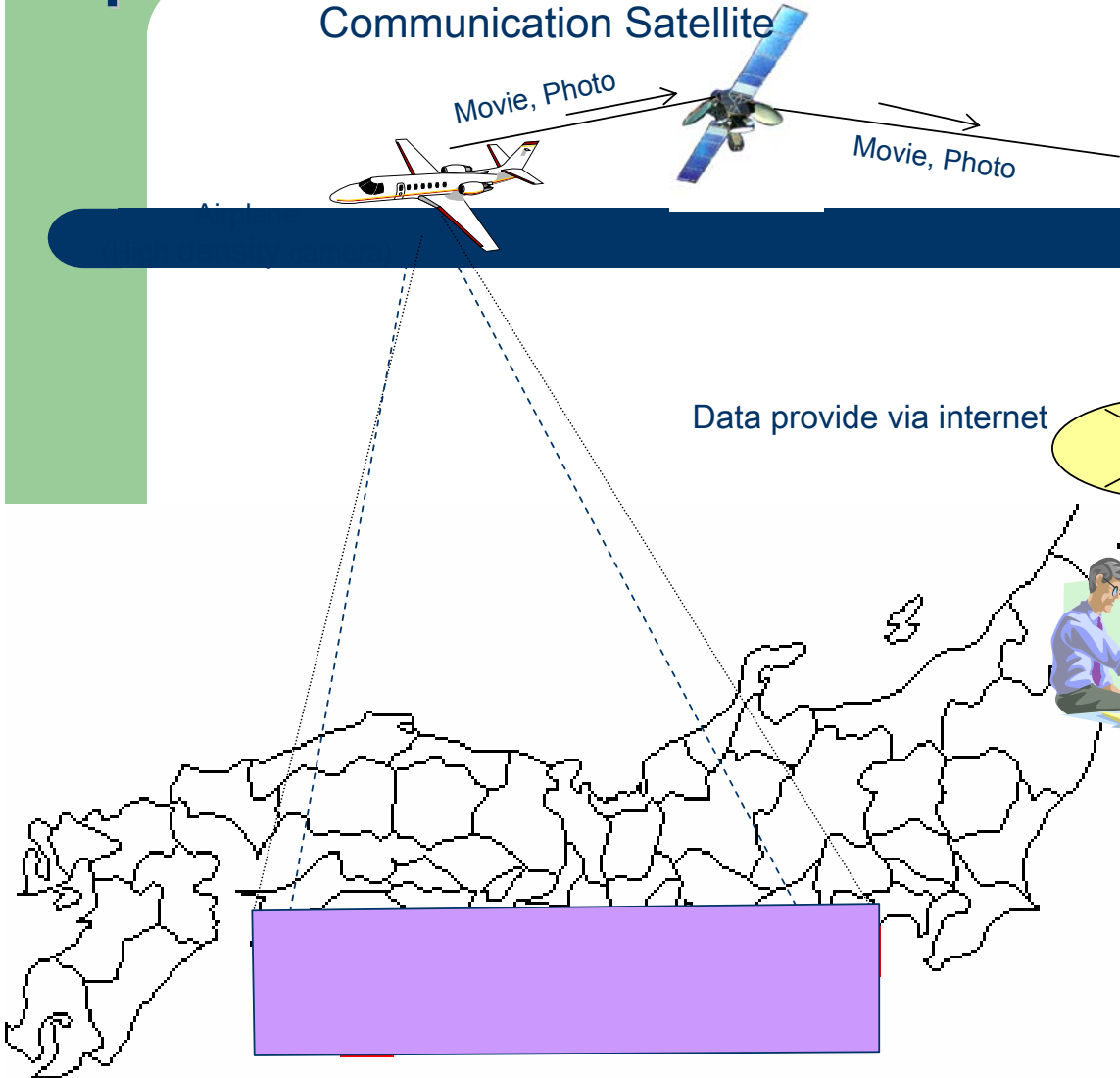
Head Quarters



Data provide via internet



Users



Jet-Plane for monitoring



Satellite Antenna



Camera

Experiment movie 1

- jet plane

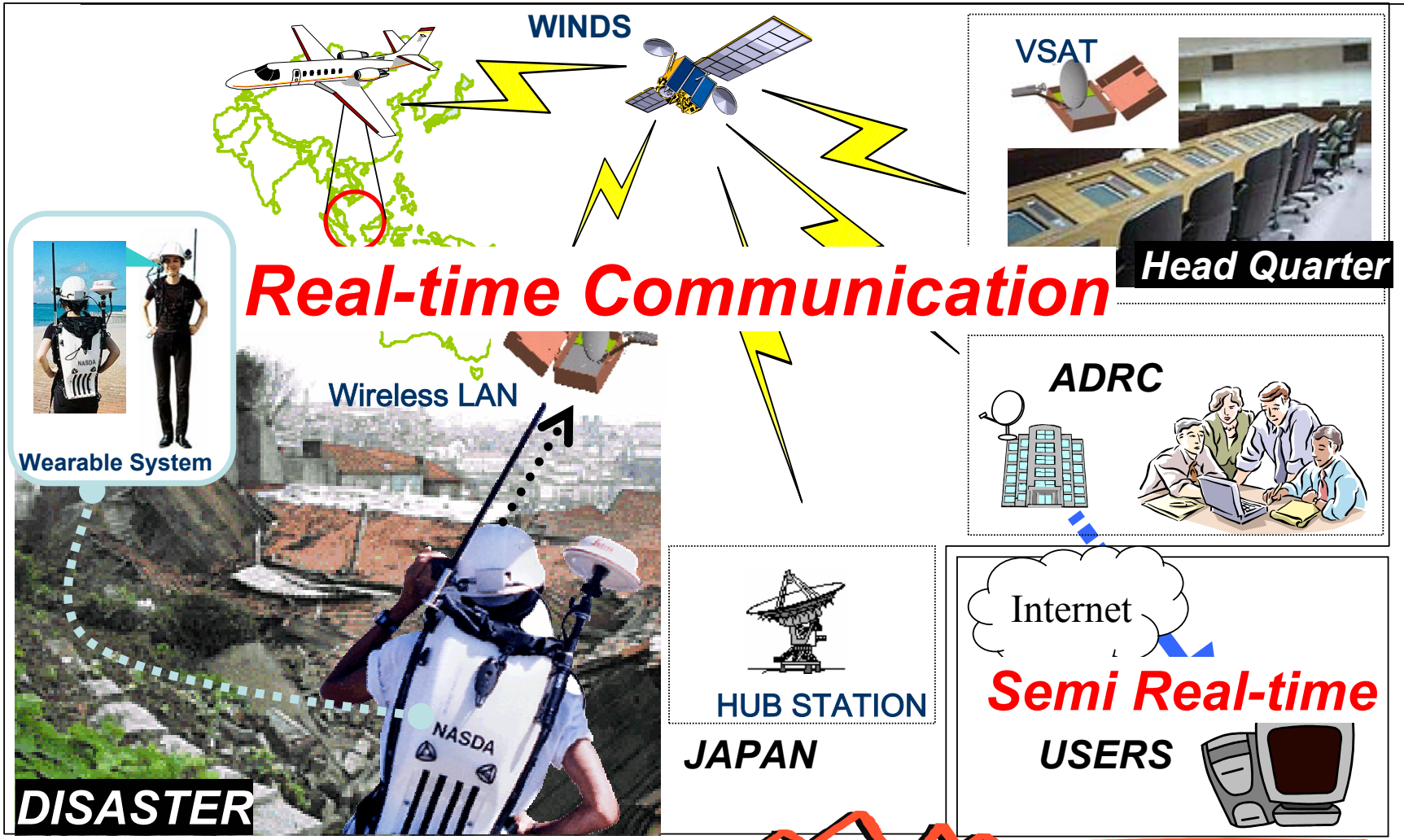
- mosaic

Space Tech will bring breakthrough to on-site Disaster Assessment & Operations

- To be hand-carried & operated by one or a few members.
- To grasp the situation in the center of affected areas where vehicles can not be easily accessible.
- To gather & communicate on-site information in an interactive way with HQs.
- To transmit movies with detailed information of affected areas to HQs.



Disaster Management Experiment in Asia



Monitoring by Headset Camera



- For evaluation of the damage situation by specialists in several locations
- Conducted experiment for
 - Volcano in *Hokkaido Mt. Usu*
 - Anticipated earthquake in *Tokai* area

Greater Capacity for Operations

- To instruct experts in remote areas for triage and emergency safety checks with monitoring of images.
- To handle communication of local headquarters under circumstances of disrupted communication existing infrastructure.
To report situations securely without any congestion or disruption of communication lines.





Experiment movie 2

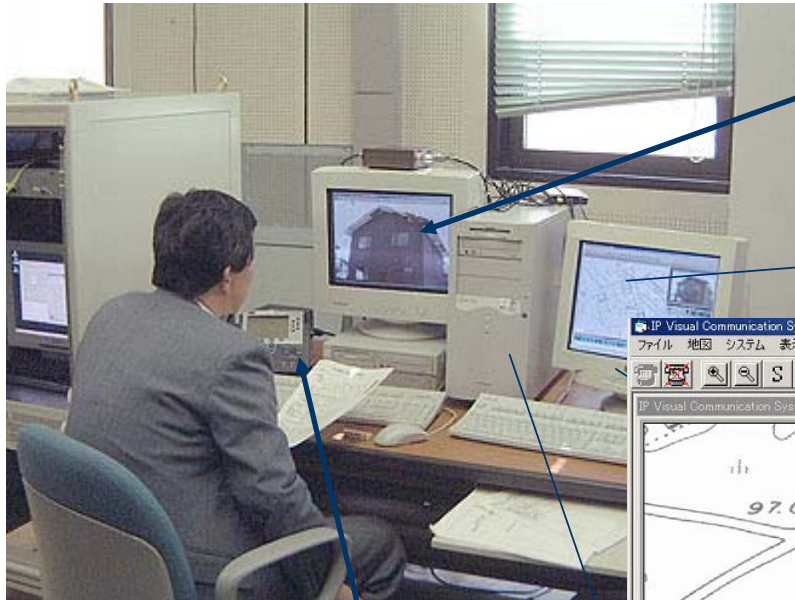


- Headset Camera Team

Experiment movie 3

- Portable IP-VSAT

Disaster Management Center

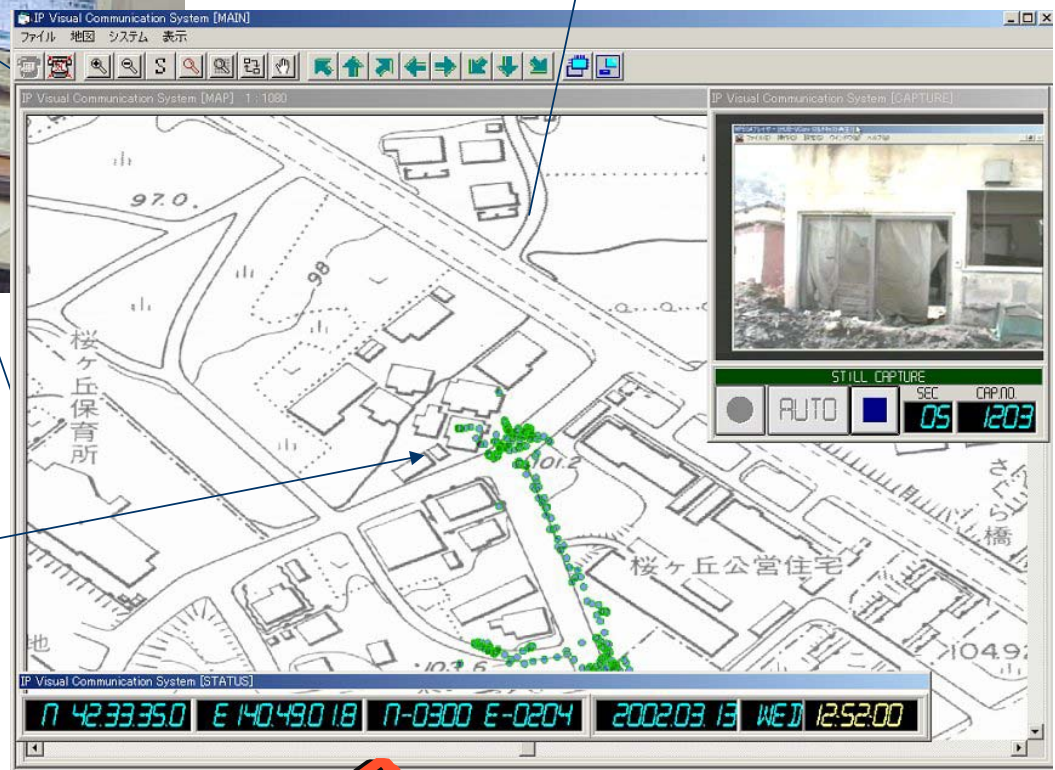


Video Monitor

Mapping of sight and its locus

IP telephone

Monitoring point



Disaster Information on <http://www.adrc.or.jp>

The image illustrates the Disaster Information System interface, showing a search form, search results, a detailed image viewer, a metadata table, and a video player.

Search Form: HTML配信検索テスト - Microsoft Internet Explorer. URL: <http://218.44.250.234/Disaster>. Fields: Country Name, Kind of Disaster, Range of Date (Start: 2000, End: 2000). Button: Search!

Search Results: Disaster Information System. Search results: 175 record display 1-10 record. Grid of images.

Image Viewer: Image. Shows a detailed view of a selected image.

Metadata Table: Disaster Information System. Search results: 209 record display 1-10 record. Table with columns: Data Key, Value, Unit.

Data Key	Value	Unit
Movie Key	4000001050000	
Movie sequence	1	
Photography time	2002/07/05 12:11:49.60	
Body latitude	24.752 634	
Body longitude	137.908 374	
Body angle (roll)	-1.2	
Body angle (pitch)	-4.3	
Body angle (yaw)	56.7	
Photography latitude	24.752 634	
Photography longitude	137.912 604	
Photography angle (roll)	25.7	
Photography angle (pitch)	-19.4	
Camera resolution	0	
GPS precision		
GPS Control User status	2.0	
GPS Control User status	2.0	
Observation material		
Data Key	4	
Movie Key	40001050000	

Video Player: MPE4 Movie. Shows a video player interface.

Navigation: A cartoon character is shown sitting at a desk with a computer, pointing towards the search form. Arrows indicate the flow from search to image selection, then to image viewing, then to metadata, and finally to video playback.

High Density Real-time Movie



Estimate of the damaged situation by the specialist of the remote place

- Watch clearly the mm unit of measure
- observe the hollow and crack of road surface
- Recognize situation of affected area with overlaid map data
- Get movie and other information through telecommunication



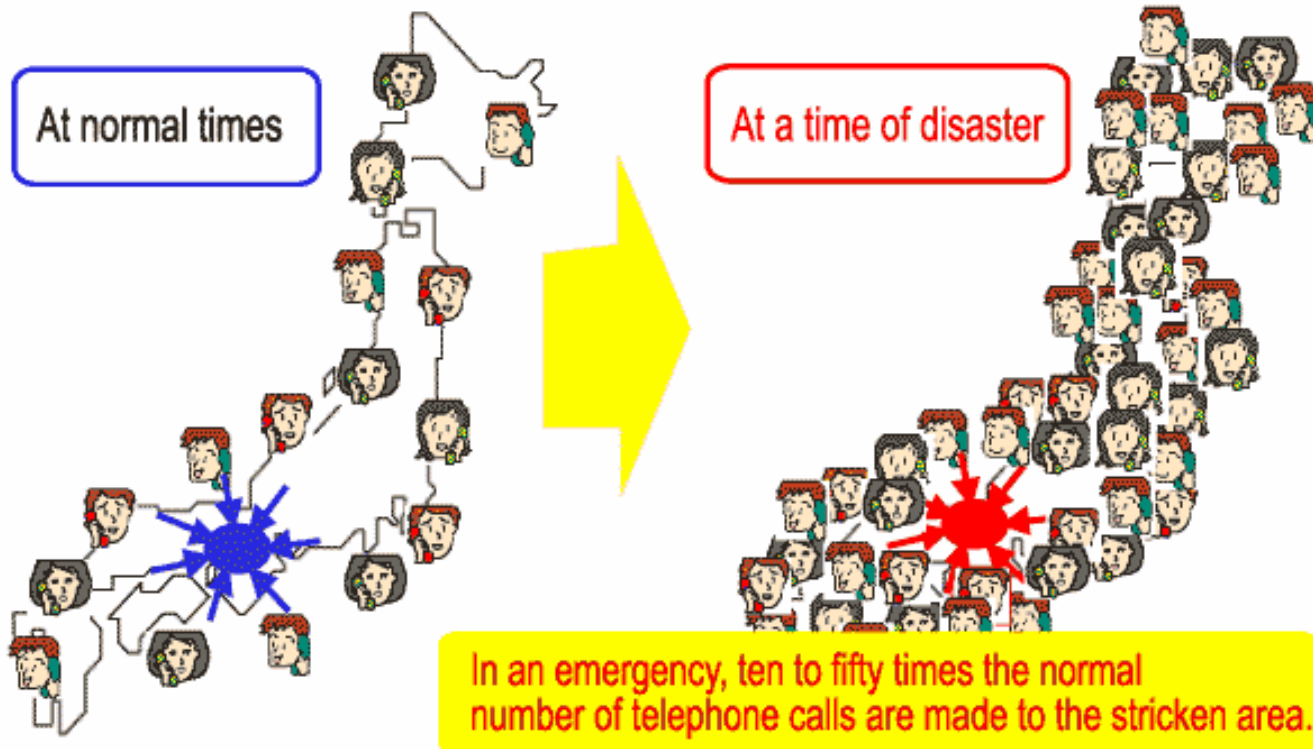
Quickly Response



New Systems for Vital Information Dissemination

What happens to your telephone in a disaster?

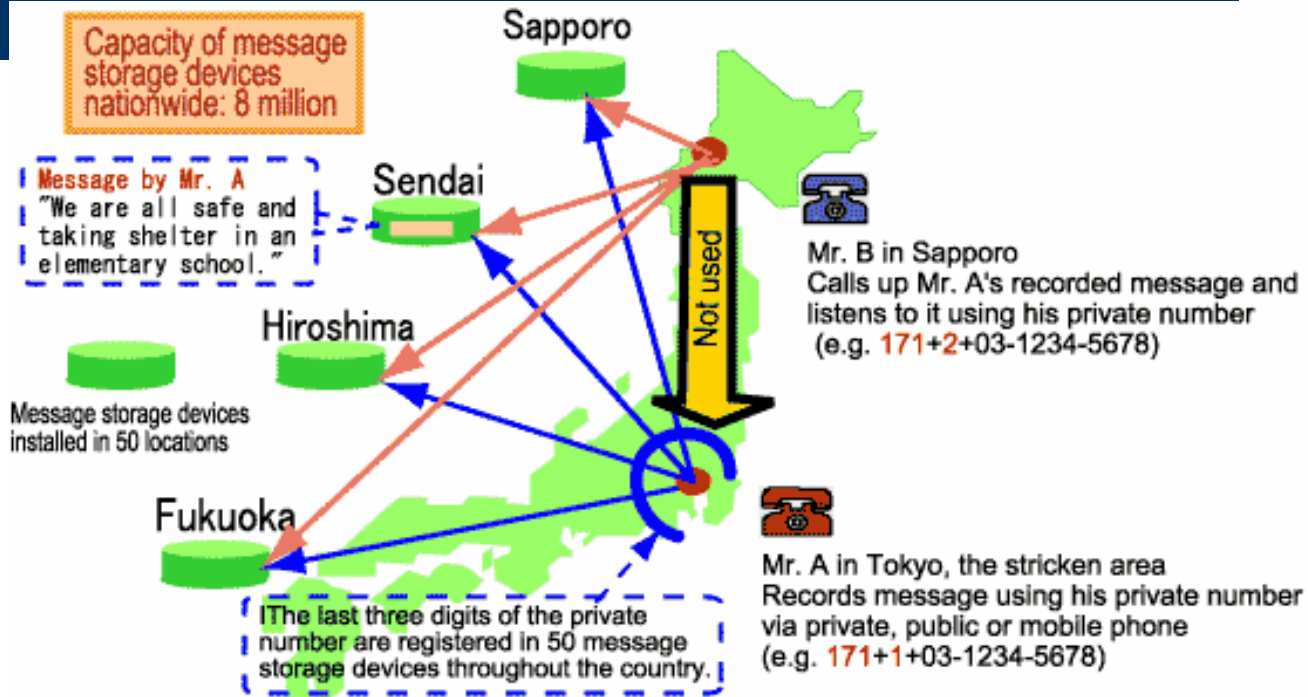
- What is Congestion?



Voice mail service in emergencies functions to convey voice messages by recording and calling up the recorded message



System of voice mail service in emergencies



Concept of voice mail service

- Example: Mr. A records a message in Tokyo, the stricken area
Mr. B calls up the recorded message in Sapporo
- Congested circuits between Tokyo and Sapporo are not used for this service.

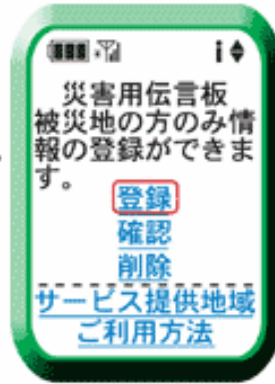
i-mode Disaster Message Board Service

Message registration Flow

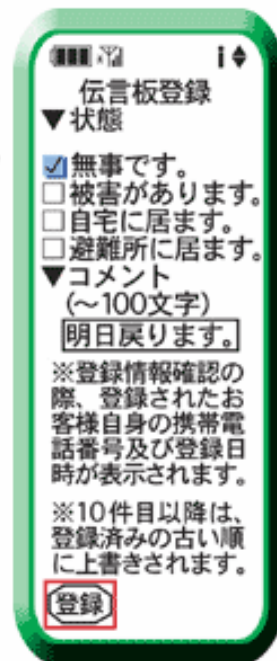
i-mode menu



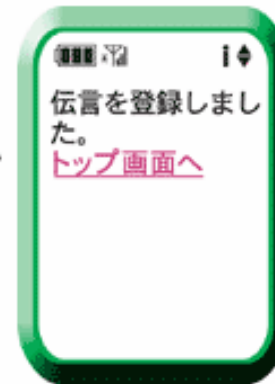
board menu



register message



save message



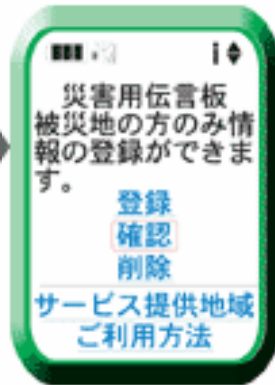
i-mode Disaster Message Board Service

Message confirmation Flow

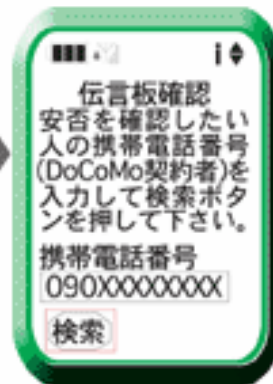
i-mode menu



board menu



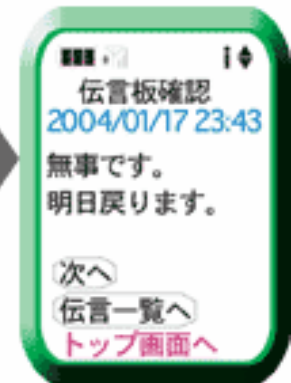
Enter phone no.



message list



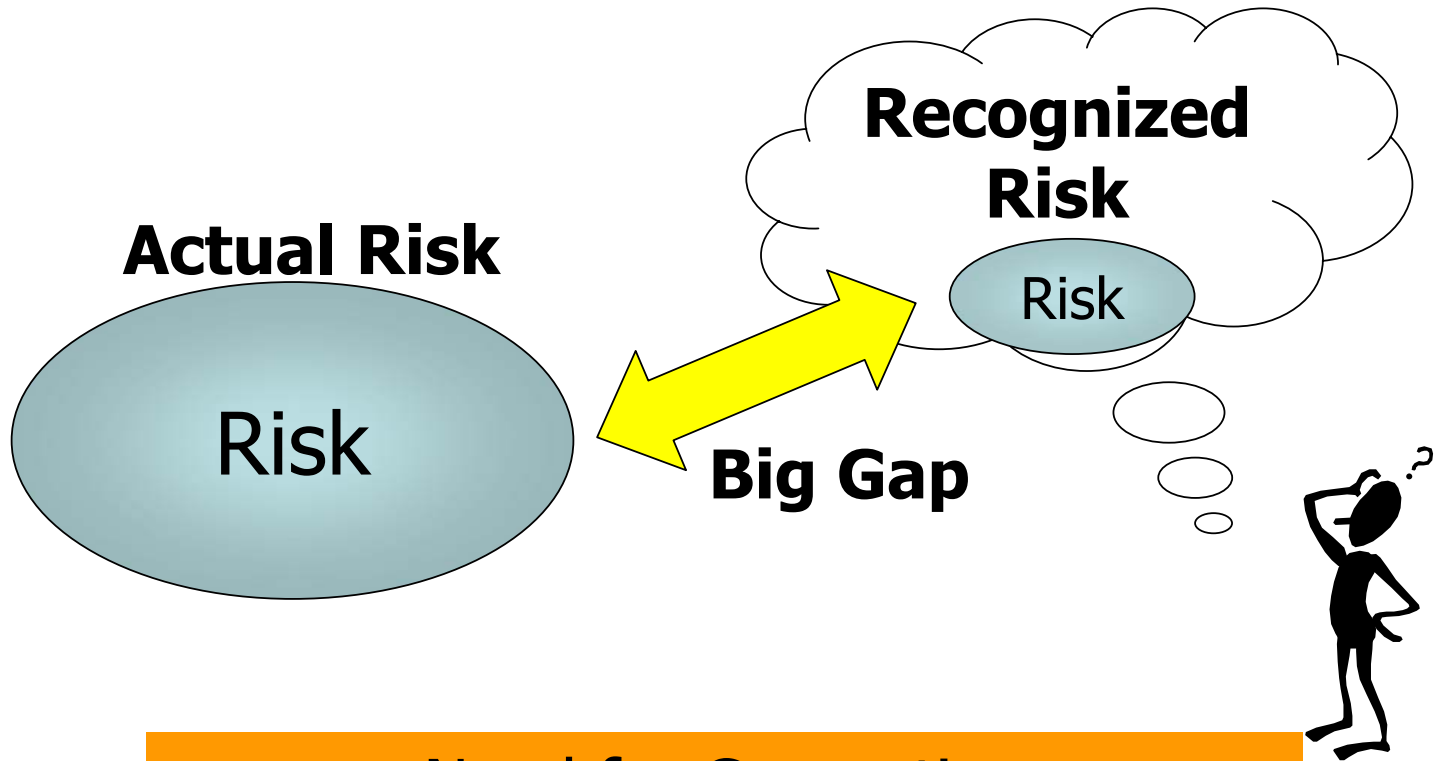
message



Dissemination of Hazard Maps for Saving Lives

- Early Warning
- +
- Hazard Mapping

Risk Perception Gap



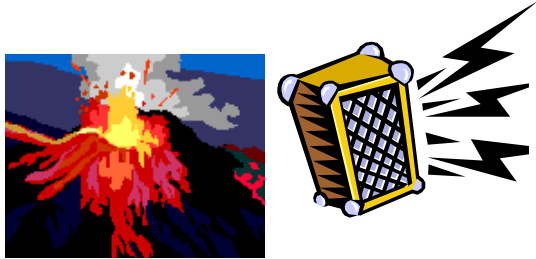
Need for Generating
Realistic Disaster Scenario

Information is Vital!

Development of Early Warning Tech.

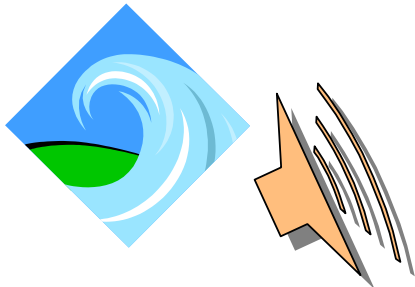


Less Community Awareness

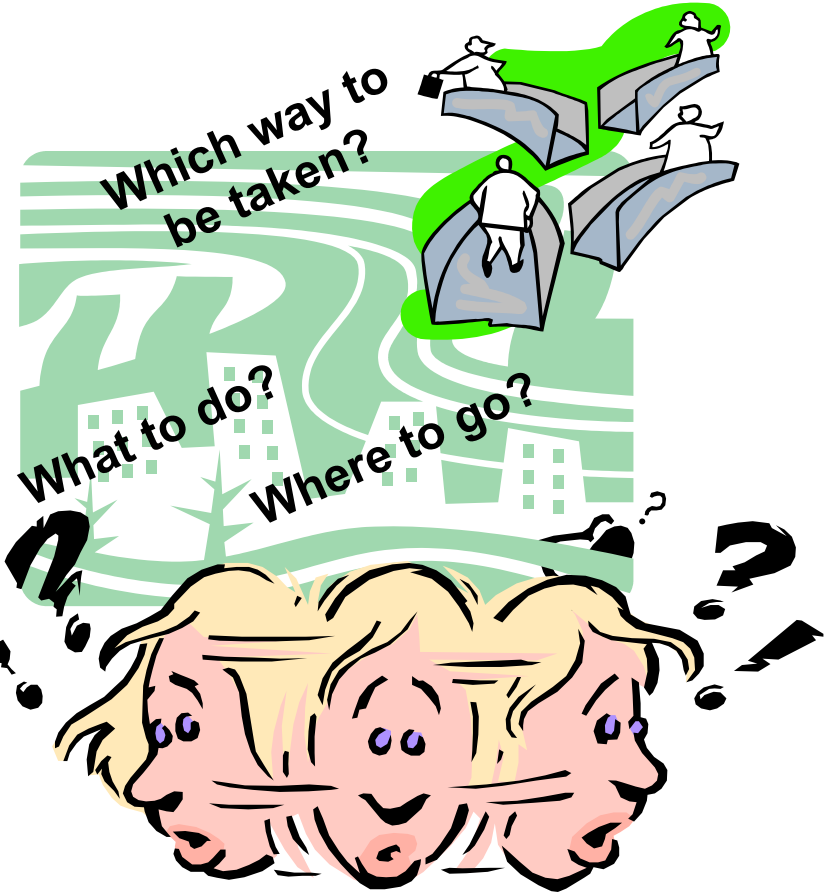


Volcanic Eruption Warning!

Flood Warning!




Tsunami Warning!




Information is Vital!


Hazard Mapping as a Tool for Effective Early Warning



Where is our evacuation area?



岩手山火山防災マップ



Safe Evacuation Route

Understanding of Hazardous Areas

Appropriate Risk Awareness of Local Communities



+

Early Warning

||



Safe Evacuation

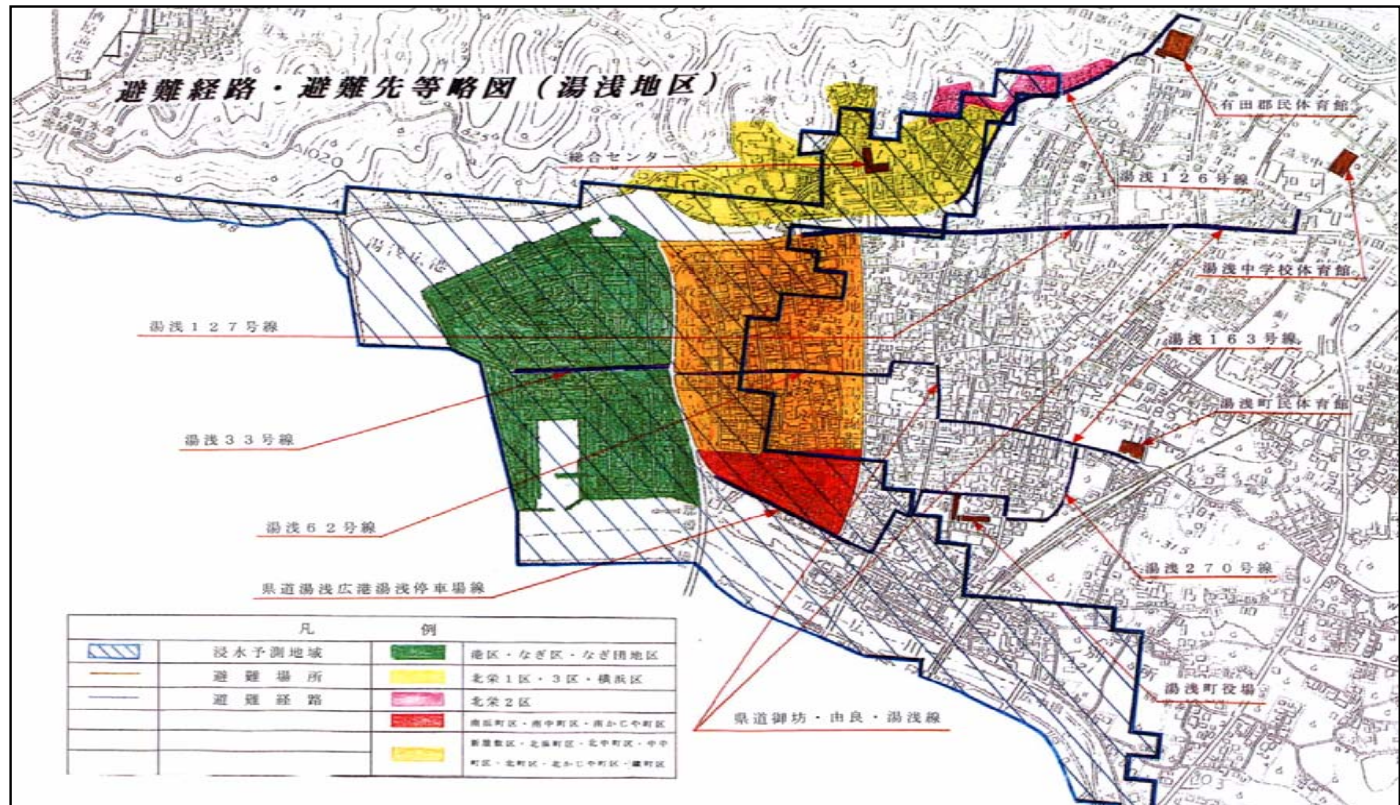
Information via Media



[アメダス.mpg](#)

Click

Example of Hazard Map



National Disaster Information Center on Website

<http://www.bosaijoho.go.jp/>

The screenshot shows the homepage of the National Disaster Information Center. At the top, the title '防災情報提供センター' (National Disaster Information Center) is prominently displayed in the center, with the Ministry of Land, Infrastructure, and Transport logo on the right. A navigation menu on the left includes links for 'トップページ', 'リアルタイム雨量', 'リアルタイムレーダー', '情報を探す(詳細検索)', '情報の提供元一覧', 'リンク集', and 'ご意見・ご感想'. A yellow banner at the top contains a notice about user feedback. Below this, an 'お知らせ' (Notice) section states that the '防災トピックス' (Disaster Topics) feature provides the latest information on disaster response. The main content area is divided into several sections: '防災情報提供センター' (National Disaster Information Center) with a brief description of the site's purpose; '防災情報' (Disaster Information) with links to 'リアルタイム雨量' (Real-time Rainfall) and 'リアルタイムレーダー' (Real-time Radar); '国土交通省防災情報リンク' (Ministry of Land, Infrastructure, and Transport Disaster Information Links) with a grid of links for '河川災害' (River Disasters), '土砂災害' (Landslide Disasters), '道路災害' (Road Disasters), '北海道における災害' (Disasters in Hokkaido), '河川情報' (River Information), '水文水質データベース' (Hydrological and Water Quality Database), '浸水想定区域図' (Flooded Area Maps), '気象情報' (Weather Information), '警報・台風などの気象情報' (Alerts and Weather Information), '波浪・潮位・海水情報' (Wave, Tide, and Sea Level Information), '過去の気象データ(電子閲覧室)' (Historical Weather Data (Electronic Reading Room)), and '災害をもたらした気象事例' (Weather Cases that Caused Disasters); '温水情報' (Hot Water Information); '道路情報' (Road Information) with links for '道路防災だより' (Road Disaster Newsletter), '道路情報提供' (Road Information Provision), and '事前通行規制情報' (Advance Traffic Regulation Information); and '東京都・大阪市降雨情報' (Tokyo and Osaka Rainfall Information) with links for '東京都下水道局降雨情報' (Tokyo Metropolitan Sewerage Bureau Rainfall Information) and '大阪市都市環境局降雨情報' (Osaka City Urban Environment Bureau Rainfall Information). A search box on the left is titled '防災情報を探す' (Search for Disaster Information) and includes a search button and a list of search options: '詳細検索(複数キーワード、カテゴリ検索)ページへ' (Detailed Search (Multiple Keywords, Category Search) Page) and '情報の詳細一覧(国土交通省防災情報リンクサイト)' (Information Detail List (Ministry of Land, Infrastructure, and Transport Disaster Information Link Site)).

防災情報提供センター

国土交通省

トップページ

リアルタイム雨量

リアルタイムレーダー

情報を探す(詳細検索)

情報の提供元一覧

リンク集

ご意見・ご感想

防災情報提供センターからのお知らせ

当ホームページに関するご意見・感想をお願いします。

お知らせ

「防災トピックス」では、防災対策などに関する最新のトピックスをご覧ください。

防災情報提供センター

リアルタイム雨量

リアルタイムレーダー

国土交通省防災情報リンク

国土交通省災害対応

河川情報

気象情報

河川災害

川の防災情報

警報・台風などの気象情報

土砂災害

水文水質データベース

波浪・潮位・海水情報

道路災害

浸水想定区域図

過去の気象データ(電子閲覧室)

北海道における災害

災害をもたらした気象事例

温水情報

道路情報

東京都・大阪市降雨情報

道路防災だより

道路情報提供

東京都下水道局降雨情報

事前通行規制情報

大阪市都市環境局降雨情報

防災情報を探す

ここに見たい情報のキーワードを入力し、検索ボタンを押してください。

検索

●詳細検索(複数キーワード、カテゴリ検索)ページへ

●情報の詳細一覧(国土交通省防災情報リンクサイト)

Flood Hazard Maps available through Website

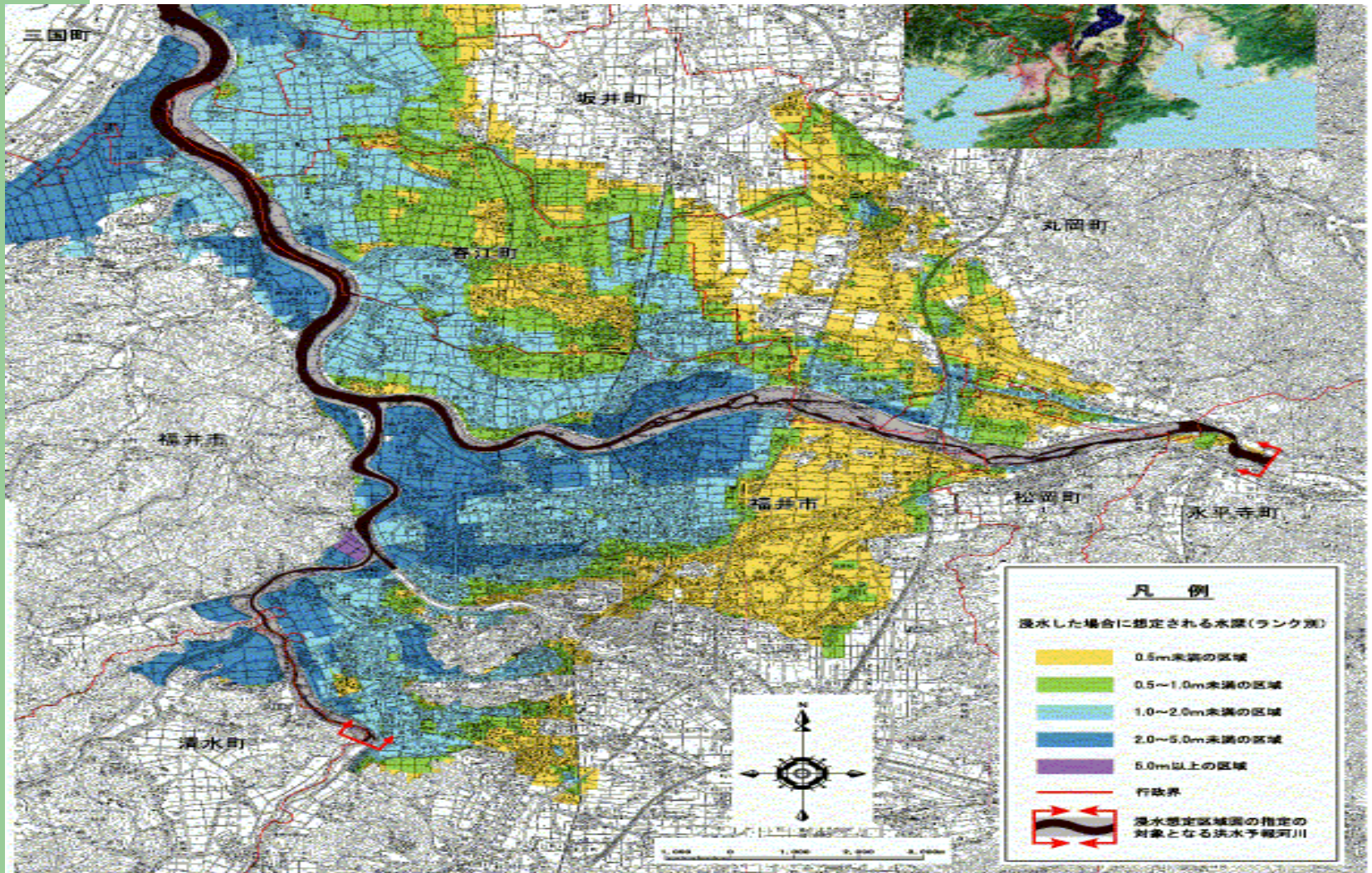
<http://www.bosaijoho.go.jp/>

浸水想定区域図のホームページリンク集(近畿地方整備局)
(平成15年5月23日現在)

水系名	河川名	指定年月日	U R L
由良川	由良川	H13.08.31	http://www.kkr.mlit.go.jp/fukuchiyama/river/win/sinsui.html
紀の川	紀の川	H13.12.20	http://www.kkr.mlit.go.jp/wakayama/whats/h131219/index.html
淀川	野洲川	H14.03.15	http://www.biwako.ws/simulation/sinsuisoutei/yasu/sinsuisoutei.html
	淀川	H14.06.14	http://www.kkr.mlit.go.jp/yodogawa/kasen/mea/bosai_sonae_01hyo.html
	桂川	H14.06.14	http://www.kkr.mlit.go.jp/yodogawa/kasen/mea/bosai_sonae_01hyo.html
	木津川	H14.06.14	http://www.kkr.mlit.go.jp/yodogawa/kasen/mea/bosai_sonae_01hyo.html
	木津川(上流)	H14.06.14	http://www.kkr.mlit.go.jp/kizujyo/pressf.html
	名張川	H14.06.14	http://www.kkr.mlit.go.jp/kizujyo/pressf.html
	宇陀川	H14.06.14	http://www.kkr.mlit.go.jp/kizujyo/pressf.html
	柘植川	H14.06.14	http://www.kkr.mlit.go.jp/kizujyo/pressf.html
	服部川	H14.06.14	http://www.kkr.mlit.go.jp/kizujyo/pressf.html
	猪名川	H14.06.14	http://www.kkr.mlit.go.jp/inagawa/bosai/shinsui/index.html
	藻川	H14.06.14	http://www.kkr.mlit.go.jp/inagawa/bosai/shinsui/index.html
	大和川	大和川	H14.03.15
新宮川	熊野川	H14.03.15	7月頃予定
円山川	円山川	H14.03.15	http://www.kkr.mlit.go.jp/toyooka/go/sinsui/index.html
	出石川	H14.03.15	http://www.kkr.mlit.go.jp/toyooka/go/sinsui/index.html
九頭竜川	九頭竜川	H14.03.15	http://www.fukui-moc.go.jp/chisui/jigyuu/kuzu_kawa.html
	日野川	H14.03.15	http://www.fukui-moc.go.jp/chisui/jigyuu/kuzu_kawa.html

Flood Hazard Maps available through Website

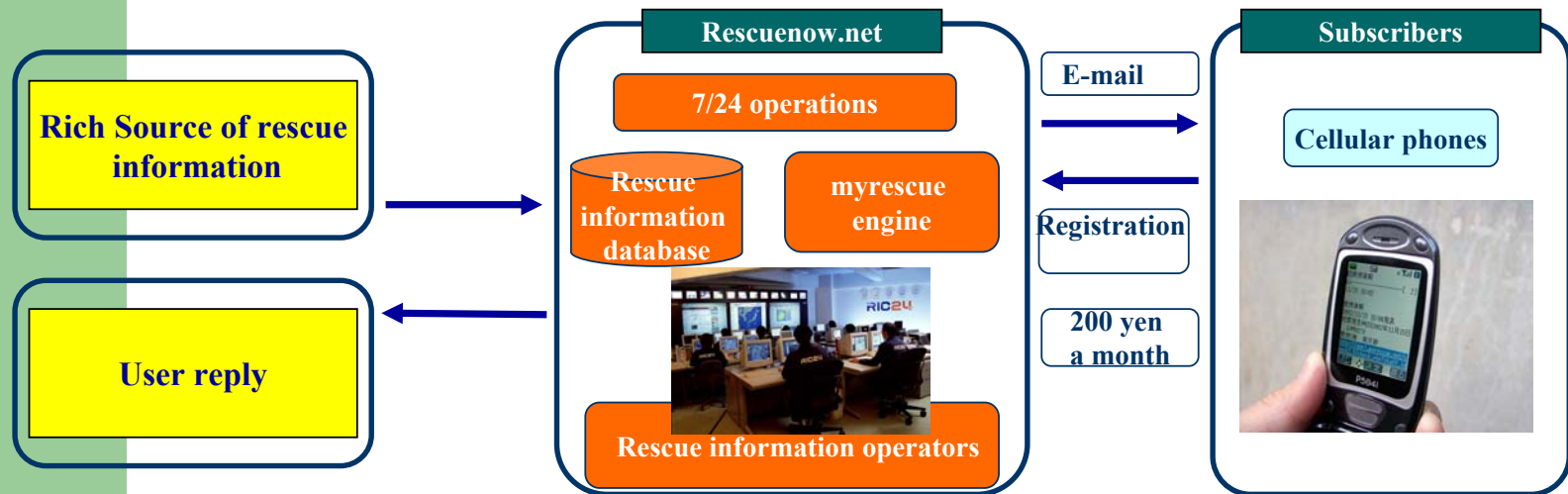
<http://www.bosaijoho.go.jp/>



Dissemination of Personalized Emergency Information via Mobile Phone



“myrescue” service



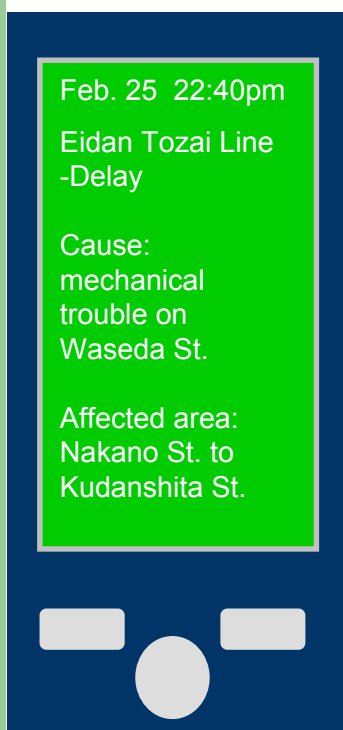
What’s “myrescue”?

- #Enable optimal coordination (between areas, on disaster levels, information categories, timing etc.)
- #Limited periods (e.g. specific days)
- #Emergency relay message service

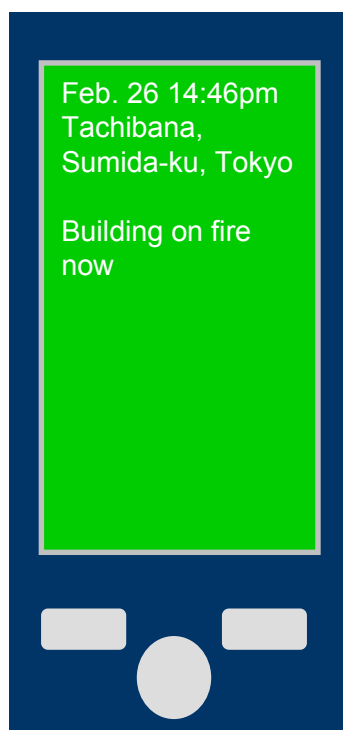
Individuals

- Corporate crisis managers
- Fire-fighting volunteer
- Local government Staff
- Mass media personnel
- Handicapped persons

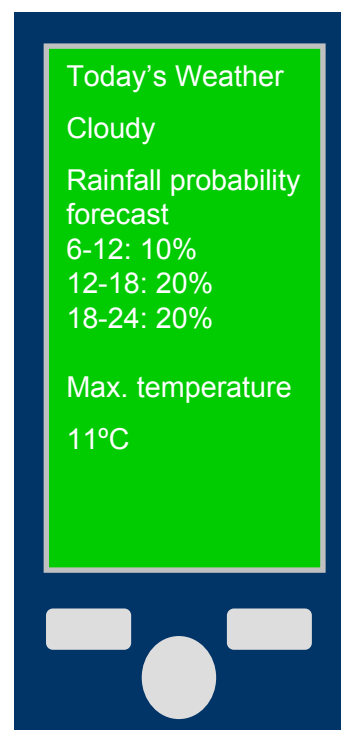
“myrescue” display



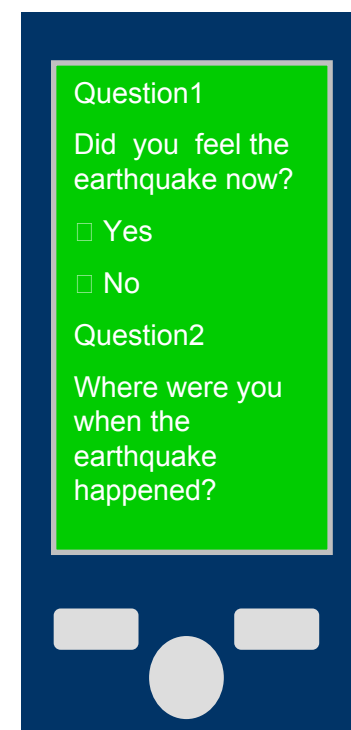
< Transportation >



< fire >

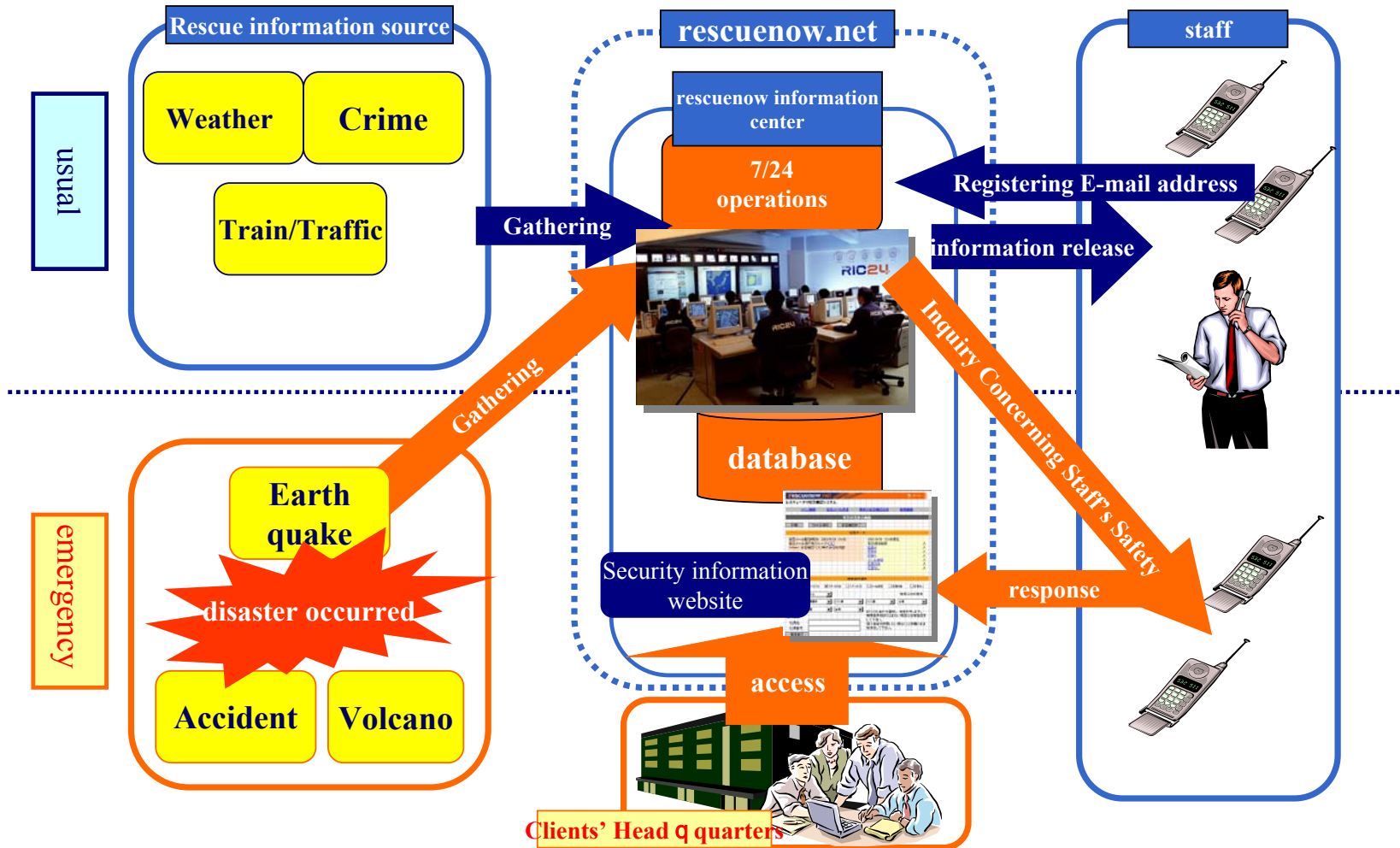


< Weather forecast >



< Questionnaire >

Inquiry Service Concerning Staff's Safety



Vital Information

Effective Use of
Hazard Map

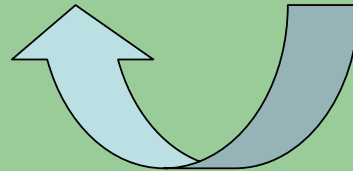
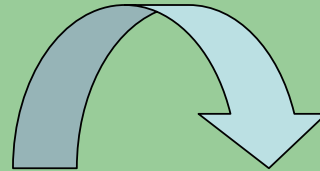
Development of
Early Warning

Appropriate Risk
Awareness of Local
Communities

Risk
Communication
Using Local
Knowledge and
Structure

Supported by IT

Reduce Damage by Disasters





THANK YOU